GOVT. HOLKAR (MODEL AUTONOMOUS) SCIENCE COLLEGE, INDORE

(An ISO 9001:2015 & ISO 14001:2015 Certified Instituion)

SSR DOCUMENT

2017-18 TO 2021-22

CRITERION –1

CURRICULAR ASPECTS

Metric No. : 1.1.2

Document Title:

Colored Syllabus Showing Employability/Entrepreneurship/Skill Development

SURESH T SILAWAT

Digitally signed by SURESH T SILAWAT
Date: 2023.07.28 13:51:25 +05'30'

Colour Showing Skill Development/Entrepreneurship/Employability

Skill Development

Entrepreneurship

Employability

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Biochemistry

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

B.Sc.: -

Govt. Holkar (Model. Autonomous) Science College, Indore
Department of Biochemistry
Syllabus Session 2021-22

Part A - Introduction				
Program: Certificate		**Class:** B.Sc.	**Semester:** I	**Session:**2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE1T**		
2	**Course title**	**Biochemical Techniques**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Core course (Major)		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in class 12th.		
5	**Course Learning Outcomes (CLO)**	**On successful completion of this course the students:** • The course covers essential techniques used in various laboratories. • It trains the learner to work in various industries' laboratories and R&D sections. • Helpful for developing technological skills. • Students get exposed to various techniques and their applications in separation and characterization of different biological molecules.		
6	**Credit Value**	Theory – **4 Credit**		
7	**Total Marks**	**Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam)** **External Evaluation Total = 100 Marks**		Min. Passing Marks: 35
Part B – Content of the course				
Total number of Lectures (In hours per week): 4 hours per week **Total Lectures:** 60 hours				
Unit	**Topic**			**Number of Lectures**
I	Concept of acids, bases, pH and buffers. Definitions, Ionization of weak acids and bases, Henderson-Hasselbalch equation. Biochemical buffers and their actions. Titration curve for amino acids and the pK values, Physiological buffers and their role.			12

	Preparation of common solutions based on molarity, normality and percent. Preparation of buffers. Measurement of pH. Glass and reference electrodes, types of electrodes, complications of pH measurement (dependence of pH on ionic strength, electrode contamination and sodium error).	
II	General principle of chromatographic separation. Technical details of Column adsorption and column partition chromatography. Paper chromatography, Thin-layer Chromatography, Gas chromatography. Principle, Technique and applications of Ion-exchange chromatography, Molecular-sieve chromatography, Affinity chromatography, Hydrophobic ligand chromatography and HPLC.	10
III	Introduction, Principle and Types of Electrophoresis. Factors affecting the rate of electrophoresis. Free and Zonal electrophoresis. Paper electrophoresis. Gel electrophoresis: Technique and uses of agarose electrophoresis, PAGE and SDS-PAGE, Two-dimensional electrophoresis, its importance and uses. Isoelectricfocussing. Principle of Centrifugation, RCF and Factors affecting it, Ultracentrifugation and its applications, Types of ultracentrifuges - Preparative and Analytical, Sedimentation coefficient and sedimentation velocity, Density gradient centrifugation.	14
IV	Principle of Spectroscopy, Lambert-Beer's Law and its limitations, Interaction of light with molecules, Light absorption and transmission. Extinction coefficient. Basic design of photoelectric colorimeter and spectrophotometer, Applications of uv-visible spectroscopic techniques. Infrared Spectroscopy, Flame Photometry, Atomic absorption spectrophotometry.	12
V	Types of Isotopes. Synthesis of labeled compounds, units of radioactivity. Measurement of radioactivity - Methods based upon Gas ionization, Ionization chamber, Proportional counters, Geiger Muller counter; Methods based upon excitation - Liquid Scintillation Counter. Autoradiography. Isotopes commonly used in biochemical studies – ^{32}P, ^{35}S, ^{14}C and ^{3}H. Isotopic labelling of biomolecules. Applications of radioisotopes. Biological hazards of radiation and safety measures in handling radioisotopes.	12
Keywords: pH, chromatography, electrophoresis, centrifugation, spectroscopy, radioactivity.		

Part A - Introduction				
Program: Certificate		**Class:** B.Sc.	**Semester:** I	**Session:** 2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE1P**		
2	**Course title**	**Application of techniques in Biochemical Analysis**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Core course (Major)		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in 12th Class.		
5	**Course Learning Outcomes (CLO)**	**The students who complete this course:** • Will obtain hands-on training in basic separation techniques in biochemistry. • Will gain expertise in the isolation, purification and characterization of biomolecules and organelles.		
6	**Credit Value**	Practical – **2 credits**		
7	**Total Marks**	**Max. Marks: 40 + 60**	**Min. Passing Marks: 35**	
Part B – Content of the course				
Total number of Lectures (In hours per week): 2 hours per week **Total Lectures:** 30 hours				

S.No.	Suggested List of experiments	Number of Lectures
1.	Preparation of common reagents, acids and alkali of different strengths/concentrations.	30 Hours
2.	Titration curves for amino acids and determination of pKa value.	
3.	Preparation of biochemical buffers of different ionic strengths.	
4.	Separation and quantification of amino acids by paper chromatography.	
5.	Separation of plant pigments by column chromatography using silica gel-G.	
6.	Separation of lipids by TLC.	
7.	Two-dimensional chromatography of amino acids.	
8.	Electrophoretic separations.	
9.	Demonstration of Polyacrylamide gel electrophoresis and SDS-PAGE of proteins.	

10.	Differential Centrifugation for organelle separation.	
11.	Verification of Lambert-Beer's Law.	
12.	Colorimetric estimations of sugars, amino acids, proteins.	
Keyword: pk, chromatography, electrophoresis, Lambert Beer's Law, Colorimetric estimation.		

Part A - Introduction				
Program: Certificate		**Class:** B.Sc.	**Semester:** I	**Session:**2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE2T**		
2	**Course title**	**Chemistry of Biomolecules**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Core Course (Minor)		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in class 12th.		
5	**Course Learning Outcomes (CLO)**	**On successful completion of this course the students:** • Are exposed to importance of biological molecules and their role in maintenance of life. • Enthusiastically learn about DNA, RNA, vitamins and lipids and their importance in biological system. • Get the insight of bio-molecular properties which can be used to carry out various studies. • Will be able to pursue research in any field as biomolecules are basis of all researches.		
6	**Credit Value**	Theory – **4 credits**		
7	**Total Marks**	**Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam)** **External Evaluation Total = 100 Marks**		**Min. Passing Marks: 35**

Part B – Content of the course

Total number of Lectures (In hours per week): 4 hours per week

Total Lectures: 60 hours

Unit	Topic	Number of Lectures
I	Applications and scope of Biochemistry. Structure of monosaccharides, stereoisomerism and optical isomerism of sugars, reactions of aldehyde and ketone groups, ring structure and anomeric forms, mutarotation, reactions of sugars due to hydroxyl groups, important derivatives of monosaccharides. Structure, occurrence, and functions of important disaccharides and trisaccharides. Structure, occurrence and biological importance of polysaccharides (starch, glycogen, cellulose, chitin).	10
II	Definition and classification of Lipids. Fatty acids: Introduction, classification, nomenclature, structure, properties of saturated and unsaturated fatty acids, essential fatty acids. Triacylglycerols: Nomenclature, physical properties, chemical properties and characterization of fats- hydrolysis, saponification value, rancidity of fats, Reichert-Meissl number and biological significance of fats; reaction of glycerol. Phospholipids: Properties and functions of Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidylserine, phosphatidylinositol, plasmalogens), Sphingomyelins. Glycolipids: cerebrosides, gangliosides.	14
III	Amino acids: Classification and structures, zwitterions, physical and chemical properties. Peptides: Peptide bond and its formation, determination of the amino acid sequence of a polypeptide chain, specific chemical and enzymatic cleavage of polypeptide chain and separation of peptides. Proteins: Introduction, classification based on solubility, shape, compositions and function; the behavior of proteins in solutions, salting in and salting out of proteins. Levels of organization in protein structure. Primary structure of proteins, secondary structure (Alpha- helix and Beta-pleated sheets), tertiary structure and quaternary structure. Denaturation and renaturation of proteins.	14
IV	Nature of genetic material. Composition of RNA and DNA, generalized structural plan of nucleic acids, other functions of nucleotides - source of energy, component of coenzymes and second messengers. Features of DNA double helix, Denaturation and annealing of DNA. Structure and roles of different types of RNA.	12
V	Porphyrins: Porphyrin nucleus and classification of porphyrins, Important metalloporphyrins occurring in nature. Vitamins: Brief introduction of vitamins, Structure and biological role of water soluble and fat-soluble vitamins.	10

Keywords: Carbohydrates, lipids, amino acids, proteins, nucleic acid, porphyrin, vitamin.

Part A - Introduction				
Program: Certificate course		**Class:** B.Sc.	**Semester:** I	**Session:**2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE2P**		
2	**Course title**	**Biomolecular Analysis**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Core course (Minor)		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in 12th Class.		
5	**Course Learning Outcomes (CLO)**	The students who complete this course: • Understands good laboratory practices, Safety & Precautions. • Will acquire proficiency in preparation of laboratory solutions, reagents, use of glassware, and qualitative analysis of biomolecules. • Learn the principles, theory & calculations for each experiment.		
6	**Credit Value**	Practical – **2 credits**		
7	**Total Marks**	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part B – Content of the course

Total number of Lectures (In hours per week): 2 hours per week
Total Number: 30 hours

S. No.	Suggested List of experiments	Number of Lectures
1.	Introduction to Biochemistry Lab. Safety aspects in Biochemical Laboratory.	30 hrs
2.	Calibration of instruments & volumetric glassware (burette, pipette etc.).	
3.	Preparation of distilled water in laboratory.	
4.	Biochemical reagent preparations for various solutions with respect to different Normality, Molarity, % Solutions (W/V), (V/V).	
5.	Preparation of buffer and its pH determination.	
6.	Determination of pKa of acetic acid and glycine.	
7.	Qualitative tests for carbohydrates and microscopic examination of osazones.	

8.	Qualitative tests for amino acids, proteins and nucleic acids.	
9.	Quantitative estimation of sugars and proteins.	
10.	Estimation of vitamin C.	
Keyword: Calibrations of instruments and volumetric glassware, normality, molarity, qualitative test for biomolecules, chromatographic separations.		
Any remarks/suggestions:		

Part A - Introduction				
Program: Certificate		**Class:** B.Sc.	**Semester:** I	**Session:**2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE2T**		
2	**Course title**	**Basics of Biochemistry**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Open Elective		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in class 12th.		
5	**Course Learning Outcomes (CLO)**	**On successful completion of this course the students** • Are exposed to importance of biological molecules and their role in maintenance of life. • Enthusiastically learn about DNA, RNA, vitamins and lipids and their importance in biological system. • Get the insight of bio-molecular properties which can be used to carry out various studies. • Will be able to pursue research in any field as biomolecules are basis of all researches.		
6	**Credit Value**	Theory - **4**		
7	**Total Marks**	**Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam)** **External Evaluation Total = 100 Marks**		**Min. Passing Marks: 35**

Part B – Content of the course		
Total number of Lectures (In hours per week): 4 hours per week **Total Lectures:** 60 hours		
Unit	**Topic**	**Number of Lectures**
I	Applications and scope of Biochemistry. Structure of monosaccharides, stereoisomerism and optical isomerism of sugars, reactions of aldehyde and ketone groups, ring structure and anomeric forms, mutarotation, reactions of sugars due to hydroxyl groups, important derivatives of monosaccharides. Structure, occurrence, and functions of important disaccharides and trisaccharides. Structure, occurrence and biological importance of polysaccharides (starch, glycogen, cellulose, chitin).	**10**
II	Definition and classification of Lipids.	**14**

	Fatty acids: Introduction, classification, nomenclature, structure, properties of saturated and unsaturated fatty acids, essential fatty acids. Triacylglycerols: Nomenclature, physical properties, chemical properties and characterization of fats- hydrolysis, saponification value, rancidity of fats, Reichert-Meissl number and biological significance of fats; reaction of glycerol. Phospholipids: Properties and functions of Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidylserine, phosphatidylinositol, plasmalogens); Sphingomyelins. Glycolipids: cerebrosides, gangliosides.	
III	Amino acids: Classification and structures, zwitterions, physical and chemical properties. Peptides: Peptide bond and its formation, determination of the amino acid sequence of a polypeptide chain, specific chemical and enzymatic cleavage of polypeptide chain and separation of peptides. Proteins: Introduction, classification based on solubility, shape, compositions and function. Levels of organization in protein structure. Primary structure of proteins, secondary structure (Alpha- helix and Beta-pleated sheets), tertiary structure and quaternary structure. Denaturation and renaturation of proteins.	**14**
IV	Nature of genetic material. Composition of RNA and DNA, generalized structural plan of nucleic acids, other functions of nucleotides – source of energy, component of coenzymes and second messengers. Features of DNA double helix, Denaturation and annealing of DNA. Structure and roles of different types of RNA.	**12**
V	Porphyrins: Porphyrin nucleus and classification of porphyrins, Important metalloporphyrins occurring in nature. Vitamins: Brief introduction of vitamins, Structure and biological role of water soluble and fat-soluble vitamins.	**10**
Keywords: Carbohydrates, lipids, amino acids, proteins, nucleic acid, porphyrin, vitamin.		

Govt. Holkar (Model. Autonomous) Science College, Indore

Department of Biochemistry

Syllabus Session 2021-22

Part A - Introduction				
Program: Certificate		**Class:** B.Sc.	**Semester:** II	**Session:**2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE2T**		
2	**Course title**	**Chemistry of Biomolecules**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Core course (Major)		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in class 12th.		
5	**Course Learning Outcomes (CLO)**	**On successful completion of this course the students** • Are exposed to importance of biological molecules and their role in maintenance of life. • Enthusiastically learn about DNA, RNA, vitamins and lipids and their importance in biological system. • Get the insight of bio-molecular properties which can be used to carry out various studies. • Will be able to pursue research in any field as biomolecules are basis of all researches.		
6	**Credit Value**	Theory - **4 Credit**		
7	**Total Marks**	**Max. Marks: 40(CCE) + 60 (End Semester or Theory Exam)** **External Evaluation Total = 100 Marks**		**Min. Passing Marks: 35**

Part B – Content of the course

Total number of Lectures (In hours per week): 4 hours per week

Total Lectures: 60 hours

Paragraph No.	Topic	Number of Lectures
I	Applications and scope of Biochemistry. Structure of monosaccharides, stereoisomerism and optical isomerism of sugars, reactions of aldehyde and ketone groups, ring structure and anomeric forms, mutarotation, reactions of sugars due to hydroxyl groups, important derivatives of monosaccharides.	10

	Structure, occurrence, and functions of important disaccharides and trisaccharides. Structure, occurrence and biological importance of polysaccharides (starch, glycogen, cellulose, chitin).	
II	Definition and classification of Lipids. Fatty acids: Introduction, classification, nomenclature, structure, properties of saturated and unsaturated fatty acids, essential fatty acids. Triacylglycerols: Nomenclature, physical properties, chemical properties and characterization of fats- hydrolysis, saponification value, rancidity of fats, Reichert-Meissl number and biological significance of fats, reaction of glycerol. Phospholipids: Properties and functions of Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidylserine, phosphatidylinositol, plasmalogens), Sphingomyelins, Glycolipids: cerebrosides, gangliosides.	14
III	Amino acids: Classification and structures, zwitterions, physical and chemical properties. Peptides: Peptide bond and its formation, determination of the amino acid sequence of a polypeptide chain, specific chemical and enzymatic cleavage of polypeptide chain and separation of peptides. Proteins: Introduction, classification based on solubility, shape, compositions and function; the behavior of proteins in solutions, salting in and salting out of proteins. Levels of organization in protein structure. Primary structure of proteins, secondary structure (Alpha- helix and Beta-pleated sheets), tertiary structure and quaternary structure. Denaturation and renaturation of proteins.	14
IV	Nature of genetic material. Composition of RNA and DNA, generalized structural plan of nucleic acids, other functions of nucleotides - source of energy, component of coenzymes and second messengers. Features of DNA double helix, Denaturation and annealing of DNA. Structure and roles of different types of RNA.	12
V	Porphyrins: Porphyrin nucleus and classification of porphyrins, Important metalloporphyrins occurring in nature. Vitamins: Brief introduction of vitamins, Structure and biological role of water soluble and fat-soluble vitamins.	10

Keywords: Carbohydrates, lipids, amino acids, proteins, nucleic acid, porphyrin, vitamin.

Part A - Introduction				
Program: Certificate course		**Class:** B.Sc.	**Semester:** II	**Session:**2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE2P**		
2	**Course title**	**Biomolecular Analysis**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Core course (Major)		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in 12th Class.		
5	**Course Learning Outcomes (CLO)**	The students who complete this course: • Understands good laboratory practices, Safety & Precautions. • Will acquire proficiency in preparation of laboratory solutions, reagents, use of glassware, and qualitative analysis of biomolecules. • Learn the principles, theory & calculations for each experiment.		
6	**Credit Value**	Practical – **2 Credit**		
7	**Total Marks**	Max. Marks: **40+60**	**Min. Passing Marks: 35**	

Part B – Content of the course		
Total number of Lectures-Tutorials- Practical's (In hours per week): 2 hours per week **Total Number:** 30 hours		
S. No.	**Suggested List of experiments**	**Number of Lectures**
11.	Introduction to Biochemistry Lab. Safety aspects in Biochemical Laboratory.	30 hrs
12.	Calibration of instruments & volumetric glassware (burette, pipette etc.).	
13.	Preparation of distilled water in laboratory.	
14.	Biochemical reagent preparations for various solutions with respect to different Normality, Molarity, % Solutions (W/V), (V/V).	
15.	Preparation of buffer and its pH determination.	
16.	Determination of pKa of acetic acid and glycine.	
17.	Qualitative tests for carbohydrates and microscopic examination of osazones.	

18.	Qualitative tests for amino acids, proteins and nucleic acids.	
19.	Quantitative estimation of sugars and proteins.	
20.	Estimation of vitamin C.	
Keyword: Calibrations of instruments and volumetric glassware, normality, molarity, qualitative test for biomolecules, chromatographic separations.		

Part A - Introduction				
Program: Certificate		**Class:** B.Sc.	**Semester:** II	**Session:**2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE1T**		
2	**Course title**	**Biochemical Techniques**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Core Course (Minor)		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in class 12th.		
5	**Course Learning Outcomes (CLO)**	• The course covers essential techniques used in various laboratories. • It trains the learner to work in the laboratories and R&D sections of various industries. • Helpful for developing technological skills. • Students get exposed to various techniques and their applications in separation and characterization of different biological molecules.		
6	**Credit Value**	Theory – **4 Credit**		
7	**Total Marks**	**Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam)** **External Evaluation Total = 100 Marks**		**Min. Passing Marks: 35**

Part B – Content of the course

Total number of Lectures (In hours per week): 4 hours per week
Total Lectures: 60 hours

Paragraph No.	Topic	Number of Lectures
I	Concept of acids, bases, pH and buffers. Definitions. Ionization of weak acids and bases, Henderson-Hasselbalch equation. Biochemical buffers and their actions. Titration curve for amino acids and the pK values. Physiological buffers and their role. Preparation of common solutions based on molarity, normality and percent. Preparation of buffers. Measurement of pH: Glass and reference electrodes, types of electrodes, complications of pH measurement (dependence of pH on ionic strength, electrode contamination and sodium error).	12

II	General principle of chromatographic separation. Technical details of Column adsorption and column partition chromatography, Paper chromatography, Thin-layer Chromatography, Gas chromatography. Principle, Technique and applications of Ion-exchange chromatography, Molecular-sieve chromatography, Affinity chromatography, Hydrophobic ligand chromatography and HPLC.	10
III	Introduction, Principle and Types of Electrophoresis. Factors affecting the rate of electrophoresis, Free and Zonal electrophoresis, Paper electrophoresis. Gel electrophoresis: Technique and uses of agarose electrophoresis, PAGE and SDS-PAGE, Two-dimensional electrophoresis, its importance and uses. Isoelectricfocussing. Principle of Centrifugation, RCF and Factors affecting it, Ultracentrifugation and its applications, Types of ultracentrifuges - Preparative and Analytical, Sedimentation coefficient and sedimentation velocity, Density gradient centrifugation.	14
IV	Principle of Spectroscopy, Lambert-Beer's Law and its limitations, Interaction of light with molecules, Light absorption and transmission, Extinction coefficient. Basic design of photoelectric colorimeter and spectrophotometer, Applications of uv-visible spectroscopic techniques. Infrared Spectroscopy, Flame Photometry, Atomic absorption spectrophotometry.	12
V	Types of Isotopes, Synthesis of labeled compounds, units of radioactivity, Measurement of radioactivity - Methods based upon Gas ionization, Ionization chamber, Proportional counters, Geiger Muller counter; Methods based upon excitation - Liquid Scintillation Counter. Autoradiography. Isotopes commonly used in biochemical studies – ^{32}P, ^{35}S, ^{14}C and ^{3}H, Isotopic labelling of biomolecules. Applications of radioisotopes. Biological hazards of radiation and safety measures in handling radioisotopes.	12

Keywords: pH, chromatography, electrophoresis, centrifugation, spectroscopy, radioactivity.

Part A - Introduction				
Program: Certificate		**Class:** B.Sc.	**Semester:** II	**Session:** 2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE1P**		
2	**Course title**	**Application of techniques in Biochemical Analysis**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Core course (Minor)		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in 12th Class.		
5	**Course Learning Outcomes (CLO)**	The students who complete this course: • Will obtain hands-on training in basic separation techniques in biochemistry. • Will gain expertise in the isolation, purification and characterization of biomolecules and organelles.		
6	**Credit Value**	Practical – **2 Credits**		
7	**Total Marks**	Max. Marks: **40+60**	**Min. Passing Marks: 35**	
Part B – Content of the course				
Total number of Lectures (In hours per week): 2 hours per week **Total Lectures:** 30 hours				

S.No.	List of experiments	Number of Lectures
1.	Preparation of common reagents, acids and alkali of different strengths/concentrations.	30 Hours
2.	Titration curves for amino acids and determination of pKa value.	
3.	Preparation of biochemical buffers of different ionic strengths.	
4.	Separation and quantification of amino acids by paper chromatography.	
5.	Separation of plant pigments by column chromatography using silica gel-G.	
6.	Separation of lipids by TLC.	
7.	Two-dimensional chromatography of amino acids.	
8.	Electrophoretic separations.	

9.	Demonstration of Polyacrylamide gel electrophoresis and SDS-PAGE of proteins.	
10.	Differential Centrifugation for organelle separation.	
11.	Verification of Lambert-Beer's Law.	
12.	Colorimetric estimations of sugars, amino acids, proteins.	
Keyword: pk, chromatography, electrophoresis, Lambert Beer's Law, Colorimetric estimation.		

Part A - Introduction				
Program: Certificate		**Class:** B.Sc.	**Semester:** II	**Session:**2021-2022
Subject: Biochemistry				
1	**Course code**	**S1-BCHE1T**		
2	**Course title**	**Analytical Techniques**		
3	**Course type (Core Course/Elective/Generic Elective/Vocational/…..)**	Open elective		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology in class 12th.		
5	**Course Learning Outcomes (CLO)**	• The course covers essential techniques used in various laboratories. • It trains the learner to work in the laboratories and R&D sections of various industries. • Helpful for developing technological skills. • Students get exposed to various techniques and their applications in separation and characterization of different biological molecules.		
6	**Credit Value**	Theory – **4 Credits**		
7	**Total Marks**	**Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam)** **External Evaluation Total = 100 Marks**		**Min. Passing Marks: 35**
Part B – Content of the course				
Total number of Lectures (In hours per week): 4 hours per week **Total Lectures:** 60 hours				

Paragraph No.	Topic	Number of Lectures
I	Concept of acids, bases, pH and buffers. Definitions. Ionization of weak acids and bases. Henderson-Hasselbalch equation. Biochemical buffers and their actions. Preparation of common solutions based on molarity, normality and percent. Preparation of buffers. Measurement of pH. Glass and reference electrodes.	12
II	General principle of chromatographic separation. Paper chromatography. Thin-layer Chromatography.	10

	Principle, Technique and applications of Ion-exchange chromatography, Molecular-sieve chromatography, Affinity chromatography and HPLC.	
III	Introduction, Principle and Types of Electrophoresis. Factors affecting the rate of electrophoresis. Paper electrophoresis. Gel electrophoresis: Technique and uses of agarose electrophoresis, PAGE, and SDS-PAGE its importance and uses. Principle of Centrifugation, RCF and Factors affecting it, Ultracentrifugation, and its applications.	14
IV	Principle of Spectroscopy, Lambert-Beer's Law and its limitations, Light absorption and transmission, Extinction coefficient. Basic design of photoelectric colourimeter and spectrophotometer, Applications of UV-visible spectroscopic techniques.	12
V	Types of Isotopes, Synthesis of labelled compounds, units of radioactivity. Measurement of radioactivity - Methods based upon Gas ionization, Ionization chamber, Proportional counters, Autoradiography. Isotopes commonly used in biochemical studies – ^{32}P, ^{35}S, ^{14}C and ^{3}H. Biological hazards of radiation and safety measures in handling radioisotopes.	12
Keywords: pH, chromatography, electrophoresis, centrifugation, spectroscopy, radioactivity.		

B.Sc II Year Biochemistry (2021-2022)
PAPER –I
ENZYMOLOGY

Max. Marks: 40 (For regular Students)
Max. Marls: 50 (for Private Students)

Unit I

Introduction: Definition, general characteristics, nomenclature, IUB enzyme classification (rationale, overview and specific examples), Significance of the numbering system.

Definitions with examples of the holoenzyme, coenzymes, cofactors, activators, inhibitors, active site (identification of groups excluded), metalloenzymes, oligomeric enzymes and multi-enzyme complexes.

Enzyme specificity.

Unit II

Nature of non-enzymatic and enzymatic catalysis. Measurement and expression of enzyme activity – enzyme assays; Definition of IU, Katal, enzyme turn over number and specific activity.

Role of non-protein organic molecules and inorganic ions-coenzyme, prosthetic groups. Roles of vitamins as coenzymes precursors (general treatment).

Enzyme purification: Methods for isolation, purification and characterization of the enzyme.

Unit III

Enzyme catalysis: Role of cofactors in enzyme catalysis: NAD/NADP, FMN/FAD, coenzyme A, biocytin, cobamide, lipoamide, TPP, pyridoxal phosphate, tetrahydrofolate and metal ions with special emphasis on coenzymes function.

Acid-base catalysis, covalent catalysis, proximity and orientation effects, strain and distortion theory. Mechanism of action of chymotrypsin, carboxypeptidase, ribonuclease and lysozyme.

Unit IV

Enzyme kinetics: Factors affecting enzyme activity- enzyme concentration, substrate concentration, pH and temperature.

Derivation of Michaelis-Menten equation for uni-substrate reactions. Km and its significance.

Kinetics of zero and first-order reactions.

Reversible and irreversible inhibition, competitive, non-competitive and uncompetitive inhibitions, determinations of Km &Vmax in presence and absence of inhibitor. Allosteric enzymes.

Unit V

Industrial and clinical application of enzymes.

Immobilization of enzymes and their industrial applications.

Productions of glucose from starch, cellulose and dextran; use of lactase in the dairy industry; Production of glucose-fructose syrup from sucrose; Use of proteases in food, detergent and leather industry; Medical application of enzymes; Use of glucose oxidase in enzyme electrodes.

B.Sc II Year Biochemistry (2021-2022)
PAPER-II
INTERMEDIARY METABOLISM

Max. Marks: 40 (For regular Students)
Max. Marks: 50 (for Private Students)

Unit I

Introduction to Metabolism: General features of metabolism, experimental approaches to study metabolism: use of intact organism, bacterial mutants, tissue slices, stable and radioactive isotopes.

Carbohydrate Metabolism: Reactions and energetic of glycolysis, Alcoholic and lactic acid fermentation. Reaction and energetic of TCA cycle. Regulation of glycolysis and TCA cycle.

Gluconeogenesis, glycogenesis and glycogenolysis. Reaction and physiological significance of the pentose phosphate pathway.

Unit II

Electron Transport Chain and Oxidative Phosphorylation: Structure of mitochondria, the sequence of electron carriers, sites of ATP production, inhibitors of electron transport chain.

The hypothesis of mitochondrial oxidative phosphorylation (basic concepts), Inhibitors and uncouplers of oxidative phosphorylation.

Transport of reducing potentials into mitochondria.

Unit III

Lipid Metabolism: Introduction, hydrolysis of triacylglycerols, transport of fatty acid into mitochondria, β-oxidation of saturated fatty acids. ATP yield from fatty acids oxidation.

Biosynthesis of saturated and unsaturated fatty acids. Metabolism of ketone bodies oxidation of unsaturated and odd chain fatty acids.

Outlines of biosynthesis of triglycerides and important phospholipids, glycolipids, sphingolipids and cholesterol.

Regulation of cholesterol metabolism.

Unit IV

Amino acid Metabolism: General reaction of amino acids metabolism: transamination, oxidative deamination and decarboxylation.

Urea cycle.

Degradation and biosynthesis of amino acids. Glycogenic and ketogenic amino acids.

Unit V

Nucleotides Metabolism: Sources of the atoms in the purine and pyrimidine molecules. Biosynthesis and degradation of purines and pyrimidines.

Regulation of purine and pyrimidine biosynthesis.

Porphyrin Metabolism: Biosynthesis and degradation of porphyrins.

Production of bile pigments.

B.Sc II Year Biochemistry (2021-2022)
PRACTICAL
(Based on Paper I and II)

1. Separation of blood, plasma and serum

2. (a) Estimation of protein from serum by biuret and Lowry methods

(b) Determination of albumin and A/G ratio in serum.

3. Estimation of bilirubin, conjugated and unconjugated in serum.

4. (a) Estimation of lipids in serum by Vanillin method (b) Estimation of cholesterol in serum.

5. Estimation of lipoproteins in plasma.

6. Estimation of blood urea nitrogen from plasma.

7. Separation and identification of amino acids by (a) paper chromatography and (b) thin layer chromatography.

8. Separation of polar and non-polar lipids by thin-layer chromatography.

9. (a) Assay of serum alkaline phosphatase activity (b) Inhibition of alkaline phosphatase activity by EDTA (c) Effect of substrate concentration on alkaline phosphatase activity and determination of its km value.

10. (a) Effect of temperature on enzyme activity and determination of activation energy (b) Effect of pH on enzyme activity and determination of optimum pH (c) Effect of enzyme concentration on enzyme activity.

11. (a) Preparation of starch from potato and its hydrolysis by salivary amylase (b) Determination of achromatic point in salivary amylase (c) Effect of sodium chloride on amylases.

B.Sc. III Year (Biochemistry (2021-2022)
PAPER –I
MOLECULAR BIOLOGY

Max. Marks: 40 (For regular Students)
Max. Marks: 50 (For Private Students)

Unit I

Basic Concept of Genetic Information. Nucleic acids as genetic information carriers, experimental evidence. Central dogma: current version and reverse transcription.

Primary structure of nucleic acids and their properties. Salient features of eukaryotic, Prokaryotic and viral genome. Basic concept about the secondary structure of nucleic acid, 5'-3' direction anti-parallel strands, base composition, base equivalence, base pairing and base stacking in DNA.

Structure Levels of DNA. Watson and Crick model. A, B and Z types of DNA, major and minor grooves, chirality of DNA, tertiary structure of DNA.

Structure and properties of RNA. Classes of RNA, secondary and tertiary structures.

Unit II

DNA replication in prokaryotes, conservative, semi-conservative and dispersive types, experimental evidence for semi-conservative replication.

DNA polymerases, other enzyme and protein factors involved in the replication.

Mechanism of replication. Inhibitors of DNA replication.

Unit III

Transcription in prokaryotes and eukaryotes. RNA polymerase, promoters, initiation, elongation and termination of RNA synthesis, inhibitors of transcription. Reverse transcriptase.

Post-transcriptional processing of RNA in eukaryotes.

Unit IV

Genetic code. Basic feature of genetic code, biological significance of degeneracy. Wobble hypothesis.

Mechanisms of translation in prokaryotes: Ribosome structure, A and P sites, charged tRNA, f-met-tRNA, initiation codon, Shine-Dalgarno consensus sequence, formation of 70S initiation complex, role of EF- Tu, EF-Ts, EF-G and GTP, non-sense codons and release factors.

Regulation of gene expression in prokaryotes: Enzyme induction and repression, operon concept (*lac* operon, *trp* operon).

Unit V

Mutation: Molecular basis of mutation, types of mutation (insertion, deletion, transition, transversion, frame-shift, suppresser sensitive, germinal and somatic, backward and forward mutations, dominant and recessive mutations, spontaneous and induced mutation).
Mutagenicity testing: Correlation of mutagenicity and carcinogenicity; Ames testing, random and site-directed mutagenesis, DNA damage and repair mechanisms.
Recombinant DNA Technology: Restriction endonucleases, a brief discussion of step in DNA cloning. Applications of recombinant DNA technology.

B.Sc. III Year Biochemistry (2021-2022)
PAPER-II
NUTRITION, CLINICAL & ENVIROMENTAL BIOCHEMISTRY

Max. Marks: 40 (For regular Students)
Max. Marks: 50 (For Private Students)

Unit I

Nutrition and dietary habits: Introduction and definition of foods and nutrition.

Fat-soluble vitamins (A, D, E and K), water-soluble vitamins (B and C); Minerals (Ca, Fe and iodine) and their biological functions.

Basic food groups: energy giving foods, bodybuilding foods and protective food.

Composition of a balanced diet, recommended dietary allowances (RDA) for average Indian, locally available foods, inexpensive quality foods and foodstuffs rich in more than one nutrient. Balance vegetarian and non-vegetarian diets, emphasis on nutritional adequacy.

Unit II

Nutritive and calorific value of foods. Basic concept of energy expenditure, units of energy, measurement of energy expenditure by direct or indirect calorimetry, calculation of non-protein RQ with respect to carbohydrate and lipids. Determination of heat production of the diet.

The basal metabolism and methods of measuring basal metabolic rate (BMR); energy requirements during growth, pregnancy, lactation and various physical activities. Calculation of energy expenditure of average man and woman.

Specific dynamic action (SDA) of foods, nutrition value of various kinds of foods generally used by Indian population, planning of dietary regimes for infants, during pregnancy and old age. Protein calories malnutrition (Kwashiorkor and Marasmus). Human milk and its virtues, breast v/s formulated milk feeding.

Unit III

Clinical biochemistry: Basic concept, definition and its scope in diagnosis, a brief review of units and abbreviation used in expressing concentrations and standard solution.

Quality control, Manual vs automation in a clinical laboratory.

Collection and preservation of biological fluids (blood, serum, plasma, urine and CSF).

Importance of biochemical analysis of blood, urine and CSF, Normal values for important constituents (in SI unit) in the blood (plasma/serum), CSF and urine.

Unit IV

Clinical enzymology: Definition of functional and non-functional plasma enzyme. Isozymes and diagnostic tests.

Enzyme pattern in health and diseases with special mention of plasma lipase, amylase, cholinesterase, alkaline and acid phosphates, SGOT, SGPT, LDH and CPK; Functional tests of liver and kidney.

Disease-related to metabolism: Hypo- and hyperglycemia, lipid malabsorption and steatorrhea, sphingolipidosis, role of lipoproteins.

Inborn errors of amino acid metabolism- alkaptonuria, phenylketonuria, albinism, gout and hyperuricemia.

Unit V

Air pollution: Suspended particulate matter, compounds of carbon, sulfur, nitrogen and their interactions, methods of estimation of biotic and abiotic pollutants, their effect on human health.

Water pollution: major pollutants from domestic, agricultural and industrial wastes, effects of pollutants on plants and animals, treatment of domestic and industrial wastes, solid-wastes and their treatment.

Soil pollution: Types and causes.

B.Sc. III Year Biochemistry (2021-2022)
PRACTICAL
(Based on Paper I and II)

1. Extraction of DNA and its estimation by diphenylamine method.
2. Effect of temperature on the viscosity of DNA using Ostwald's viscometer.
3. Extraction of RNA and its estimation by Orcinol method.
4. Estimation of hemoglobin.
5. Estimation of calcium in serum & urine.
6. Estimation of phosphorus in serum & urine.
7. Estimation of creatinine in plasma and urine.
8. Estimation of immunoglobulins by precipitation with saturated ammonium sulfate.
9. Estimation of SGOT and SGPT.
10. Enumeration of bacteria from air, water and soil.

M.Sc.: -

Department of Biochemistry
Govt. Holkar Science College, Indore (M.P.)
M.Sc. BIOCHEMISTRY (2021-2022)

BIOCHEMISTRY

M.Sc. SEMESTER I (2021-2022)

Paper 1: Chemistry of Biomolecules (Core 1) - 4 Credits

UNIT – I

Carbohydrates: occurrence, stereochemistry. Classification, structure, properties and biological importance of Carbohydrates. Isomerism in carbohydrates Mucopolysaccharide, Proteoglycans and amino sugars. Bacterial cell wall polysaccharide.

UNIT – II

Proteins: Classification, structure and properties of amino acids, essential amino acids, biologically active peptides, Classification and properties of proteins, sequencing of proteins, conformation and structure of proteins: primary, secondary, tertiary and quaternary structure, Forces stabilizing these structures, coagulation and denaturation of Proteins. Ramachandran Plot.

UNIT – III

Lipids: Definition, classification, structure and properties of fatty acid, Essential fatty acid. Chemical properties and characterization of fats. Waxes, cerebrosides, gangliosides. Phospholipids and proteolipids. Steroids and bile salts. Prostaglandins: structure properties and biological importance.

UNIT- IV

Nucleic acids: Structural constituents of nucleic acid- purines, pyrimidines, nucleosides and nucleotides. Biological role of nucleotides. Features of DNA double helix, Denaturation and annealing of DNA. Structure, types and biological role of RNA.

UNIT – V

Vitamins: Structure and biochemical properties of water-soluble and fat-soluble vitamins and their coenzyme activity.

Hormones: Mechanism of hormone action. Chemistry, role, hypo and hyperactivity of Insulin, Glucagon, Thyroxine, Cortisol, Growth Hormone, Estrogen, Progesterone and Testosterone.

BIOCHEMISTRY

M.Sc. SEMESTER I (2021-2022)

Paper 2: Analytical Biochemistry (Core 2) - 4 Credits

UNIT – I

The concept of pH, Dissociation and ionization of acids and bases, pKa, buffers and buffering mechanism, Henderson-Hasselbalch equation, ionization of amino acids and proteins, measurement of pH. General principle and different types of chromatography, adsorption and partition, Column, Paper and thin layer.

UNIT – II

Principle, materials used and applications of Ion-exchange chromatography, Gel filtration chromatography, Affinity chromatography and High-Performance Liquid Chromatography.

UNIT – III

Electrophoresis: General Principle, factors affecting electrophoretic migration, Moving boundary and Zonal Electrophoresis, Paper and Gel Electrophoresis, PAGE and SDS PAGE, Isoelectric focusing technique.

Sedimentation: Basic principles of sedimentation, Sedimentation velocity, preparative and analytical ultracentrifugation techniques, differential and density gradient centrifugation, Subcellular fractionation.

UNIT-IV

Radioactivity: Types of radioisotopes used in Biochemistry (^{32}P, ^{35}S, ^{14}C and ^{3}H) Disintegration of radionucleotides, half-life of radioactive compounds, measurement of radioactivity, scintillation counting, Use of radioisotopes *in vivo* and *in vitro* labeling, Isotopic tracer techniques, Autoradiography.

UNIT – V

Spectrophotometry: Beer Lambert's law, extinction coefficient and its importance, design of colorimeter and spectrophotometer. Applications of UV-VIS spectrophotometry. Atomic absorption spectrophotometry and its applications in Biology.

Principle of Optical Rotatory Dispersion, Circular Dichroism and X-ray diffraction and their applications in structure determination. Principle of NMR spectroscopy. Application of NMR in Biology.

BIOCHEMISTRY

M.Sc. SEMESTER I (2021-2022)

Paper 3: Cell Biology (Core 3) - 4 Credits

UNIT – I

Cell- Difference between eukaryotic and prokaryotic cell, Structure of plant and animal cell, Plant cell wall and its composition, Models of the biomembrane, structure, constituents and fluidity of plasma membrane, Cytoskeleton.

UNIT – II

Transport of metabolites across the Plasma membrane, Diffusion and Osmosis, non-mediated and mediated, passive and active transport. Primary and secondary active transport. Intracellular communication through gap junction, tight junction, Plasmodesmata.Cell-cell interactions.

UNIT – III

Structure of Mitochondria, mitochondrial enzymes and their location, electron transport complexes, ATP synthase, mitochondrial DNA.

Structure of Chloroplast, protein complexes and photosynthetic electron transport chain, DNA of the Chloroplast.

UNIT- IV

Structure and functions of the Ribosomes. Structure, Types and Function of Endoplasmic Reticulum, protein sorting and signal hypothesis. Cell cycle.

UNIT – V

Structure and function of Golgi body and Lysosomes, Vesicular transport within the cell. Structure of Nucleus: nuclear membrane and chromatin.

BIOCHEMISTRY

M.Sc. SEMESTER I (2021-2022)

Paper 4: Biostatistics (Core 4) - 4 Credit

UNIT – I

Types of data, Collection of data, Sampling technique: Probability v/s non-probability and non-sampling methods.

Representation of Data: Frequency distribution table. Graphical representation of data: Line diagram, Bar diagram, Pie diagram. Histogram and Relative frequency histogram, Frequency polygon and Frequency curve, Cumulative frequency curve (Ogive).

UNIT – II

Central Tendency: Meaning and its measure: Arithmetic mean, Median, Mode, Geometric mean, Harmonic mean.

Dispersion: Meaning and its measures: Range, Semi-interquartile range, Mean deviation, Standard deviation, Coefficient of variation, Skewness, Kurtosis and their application in Biochemistry.

UNIT – III

Correlation: Meaning, Types and Method of studying correlation: Karl Pearson's correlation coefficient, Spearman's rank correlation coefficient, scatter diagram. Overview of Partial V/s Multiple correlations.

Regression: Meaning, Types, Regression equation and line: Graphical method and algebraic method, Method of Least Squares for line of best Fit, Regression coefficient and its determination.

UNIT- IV

Probability and probability distributions: Classical and Statistical definitions of probability, Conditional Probability. Binomial, Poisson and Normal Distributions and their application in Biochemistry.

UNIT – V

Tests of Significance: Tests based on t, z, F and Chi-square distributions. Analysis of Variance: one-way and two-way classification and their applications in Biochemistry. p-value and its significance.

BIOCHEMISTRY

M.Sc. Semester I (2021-2022)

Practical 1

1. Qualitative tests of carbohydrates.

2. Qualitative tests of proteins.

3. Qualitative tests of lipids.

4. Detection of normal and abnormal constituents of urine.

5. Preparation of lecithin and cholesterol from egg yolk.

6. Separation of amino acids by chromatography

M.Sc. Semester I

Practical 2

1. Estimation of glucose by folin-wu method.

2. Estimation of glucose by anthrone method.

3. Estimation of protein by biuret method.

4. Determination of percent purity of Glycine by Sorensen's formal titration.

5. Determination of iodine value of oils.

6. Determination of Saponification number of fats.

BIOCHEMISTRY

M.Sc. SEMESTER II (2021-2022)

Paper 1: Physiology (Core 5) - 4 Credits

UNIT – I

Composition and function of blood, plasma and blood corpuscles, functions of plasma proteins, structure and function of hemoglobin, abnormal hemoglobins.

Blood coagulation – Blood clotting factors, Intrinsic and extrinsic pathways and regulation. Blood groups- The ABO system and rhesus system.

UNIT – II

Structure of nephron, composition and mechanism of urine formation, glomerular filtration, tubular reabsorption of glucose, water and electrolytes, tubular secretion. Dilute and concentrated urine formation.

Regulation of water and electrolyte balance, role of kidneys and hormones in their maintenance.

UNIT – III

Hydrogen Ion homeostasis, acid-base balance, metabolic and respiratory acidosis and alkalosis.

Respiration Unit exchange and transport of respiratory gases in the body, Factors affecting their transport, role of 2,3 DPG, Bohr effect and Chloride shift.

UNIT- IV

Classification of muscles; Structure of skeletal, smooth and cardiac muscles. Actin, myosin tropomyosin, troponin, Z disc and H line components. The Sliding filament mechanism and subcellular ion movements during the contraction cycle in skeletal muscles.

UNIT – V

Structure of nerve impulse, resting membrane potential, action potential, Types of neurotransmitters, origin and transmission of nerve impulse, neuromuscular junction, mechanism of nerve conduction, Nerve conduction across synapse, Reflex action and reflex arc.

BIOCHEMISTRY

M.Sc. SEMESTER II (2021-2022)

Paper 2: Microbial Biochemistry (Core 6) - 4 Credits

UNIT – I

Cellular organization of bacteria with special reference to molecular organization of cell wall(gram-positive and gram-negative bacteria). Flagella and pilli.
Identification and classification of bacteria.

UNIT – II

Methods of sterilization and disinfectant. Methods of isolation and pure culture technique, culture media.
Nutritional classes of bacteria, bacterial growth and its kinetics.

UNIT- III

Energy metabolism in bacteria –fermentation, Aerobic and anaerobic respiration and bacterial photosynthesis.
Application of microbes in food industry, Dairy products and food preservation. Food spoilage and foodborne infection.

UNIT- IV

Fermentation technology, Primary and secondary metabolites, continuous and batch type culture techniques. Types and design of fermentors, fermentation processes – brewing, manufacture of penicillin, production of other antibiotics and organic compounds, single-cell proteins.
Microbial assay of vitamins and amino acids.

UNIT – V

Viruses structure proteins, classification and methods of assay. Replication of RNA –negative strand (VSV), positive-strand (polio) retrovirus and DNA viruses- adeno or SV40. Coronavirus; structure, mode of infection. Virus-host interaction.Vaccines and prevention.

BIOCHEMISTRY

M.SC. SEMESTER II (2021-2022)

Paper 3: Nutritional Biochemistry (Core 7) - 4 Credits

UNIT – I

Direct and indirect Calorimetry, energy value of the foods, thermal equivalent of oxygen, respiratory quotient, calorigenic action of the foods, basal metabolic rate-definition and its measurement, factors affecting BMR, energy requirement of the human beings.

UNITS – II

Nutritional aspects of the Carbohydrates – different dietary types, available and unavailable carbohydrates, requirements, utilization and function. The special role of the non-starch polysaccharides.

Nutritional aspects of the lipids – different dietary lipids, requirements, utilization and functions. Essential fatty acids and their physiological significance.

UNIT- III

Nutritional aspects of the proteins –Nitrogen balance studies, factors influencing nitrogen balance. Quality of proteins: Digestibility coefficient, Net protein utilization, Biological value and amino acids score, protein requirements and function.

UNIT- IV

Vitamins- Dietary sources, biochemical function and specific deficiency diseases.
Minerals- Nutritional significance, sources, daily requirement and dietary deficiency disorders of calcium, phosphorus, magnesium, iron, zinc and copper.

UNITS – V

Balanced diet – Recommended dietary allowances for different categories of human beings. Food processing and loss of nutrients during processing and cooking. Naturally occurring anti-nutrients.

Disorders related to nutrition – protein-energy malnutrition, Starvation, Obesity.

BIOCHEMISTRY

M.SC. SEMESTER II (2021-2022)

Paper 4: Genetics (Core 8) - 4 Credits

UNIT – I

Mendelian inheritance: Segregation and Independent assortment, Extension of Mendelism: Incomplete dominance, codominance, Multiple allelism, Gene interaction, Epistasis, Pleiotropy, Linkage, Crossing over.

UNIT – II

Genetic mapping by recombination frequency in diploids: Two factor and three factor genetic crosses. Interference, Penetrance and Expressivity, Linkage detection in fungi by tetrad analysis.

UNIT- III

Linkage in human: Somatic cell hybridization,
Definition of the gene, complementation test and its limitation, complementation mapping. Hardy Weinberg principle.
Viral genetics: Recombination in bacteriophages, Genetic fine structure.

UNIT – IV

Genetic analysis in microbes: DNA transfer, transformation, transduction and conjugation and their mechanisms, genetic map of E.coli, transposable element.

UNIT- V

Gene mutation: Molecular basis of mutation, Types of mutation, e.g. transition, transversion, frameshift, insertion, deletion, suppressor sensitive, true reversion and suppression, dominant and recessive, spontaneous and induced mutations, Mutagenicity testing.
Chemical and physical mutagens and their actions.
DNA repair mechanisms.

BIOCHEMISTRY

M.Sc. Semester II (2021-2022)

Practical I

1. Estimation of reducing sugars in biological material by Nelson Somogyi Method.
2. Estimation of maltose by DNS method.
3. Estimation of Hemoglobin.
4. Blood group determination.
5. RBC and WBC count in blood sample.
6. Cultivation, isolation and staining of microorganisms.

M.Sc. Semester II

Practical II

1. Estimation of creatinine in urine.
2. Estimation of chloride in urine.
3. Estimation of inorganic phosphate in urine.
4. Estimation of ascorbic acid in citrus fruits.
5. Estimation of riboflavin in multi vitamin tablet.
6. Estimation of tyrosine by Millon's method.

BIOCHEMISTRY

M.Sc. SEMESTER III (2021-2022)

Paper 1: Enzymology (Core 9) - 4 Credits

UNIT – I

Isolation and purification, Classification and nomenclature of enzyme.

Enzyme catalysis: Enzyme specificity including stereospecificity and the concept of active site, determination of active site.

UNIT – II

Enzyme kinetics: Factors affecting rates of enzymes catalyzed reaction, unisubstrate reaction, concept of Michaelis – Menten Kinetics, Briggs - Haldane relationship for reversible reaction. Determination and significance of kinetic constants, catalytic rate constant and specificity constant. Limitations of Michaelis – Menten kinetics. Line weaver Burk plot and its limitation.

UNIT – III

Classification and kinetics of multisubstrate reaction, sequential and ping pong bi bi models with examples.

Reversible and irreversible inhibition, Types of reversible inhibition: competitive, non-competitive and uncompetitive inhibitions.

UNIT – IV

Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, concerted acid-base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion-catalysis. Theories on mechanism of catalysis.

Mechanism of enzyme action: mechanism of action of Lysozyme, Chymotrypsin, Carboxypeptidase. Multienzyme system, Mechanism of action, regulation and coenzyme of Pyruvate Dehydrogenase and Fatty acid Synthetase complexes.

UNIT – V

Enzyme regulation: General mechanisms of enzyme regulation, Allosteric enzymes, sigmoidal kinetics and their physiological significance. Symmetric and sequential models for action of allosteric enzymes. Reversible and irreversible covalent modification of enzymes.

Immobilized enzymes and their industrial applications.

BIOCHEMISTRY

M.Sc. SEMESTER III (2021-2022)

Paper 2: Metabolism I (Core 10) **4 Credits**

UNIT – I

The concept of Gibbs free energy, exergonic and endergonic reactions, redox potential. High energy bond and key position of ATP, Substrate level and oxidative phosphorylation. Shuttle pathways, Electron Transport Chain, Inhibitors and uncouplers of Electron Transport Chain.

UNIT – II

Carbohydrates: Glycolysis and glycogenolysis and their regulation, glycogen storage diseases Glycogenesis and Gluconeogenesis, Cori's cycle. Role of hormones in blood sugar regulation.

UNIT – III

Degradation of carbohydrates: Pyruvate dehydrogenase complex, reactions, regulation and energetic of Krebs-cycle, Glyoxalate pathway. Pentose phosphate pathway and its physiological significance, Uronic acid pathway and its importance.

UNIT-IV

Lipids: Oxidation of fatty acids- mitochondrial β-Oxidation, α-Oxidation and ω-Oxidation, Oxidation of unsaturated and odd-chain fatty acids, ketone bodies.
Biosynthesis of fatty acid- saturated and unsaturated.

UNIT – V

Phospholipids and glycosphingolipids- synthesis and degradation, lipid storage diseases.
Salient features of the metabolism of cholesterol and bile acids.
Regulation of lipid metabolism.

BIOCHEMISTRY

M.Sc. SEMESTER III (2021-2022)

Paper 3: Plant Biochemistry (Elective 1) - 4 Credits

UNIT – I

Structure of Chloroplast, Photosynthesis, dissipation of excitation energy by chlorophyll, photosynthetic electron transport chain. Thylakoid membrane protein complexes – PS I, PS II, LHC II, Cyt b6f, ATP synthase complexes, cyclic photophosphorylation.

UNIT – II

Calvin cycle: Biochemistry of RuBP Carboxylase/oxygenase, activation of RUBISCO, oxygenation reaction, photorespiration and compensation point, photosynthetic efficiency. Regulation of enzymes of carbon dioxide fixation by light; Difference between C_3 and C_4 plants Hatch and slack pathway, CAM plants.

UNIT – III

Nitrogen metabolism: Nitrogen fixation, nitrogenase complex, mechanism of action of Nitrogenase. Structure of 'NIF' genes and their regulation. Hydrogen uptake and bacterial hydrogenases.

Nitrate metabolism: Enzymes of nitrate metabolism, regulation of their synthesis and activity.

UNIT-IV

Ammonia assimilation, Nitrification, Denitrification, Nitrate and sulfate reduction and their incorporation in amino acids.

Translocation of organic and inorganic substances.

UNIT – V

Special features of secondary plant metabolism, formation of phenolics, tannins, lignin, terpenes, terpenoids and alkaloids.

Water and mineral balance in plants.

Structure, function and mechanism of action of phytohormones- Auxin Gibberlin ABA, Cytokinin and Ethylene.

Defense system in plants.

BIOCHEMISTRY

M.Sc. SEMESTER III (2021-2022)

Paper 4: Environmental Toxicology (Elective 1) - 4 Credits

UNIT – I

Fundamental of toxicology. Definition and Scope. Types of toxic substances. Dose-response relationship. Xenobiotic metabolism: 1) Absorption 2) Distribution 3) Metabolism 4) Phase –I reaction and Phase II reaction.

UNIT – II

Types of exposure. Types of toxic response.
Tissue specificity and organ specificity of toxicity (w.r.t. liver, lungs, kidney)
Diagnosis of toxic changes in liver and kidney.Drugs as toxic substances.
Metabolism of haloalkanes, haloalkenes and paracetamol with their toxic effects on tissue.
Food toxicology: Role of diet in cardiovascular disease and cancer, Toxicology of food additives.

UNIT – III

Pesticide's Toxicology: 1) Insecticide toxicology: Organochlorines, Organophosphates, Carbamates 2) Herbicide toxicology Paraquat.
Metal toxicity: 1) Arsenic 2) Mercury 3) Lead 4) Cadmium

UNIT-IV

Environmental Pollution: Air Pollution, Common air pollutants and their sources, acid rain, ozone layer depletion, water pollution.

UNIT – V

Toxicity by natural products: Plant toxins, Animal Toxins, Microbial Toxins (Fungal and bacterial)
Toxicity by household products: carbon monoxide, Antifreeze, Ethylene glycol, Alcohol.
Toxicity testing: Acute Toxicity Test, Sub Acute Toxicity Tests, Chronic Toxicity Tests

BIOCHEMISTRY

M.Sc. SEMESTER III (2021-2022)

Paper 5: Biotechnology (Elective 2) - 4 Credits

UNIT – I

Basic principles of genetic engineering. Methods of creating recombinant DNA molecule, splicing, properties of restriction endonucleases and their mode of action. Construction of DNA library: Genomic library and cDNA library, chemical synthesis of gene.

UNIT – II

Structure, selection and screening of Cloning vectors (lambda phage, plasmid, M-13 phage, cosmid, shuttle vectors) and expression vectors

UNIT – III

Analysis of genomic DNA by southern hybridization, Northern and Western blotting techniques.

Restriction mapping: Restriction fragment length polymorphism (RFLP), Rapid amplified polymorphic DNA (RAPD) and amplified fragment length polymorphism (AFLP).

UNIT-IV

DNA sequencing techniques: plus and minus, dideoxynucleotide, Maxam and Gilbert method, Amplification of DNA by polymerase chain reaction (PCR). Applications and variation of PCR.

Site-directed mutagenesis. Antisense RNA technique.

UNIT – V

Transfection methods for animals and plants electroporation, particle gun, microinjection.

Transformation techniques for plants-: Agrobacterium mediated gene transfer and direct gene transfer.

Application of genetic engineering in medicine and agriculture, vaccine production.

BIOCHEMISTRY

M.Sc SEMESTER III (2021-2022)

Paper-6 Advanced Biochemistry (Elective 2) - 4 Credits

Unit-I – Genome Organization

Organization & Structure of eukaryotic chromosome
Role of nuclear matrix in chromosome organization & function
Heterochromatin & Euchromatin
DNA reassociation kinetics (Cot Curve analysis), repetitive & unique sequence
Satellite DNA, DNA melting & buoyant density, nucleoside phasing

Unit-II- Molecular Biological Technique

Nucleic acid isolation – Isolation of genomic DNA, RNA, Plasmid DNA
PCR, Blotting techniques & hybridization technique
RNA Interference
Genetic mapping & genetic marker – RFLP, mini & macro satellite, RAPD, AFLP
Gene knockout

Unit-III- Cell Signaling

Signaling molecules & their receptors
Function of G-protein- coupled receptor
Protein tyrosine kinase & cytokine receptor
Pathway of intracellular signal transduction

Unit-IV- Plant Metabolism

Photosynthesis-general features of photophosphorylation, Light absorption, light-driven electron flow, ATP synthesis by phosphorylation
N_2 metabolism- Biological N_2 fixation, nitrogenase complex, biotechnology of N_2 fixation, role of leghemoglobin, regulation of nif gene

Unit-V- Metabolic disorder

Inborn error of protein metabolism
Inborn error of carbohydrate metabolism
Inborn error of lipid metabolism, lipid storage diseases
Diabetes, Atherosclerosis, Arthritis, Gout

BIOCHEMISTRY

M.Sc SEMESTER III (2021-2022)

Open Elective (Interdisciplinary)

Paper-: Biochemical Techniques - 4 Credits

Unit-I

The concept of pH, Dissociation and ionization of acids and bases, pKa buffering mechanism, Henderson-Hasselbalch equation, ionization of amino acids and proteins, measurement of pH.

General principle, types of chromatography, adsorption and partition, Column, paper and thin layer.

Unit-II

Principle, materials used and applications of Ion-exchange chromatography, Gel filtration chromatography, Affinity chromatography, Gas Chromatography and High-performance liquid chromatography.

Unit-III

Electrophoresis: General Principle, factors affecting electrophoretic mobility, moving boundary and Zonal Electrophoresis, paper and Gel Electrophoresis, PAGE and SDS PAGE, Isoelectric focusing technique.

Sedimentation: Basic principle of sedimentation, Sedimentation velocity, preparative and analytical ultracentrifugation techniques, differential and density gradient centrifugation, Subcellular fractionation.

Unit-IV

Radioactivity: Types of radioisotopes used in Biochemistry (^{32}P, ^{35}S, ^{14}C and ^{3}H) Disintegration of radio nucleotides, half-life of radioactive compounds, measurement of radioactivity, scintillation counter, Gieger Muller counter, Use of radioisotopes *in vivo and in vitro* labeling, isotopic tracer techniques, Autoradiography.

Unit-V

Spectrophotometry: Beer Lambert's law, extinction coefficient and its importance, design of colorimeter and spectrophotometer. Applications of UV-VIS spectrophotometry, Atomic absorption spectrophotometry.

Principle and applications of Optical Rotatory Dispersion, Circular Dichroism, X-ray diffraction and NMR spectroscopy.

BIOCHEMISTRY

M.Sc. Semester III (2021-2022)

Practical I

1. Extraction and estimation of Proteins from plant material.
2. Extraction and estimation of RNA from plant material.
3. Extraction and estimation of DNA from plant material.
4. Estimation of chlorophyll and carotenoid pigments in plant material.
5. Determination of peroxidase activity in plant material.
6. Determination of Nitrate reductase activity in plant material.
7. Determination of Glutamate dehydrogenase activity in plant material.
8. Determination of total phenolic content in plant material.

M.Sc. Semester III

Practical II

1. Estimation of activity of salivary amylase by DNS method.
2. Effect of substrate concentration on enzyme activity.
3. Effect of enzyme concentration on enzyme activity.
4. Effect of temperature on enzyme activity
5. Effect of pH on enzyme activity.
6. Estimation of activity of Catalase.
7. Estimation of activity of Glutathione reductase.

BIOCHEMISTRY

M.Sc. SEMESTER IV (2021-2022)

Paper 1 : Molecular Biology (Core 11) - 4 Credits

UNIT – I

Structure of DNA. Structural organization of the DNA in the nuclear material- General properties and modifications of histones, nucleosomes and solenoid structure.

Concept and definition of gene, complexity of the eukaryotic genome.

UNIT – II

Replication: Modes of replication, Experimental evidence for semiconservative mode of replication. The enzymes of DNA replication in prokaryotes and eukaryotes. Mechanism of replication in bacteria and viruses, reverse transcriptase, salient features of eukaryotic nuclear and mitochondrial DNA replication. Inhibitors involved in process of replication.

UNIT – III

RNA synthesis (Transcription): The enzymes of transcription in prokaryotes and eukaryotes, mechanism of transcription in bacteria, heteronuclear RNA, post-transcriptional processing of RNA, role of ribozymes. Inhibitors involved in process of transcription.

UNIT-IV

Protein synthesis (Translation): Concept of the genetic code, structure of rRNA and t-RNA, enzymes of translation in prokaryotes and eukaryotes, mechanism of protein synthesis, post-translational processing. Inhibitors involved in process of translation.

UNIT – V

Regulation of gene expression in prokaryotes and eukaryotes. Types of operon- Inducible and repressible, Positive and negative control. Structure (promoter, operator, structural gene and regulator) and mechanisms of various operons, such as Lac, Trp and Ara.

BIOCHEMISTRY

M.Sc. SEMESTER IV (2021-2022)

Paper 2: Metabolism II (Core 13) - 4 Credits

UNIT – I

Proteins: Digestion and absorption of proteins. Protein metabolism: proteolysis, deamination- oxidative and non-oxidative, Transamination- mechanism and role of pyridoxal phosphate, decarboxylation reactions, nitrogen balance, ammonia transport, Urea cycle.

UNIT – II

Amino acid metabolism: Glucogenic and ketogenic amino acids, one-carbon metabolism, Biosynthesis of non-essential amino acids, pyruvate forming and glutamate forming amino acids. Inborn errors associated with them.

UNIT – III

Catabolism of Sulphur containing amino acid-methionine,
Catabolism of acidic amino acid-aspartate,
Catabolism of basic amino acid -lysine,
Catabolism of branched-chain Amino acid
Catabolism of aromatic amino acids.
Inborn errors associated with Amino acid metabolism

UNIT – IV

Nucleic acid metabolism-Degradation of nucleoprotein. Biosynthesis and degradation of purines and pyrimidines and their regulation.
Structure and regulation of ribonucleotide reductase. Inhibitors of nucleic acid biosynthesis. Inherited disorders of purine and pyrimidine metabolism- Gout, Lesch-nyhan syndrome, orotic aciduria.

UNIT – V

Mineral metabolism: Biological role of minerals and trace elements- Ca, P, Fe, Cl, Mn, Zn, Cu, Mg
Toxic effects of heavy metals, such as Hg, Cd, Pb, As.

BIOCHEMISTRY

M.Sc. SEMESTER IV (2021-2022)

Paper 3: Applied Clinical Biochemistry (Core 12) - 4 Credits

UNIT – 1

Collection and preservation of biological fluids. Chemical analysis of CSF. Composition of ICF and ECF. Fluid and Electrolyte balance
Disorders related to Acid-base balance. Chemistry and mode of action of antibiotics: Penicillin, tetracycline, streptomycin and chloramphenicol.

UNIT – II

Disorders of carbohydrate metabolism, Postprandial and Glucose tolerance test. Biochemical changes in Diabetes mellitus, Hypoglycemia, Ketone bodies, Glycosylated hemoglobin.
Lipids, lipoproteins and apolipoproteins- role in diseases.

UNIT – III

Evaluation of organ function tests of gastric, pancreas, kidney and liver. Bilirubin- direct and indirect, Vanden bergh test and its clinical significance, jaundice. Fatty liver, Bile pigments- chemical nature and physiological significance.

UNIT-IV

Porphyrins – chemical nature and physiological significance and their detection by spectrophotometry and fluorescence.
Enzymes in differential diagnosis of diseases and their clinical significance.
Detoxification, Phase I and Phase II reactions, Enzymes of detoxication.

UNIT – V

Carcinogenesis, characteristics of cancerous cells, agents promoting carcinogenesis. Free radicals in biological system, Antioxidants.

BIOCHEMISTRY

M.Sc. SEMESTER IV (2021-2022)

Paper 4: Immunology (Elective 3) - 4 Credits

UNIT – I

Types of immunity, innate, acquired, passive, and active, self vs non-self discrimination.

Physiology of immune response: HI and CMI specificity and memory, Antigen types.

Immunoglobulins – structure, distribution and functions, Isotypic, Allotypic and Idiotypic variants. Immunoglobulin superfamily.

UNIT – II

Structure and function of lymphoid tissue., origin and development of T- and B-lymphocytes, differentiation of lymphocytes. T and B cells and their surface markers. Activation of T- and B- lymphocytes and signaling pathways in T and B cells.

Antigen processing and presentation, lymphokines, phagocytic cells, macrophage, dendritic cells, K and NK cells.

UNIT – III

MHC genes and products, polymorphism in MHC genes. Role of MHC antigens in immune responses, MHC antigens in transplantation and HLA tissue typing. Structure and function of class I and II molecules.

Effector mechanisms in immunity macrophage activation, cell-mediated cytotoxicity, cytotoxicity assay.

UNIT – IV

Hypersensitivity reactions and types.

The complement system, mode of activation, classical, alternate and lectin pathway, biological functions of C proteins.

Immunological tolerance and suppression.

UNIT – V

Antigen-antibody reactions, Immunotechiques- Agglutination and precipitation, Single and double immunodiffusion, Immunoelectrophoresis, Immunofluorescence, RIA and ELISA, Monoclonal antibodies- production and application.

BIOCHEMISTRY

M.Sc. SEMESTER IV (2021-2022)

Paper 5: Environmental Biochemistry (Elective 4) - 4 Credits

Unit-I

Environmental components: Atmosphere, structure and chemical composition of atmosphere. Internal structure of the Earth, rocks and their classification, minerals and their classification.
Weathering and soil formation, soil profile, soil classification, Soil erosion; Inorganic and Organic components of soil -Nitrogen pathways in soil soils of India.

Unit-II

Global Water Balance. Origin and composition of sea water. Hydrological cycle. Classification of trace elements, mobility of trace elements, biogeochemical cycles.

Fundamentals of water chemistry; Concept of DO, BOD, COD, Total hardness, Redox potential; Carbonate system

Unit - III

Fundamentals of Ecology: Definition, subdivisions. Ecosystems: concept of ecosystems, aquatic ecosystem, terrestrial ecosystem, energy flow in ecosystems, nutritional flux. Foodchains, Food web, ecotone, edge effects, ecological habitat & niche, ecological pyramids and ecosystem stability, concept of habitat and niche.

Unit -IV

Biomes and Habitat Diversity: Classification of biomes, major biotic elements of each biome and their characteristics. Population and community ecology, population growth curves, life history strategies (r &k selection); concept of metapopulation. Ecological succession, primary and secondary, mechanism of succession.

Unit-V

Global environmental issues and International laws: Global warming, Greenhouse effect, ozone depletion, acid rains, hazardous waste, CITES etc. Earth's carbon cycle, carbon sequestration, sustainable development.

Bioremediation: Introduction and types of bioremediation, bioremediation of surface soil and sludge, bioremediation of subsurface material, In situ and Ex-situ technologies, Phytoremediation.

BIOCHEMISTRY

M.Sc. Semester IV (2021-2022)

Practical I

1. Estimation of phosphate in serum.
2. Estimation of creatinine in serum.
3. Estimation of calcium in serum.
4. Estimation of cholesterol in serum sample.
5. Estimation of chloride in serum sample.
6. Estimation of urea in blood sample.

M.Sc. Semester IV

Practical II

1. Estimation of bilirubin in serum sample.
2. Estimation of uric acid in serum sample.
3. Assay of serum amylase enzyme.
4. Assay of serum phosphatase enzymes-acid and alkaline phosphatase.
5. Assay of serum enzymes- Aspartate transaminase and Alanine transaminase.
6. Electrophoretic separation of proteins.
7. Demonstration of immunological techniques (Radial immunodiffusion and Ouchterlony double diffusion).

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Bioinformatics

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

B.Sc.: -

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** FIRST **Session:** 2021 -2022		
Subject: Bioinformatics (Major)		
1	**Course Code**	**S1-BINF1T**
2	**Course Title**	**Paper I - Cell and Molecular Biology**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	Core Course
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** 1. Develop the idea about basics of cell and molecular biology, gene expression patterns and mutations. 2. Apply the knowledge of biochemical, molecular and physiological aspects of cells and cellular behavior and organizations during tackling the biological problems through *in silico* approach.
6	**Credit Value**	Theory — 4
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
Paper : Cell and Molecular biology (Major)		
Unit	Topic	**Number of Lectures**
Unit I	**Cell-Basic Unit of Life** 1.1 History of cell, Cell as a basic unit of life and Cell Theory 1.2 Ultra structure of cell. Organization of plant and animal cells. Comparison of microbial, plant and animal cell. Cells as experimental models. 1.3 Biochemical components of cells (nucleic acid, carbohydrate, protein and lipids). **Keywords:** Cell, Cell Theory, Prokaryotes, Eukaryotes, Biomolecules.	15
Unit II	**Sub cellular components and Cell Division Cycle** 2.1 Sub cellular organization, Cytosol, 2.2 Structure and functions of cytoplasmic organelles: Golgi body, Endoplasmic reticulum, Lysosomes, Peroxixomes, Nucleus, Mitochondria and Chloroplast. 2.3 Structure and function of Cell Membrane. 2.4 Cell division cycle (eukaryotic and prokaryotic), mitosis, meiosis and cell death. **Keywords:**Cytosoi, Cell organelles, Plasma membrane, Mitosis, Meiosis.	15
UnitIII	**DNA- Genetic Material** 3.1 DNA as a genetic material, Experimental evidences - Griffith's, McLeod, McCarty and Avery's, Hershey and Chase experiments. 3.2 Structure of DNA, Definition of gene, Chromosome structure and functions, Lampbrush and Polytene chromosome. 3.3 Gene transfer in bacteria: Transformation, Conjugation &Transduction. 3.4 DNA replication in prokaryotes & eukaryotes, Proteins necessary for DNA replication, Regulation of DNA replication. **Keywords:** DNA, Gene. Chromosome, Gene Transfer, DNA Replication	15
UnitIV	**Gene Expression and Mutation** 4.1 .Gene expression: Transcription and translation in prokaryotes & eukaryotes. 4.2. Post translational modification in eukaryotes. 4.3. Regulation of gene expression in prokaryotes &eukaryotes 4.4 Mutation: types of mutation, mutagens & mutagenesis.	15

	Keywords: Gene expression, Transcription, Translation, Mutation, Mutagen	

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1. Krebs, Jocelyn E. , Goldstein, Elliott S., Kilpatrick, Stephen T., Lewin's GENES XII. United States, Jones & Bartlett Learning, 2017. 2. Molecular Cell Biology, Lodish, H., Berk, A. et, al, WH Freeman & Co Ltd., 2016 3. Molecular Biology of the Cell, Alberts, B., W.W. Norton, United States, 2017. 4. Molecular Biology: Genes to Proteins, Tropp, Burton E., N.p., Jones & Bartlett Learning, LLC, 2020. 5. Molecular Biology of the Gene, Watson James D., et,al Pearson Education, 2017.
Suggested equivalent online courses: 1. https://onlinecourses.nptel.ac.in/noc21 cvl5/preview 2. https://nptel.ac.in/courses/102/106/102106025/ 3. https://nptel.ac.in/courses/102/106/102106087/

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part D: Assessment and Evaluation (Theory)		
Maximum Marks: 100 Continuous Comprehensive Evaluation(CCE): **25** End Semester Exam (UE): **75**		
Internal sive **Assessment(CCE) Continuous Comprehen Evaluation**	Four Class lest ot 4 marks each	16
	Assignment/Presentation	04
	Overall performance in the semester	05
	Total	**25**
External Assessment: End Semester Exam.	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (B) : Two Long Questions (500 Words Each)	02 X 015=30

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** FIRST **Session:** 2021 -2022		
Subject: Bioinformatics		
1	**Course Code**	**S1-BINF1P**
2	**Course Title**	**Practical in Cell and Molecular Biology (Major)**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	Core Course
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12[1]
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** 1.Apply the knowledge of biochemical, molecular and physiological aspects of cells and cellular behavior and organizations during tackling the biological problems through ***in silico*** **approach.** 2. Conduct experiments, analyse and interpret the results using **basic cellular & molecular biological techniques.**
6	**Credit Value**	Practical - 2
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
Paper I: Practical Cell and Molecular biology		
Practical	Topic	**Number of Lectures**
	1. Study of microbial cells by monochrome staining and Gram staining 2. Study of different stages of mitosis and meiosis. 3. Qualitive test for carbohydrates, protein and lipids. 4. Isolation of Chromosomal DNA from plant cell/animal cell 5. Isolation of genomic/plasmid DNA from microorganism. 6. Analysis of isolated DNA by Agarose gel electrophoresis. 7. Transformation in E. coli. 8. UV as mutagen.	30

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1. Willison and Walker's Principle and Techniques of Biochemistry and Molecular Biology, United Kingdom: Cambridge End Semester press 2018. 2. An introduction to practical biochemistry, David T Plummer, Tata McGraw-Hill Edition, 2003 3. Molecular Cloning: A Laboratory Manual, Green and Sambrook, Cold Spring Harbor Laboratory press 2003. 4. Molecular Cell Biology, Loudish, H., Berk, A.et. al. WH Freeman & Co Ltd., 2016 5. Molecular Biology: Genes to proteins, Troop, Burton E., N.P., Jones & Bartlett Learning, LLC, 2020 Suggested equivalent online courses: 1. https://onlinecourses.nptel.ac.in/noc21 cvl5/preview 2. https://nptel.ac.in/courses/102/106/102106025/ 3. https://nptel.ac.in/courses/102/106/102106087/

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part D: Assessment and Evaluation (Theory)			
Suggest Continuous Evaluation Methods:			
Internal Assement	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva voce on Practical	15
Attendance	5	Practical Record file	10
Assignment (Charts/Model/ Seminar/ Ruler/ Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial visit)	10	Table work /Experiments	50
Total	25		75

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** FIRST **Session:** 2021 -2022		
Subject: Bioinformatics (Minor)		
1	**Course Code**	**S1-BINF1T**
2	**Course Title**	**Paper - Cell and Molecular Biology (Minor)**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	Core Course
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** 1. Develop the idea about basics of cell and **molecular biology, gene expression** patterns and mutations. 2. Apply the knowledge of biochemical, molecular and physiological aspects of cells and cellular behavior and organizations during tackling the biological problems through ***in silico*** **approach.**
6	**Credit Value**	Theory — 4
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
Paper : Cell and Molecular biology (Minor)		
Unit	Topic	**Number of Lectures**
Unit I	**Cell-Basic Unit of Life** 1.1History of cell, Cell as a basic unit of life and Cell Theory 1.2 Ultra structure of cell. Organization of plant and animal cells. Comparison of microbial, plant and animal cell. Cells as experimental models. 1.3 Biochemical components of cells (nucleic acid, carbohydrate, protein and lipids). **Keywords:** Cell, Cell Theory, Prokaryotes, Eukaryotes, Biomolecules.	15
Unit II	**Sub cellular components and Cell Division Cycle** 2.1Sub cellular organization, Cytosol, 2.2Structure and functions of cytoplasmic organelles: Golgi body, Endoplasmic reticulum, Lysosomes, Peroxixomes,Nucleus, Mitochondria and Chloroplast. 2.3Structure and function of Cell Membrane. 2.4 Cell division cycle (eukaryotic and prokaryotic), mitosis, meiosis and cell death. **Keywords:**Cytosoi, Cell organelles, Plasma membrane, Mitosis, Meiosis.	15
Unit III	**DNA- Genetic Material** 3.1 DNA as a genetic material, Experimental evidences - Griffith's, McLeod, McCarty and Avery's, Hershey and Chase experments. 3.2 Structure of DNA, Definition of gene, Chromosome structure and functions, Lampbrush and Polytene chromosome. 3.3 Gene transfer in bacteria: Transformation, Conjugation &Transduction. 3.4 DNA replication in prokaryotes & eukaryotes, Proteins necessary for DNA replication, Regulation of DNA replication. **Keywords:** DNA, Gene. Chromosome, Gene Transfer, DNA Replication	15
Unit IV	**Gene Expression and Mutation** 4.1 Gene expression: Transcription and translation in prokaryotes& eukaryotes. 4.2. Post translational modification in eukaryotes. 4.3. Regulation of gene expression in prokaryotes &eukaryotes 4.4 Mutation: types of mutation, mutagens & mutagenesis. **Keywords:** Gene expression, Transcription, Translation, Mutation, Mutagen	15

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1. Krebs, Jocelyn E. , Goldstein, Elliott S., Kilpatrick, Stephen T., Lewin's GENES XII. United States, Jones & Bartlett Learning, 2017. 2. Molecular Cell Biology, Lodish, H., Berk, A. et, al, WH Freeman & Co Ltd., 2016 3. Molecular Biology of the Cell, Alberts, B., W.W. Norton, United States, 2017. 4. Molecular Biology: Genes to Proteins, Tropp, Burton E., N.p., Jones & Bartlett Learning, LLC, 2020. 5. Molecular Biology of the Gene, Watson James D., et,al Pearson Education, 2017.
Suggested equivalent online courses: 1. https://onlinecourses.nptel.ac.in/noc21 cv15/preview 2. https://nptel.ac.in/courses/102/106/102106025/ 3. https://nptel.ac.in/courses/102/106/102106087/

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part D: Assessment and Evaluation (Theory)		
Maximum Marks: 100 Continuous Comprehensive Evaluation(CCE): **25** End Semester Exam (UE): **75**		
Internal sive **Assessment(CCE) Continuous Comprehen Evaluation**	Four Class lest ot 4 marks each	16
	Assignment/Presentation	04
	Overall performance in the semester	05
	Total	**25**
External Assessment: End Semester Exam.	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (B) : Two Long Questions (500 Words Each)	02 X 015=30

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** FIRST **Session:** 2021 -2022		
Subject: Bioinformatics		
1	**Course Code**	**S1-BINF1P**
2	**Course Title**	**Practical in Cell and Molecular Biology (Minor)**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	Core Course
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12[1]
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** 1. Apply the knowledge of biochemical, molecular and physiological aspects of cells and cellular behavior and organizations during tackling the biological problems through *in silico* approach. 2. Conduct experiments, analyse and interpret the results using basic cellular & molecular biological techniques.
6	**Credit Value**	Practical - 2
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
Paper I: Practical Cell and Molecular biology		
Practical	Topic	**Number of Lectures**
Unit I	9. Study of microbial cells by monochrome staning and Gram staining 10. Study of different stages of mitosis and meiosis. 11. Qualitive test for carbohydrates, protein and lipids. 12. Isolation of Chromosomal DNA from plant cell/animal cell 13. Isolation of genomic/placmid DNA from microorganism. 14. Analysis of isolated DNA by Agarose gel electrophoresis. 15. Transformation in E. coli. 16. UV as mutagen.	30

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 6. Willison and Walker's Principle and Techniques of Biochemistry and Molecular Biology, United Kingdom: Cambridge End Semester press 2018. 7. An introduction to practical biochemistry, David T Plummer, Tata McGraw-Hill Edition, 2003 8. Molecular Cloning: A Laboratory Manual, Green and Sambrook, Cold Spring Harbor Laboratory press 2003. 9. Molecular Cell Biology, Loudish, H., Berk, A.et. al. WH Freeman & Co Ltd., 2016 10. Molecular Biology: Genes to proteins, Troop, Burton E., N.P., Jones & Bartlett Learning, LLC, 2020
Suggested equivalent online courses: 1. https://onlinecourses.nptel.ac.in/noc21 cvl5/preview 2. https://nptel.ac.in/courses/102/106/102106025/ 3. https://nptel.ac.in/courses/102/106/102106087/

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part D: Assessment and Evaluation (Theory)			
Suggest Continuous Evaluation Methods:			
Internal Assement	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva voce on Practical	15
Attendance	5	Practical Record file	10
Assignment (Charts/Model/ Seminar/ Ruler/ Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial visit)	10	Table work /Experiments	50
Total	25		75

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester: First Session:** 2021 -2022		
Subject: Bioinformatics (Open Elective)		
1	**Course Code**	**S1-BINF1T (OE)**
2	**Course Title**	**General Introduction to Bioinformatics**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	**Core Course**
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** The students shall be able to : 1.Get the general overview of internet protocols and general introduction of bioinformatics. 2.Acquire the knowledge about the biological databases, sequence alignments, data retrieval system, phylogenetic analysis and comparative genome analysis. 3.Join as lab assistant/ technical assistant in any R&D project in Life sciences.
6	**Credit Value**	Theory — **4**
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

BSc Ist semester Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
General Introduction to Bioinformatics (OE)		
Unit	Topic	**Lectures**
Unit I	Introduction to Bioinformatics 1.1 Introduction to Bioinformatics and application oriented background of bioinformatics. 1.2 Introduction to Biological Databases. 1.3 Types of Biological Databases: Nucleic Acid Databases, Protein Databases, Specialized Genome Databases, Structure Classification Databases and Structure Database. **Keywords:** Biological Databases, Nucleic Acid Database, Protein Databases, Specialised Genome Database, Structure Classification Database, Structure Databases.	15
Unit II	Data Acquisition and Information Retrieval from Biological Databases 2.1 Data Acquisition - concept and purposes. 2.2 Information Retrieval from Biological Databases: Integrated information Retrieval (Entrez System), Retrieving database entries. 2.3 The NCBI data model: Introduction, Seq-id, Sequence, collection of sequence, annotation of sequence, describing sequence. 2.4 GenBank Sequence Database: Introduction to structure, Primary and secondary database, Format vs Content: Computer vs. Human, Databases, Genbank Flat file, GCG. **Keywords:**Entrez, NCBI, Sequence, Seq-id,GenBank	15

Part C: Learning Resources
Text Books, Reference Books, Other Resources

Suggested Readings:

1.Bioinformatics, Andreas D. Baxevanis, David S. Wishart, Gary D.Bade, Wiley, United Kingdom, 2019.
2.Essential Bioinformatics, Xiong, Jin, Cambridge End Semester Press, United States,2014
3.Bioinformatics: Sequence and Genome Analysis, Mount, D. W., CBS Publishers &Distributors, India, 2005.
4.Introduction to Bioinformatics, Lesk, Arthur M, Oxford End Semester Press, USA, 2019. 5th edition
5.Bioinformatics: methods and applications: (Genomics, Proteomics and Drug Discovery), Mendiratta, N., Rastogi, P., Rastogi, S. C, PHI Learning, India, (2013).
6.Bioinformatics: Principles and applications, Ghosh, Z., Mallik, B., Oxford Press, New Delhi, India, 2012.
7.Bioinformatics and Functional Genomics, Pevsner, Jonathan, Wiley, United Kingdom, 2015.3rd edition.

Suggested equivalent online courses:

1. NPTEL :: Biotechnology - NOC: Bioinformatics: Algorithms and Applications
2. Bio-Informatics - HTM - YouTub

Part D: Assessment and Evaluation (Theory)		
Maximum Marks: **100** Continuous Comprehensive Evaluation(CCE): **25** End Semester Exam (UE): **75**		
Internal sive **Assessment(CCE) Continuous Comprehen Evaluation**	Four Class lest ot 4 marks each	16
	Assignment/Presentation	04
	Overall performance in the semester	05
	Total	**25**
External Assessment: End Semester Exam.	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (B) : Two Long Questions (500 Words Each)	02 X 015=30

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester: Second Session:** 2021 - 2022		
Subject: Bioinformatics (Major)		
1	**Course Code**	**S1-BINF1T (Major)**
2	**Course Title**	**General Introduction to Bioinformatics**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	**Core Course**
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** The students shall be able to : 1.Get the general overview of internet protocols and general introduction of bioinformatics. 2.Acquire the knowledge about the biological databases, sequence alignments, data retrieval system, phylogenetic analysis and comparative genome analysis. 3.Join as lab assistant/ technical assistant in any R&D project in Life sciences.
6	**Credit Value**	Theory — **4**
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

BSc Ist semester Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
General Introduction to Bioinformatics (Major)		
Unit	Topic	**Lectures**
Unit I	Introduction to Bioinformatics 1.1 Introduction to Bioinformatics and application oriented background of bioinformatics. 1.2 Introduction to Biological Databases. 1.3 Types of Biological Databases: Nucleic Acid Databases, Protein Databases, Specialized Genome Databases, Structure Classification Databases and Structure Database. **Keywords:** Biological Databases, Nucleic Acid Database, Protein Databases, Specialised Genome Database, Structure Classification Database, Structure Databases.	15
Unit II	Data Acquisition and Information Retrieval from Biological Databases 2.1 Data Acquisition - concept and purposes. 2.2 Information Retrieval from Biological Databases: Integrated information Retrieval (Entrez System), Retrieving database entries. 2.3 The NCBI data model: Introduction, Seq-id, Sequence, collection of sequence, annotation of sequence, describing sequence. 2.4 GenBank Sequence Database: Introduction to structure, Primary and secondary database, Format vs Content: Computer vs. Human, Databases, Genbank Flat file, GCG. **Keywords:** Entrez, NCBI, Sequence, Seq-id,GenBank	15
Unit III	Sequence Alignment and Database Searching 3.1Sequence Alignment And Database Searching: Introduction, Evolutionary Basis of Sequence Alignment, 3.2Optimal alignment method, Substitution Score and Gap Penalty, Statistical Significance of Alignment. Database similarity searching, FASTA, BLAST, Database searching Artefacts, Position Specific Scoring Matrices. 3.3 Multiple Sequence Alignment (MSA): About MSA, Structural or Evolutionary Alignment, ways to align Sequences, Tools. **Keywords:** Sequence Alignment, FASTA, BLAST, Optimal alignmentmethod.	15
UnitIV	**Phylogenetic Analysis, Predictive Methods and Comparative Genome Analysis** 4.1 Phylogenetic Analysis: Fundamental of Phylogenetic model, Tree interpretation - Paralogies and orthologues, Tree building and Tree evaluation, Phylogenetic software. 4.2Predictive Method using Nucleotide Sequence: Introduction, Marking repetitive DNA, Database search, Codon bias detection, detecting functional site in DNA. 4.3Predictive Method using Protein Sequence: Protein identification based on composition , Physical properties based on sequence, Motif and pattern , Secondary structure and folding classes, specialized structure or features, Tertiary structures. 4.4Structure Database: Introduction to Structure, PDB, MMDB, Structure file format, visualizing structure information, Structure viewers, structure similarity searching,	15

	Advanced structure modelling. 4.5Comparative Genome Analysis: Introduction, application, genome analysis and annotation. **Keywords**: Phylogenetic Analysis, Predictive Method, Motif, PDB, MMDB, Comparative Genome Analysis.	

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1.Bioinformatics, Andreas D. Baxevanis, David S. Wishart, Gary D.Bade, Wiley, United Kingdom, 2019. 2.Essential Bioinformatics, Xiong, Jin, Cambridge End Semester Press, United States,2014 3.Bioinformatics: Sequence and Genome Analysis, Mount, D. W., CBS Publishers &Distributors, India, 2005. 4.Introduction to Bioinformatics, Lesk, Arthur M, Oxford End Semester Press, USA, 2019. 5th edition 5.Bioinformatics: methods and applications: (Genomics, Proteomics and Drug Discovery), Mendiratta, N., Rastogi, P., Rastogi, S. C, PHI Learning, India, (2013). 6.Bioinformatics: Principles and applications, Ghosh, Z., Mallik, B., Oxford Press, New Delhi, India, 2012. 7.Bioinformatics and Functional Genomics, Pevsner, Jonathan, Wiley, United Kingdom, 2015.3rd edition.
Suggested equivalent online courses: 1. NPTEL :: Biotechnology - NOC: Bioinformatics: Algorithms and Applications 2. Bio-Informatics - HTM - YouTub

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part D: Assessment and Evaluation (Theory)		
Maximum Marks: **100** Continuous Comprehensive Evaluation(CCE): **25** End Semester Exam (UE): **75**		
Internal sive **Assessment(CCE) Continuous Comprehen Evaluation**	Four Class lest ot 4 marks each	16
	Assignment/Presentation	04
	Overall performance in the semester	05
	Total	**25**
External Assessment: End Semester Exam.	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (B) : Two Long Questions (500 Words Each)	02 X 015=30

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course**Class:** B.Sc. Semester :Second **Session:** 2021 -2022		
Subject: Bioinformatics		
1	**Course Code**	S1-BINF2P
2	**Course Title**	**Practical in General Introduction to Bioinformatics (Major)**
3	**Course Type (Core/Elective/Generic Elective/ Vocational/...)**	Core Course
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12[1]
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** The students shall be able to : 1.Retrieve the DNA/Protein sequences from databases and analyze them using bioinformaticstools. 2. Perform multiple sequence alignment using bioinformatics tools. 3.Visualize the structures of proteins.
6	**Credit Value**	Practical - 2
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 2 hours per week (Total 30		
Paper II: Practical in General Introduction to Bioinformatics		
Practical	Topic	No of Lectures
	1. Introduction to NCBI. 2. Using Entrez to search Literature Databases. 3. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored. 4. Retrieving Protein sequence from GenPept (NCBI) andExpasy. 5. Analyzing Protein Sequences. 6. Analyzing DNA sequence. 7. Sequence alignment using BLAST (Basic LocalAlignment SearchTool). 8. Sequence alignment using FASTA. 9. Multiple sequence alignment using CrustalW. 10.Introduction to the structure database PDB. 11.Visualization of the protein structure using VMD. 12. Secondry structure prediction using GOR algorithm.	30

Part C: Learning Resources
Text Books, Reference Books, Other Resources
1.Bioinformatics, Andreas D. Baxevanis, uaviuBade, Wiley, United Kingdom, 2019. 2.Essential Bioinformatics, Xiong, Jin, Cambridge End Semester Press, United States, 2014 3.Bioinformatics: Sequence and Genome Analysis, Mount, D. W., CBS Publishers & Distributors. India, 2005. 4.Introduction to Bioinformatics, Lesk, Arthur M, Oxford End Semester Press, USA, 2019. 5th edition 5Bioinformatics: methods and applications: (Genomics, Proteomics and Drug Discovery), Mendiratta, N., Rastogi, P., Rastogi, S. C, PHI Learning, India, (2013). 6.Bioinformatics: Principles and applications, Ghosh, Z., Mallik, B., Oxford Press, New Delhi, India, 2012. 7.Bioinformatics and Functional Genomics, Pevsner, Jonathan, Wiley, United Kingdom, 2015. 3rd edition.

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part D: Assessment and Evaluation (Theory)			
Suggest Continuous Evaluation Methods:			
Internal Assesment	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva voce on Practical	15
Attendance	5	Practical Record file	10
Assignment (Charts/Model/ Seminar/ Ruler/ Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial visit)	10	Table work /Experiments	50
Total	25		75

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester: Second Session:** 2021 - 2022		
Subject: Bioinformatics (Minor)		
1	**Course Code**	**S1-BINF1T (Minor)**
2	**Course Title**	**General Introduction to Bioinformatics**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	**Core Course**
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** The students shall be able to : 1.Get the general overview of internet protocols and general introduction of bioinformatics. 2.Acquire the knowledge about the biological databases, sequence alignments, data retrieval system, phylogenetic analysis and comparative genome analysis. 3.Join as lab assistant/ technical assistant in any R&D project in Life sciences.
6	**Credit Value**	Theory — **4**
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

BSc Ist semester Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
General Introduction to Bioinformatics (Minor)		
Unit	Topic	**Lectures**
Unit I	Introduction to Bioinformatics 1.1 Introduction to Bioinformatics and application oriented background of bioinformatics. 1.2 Introduction to Biological Databases. 1.3 Types of Biological Databases: Nucleic Acid Databases, Protein Databases, Specialized Genome Databases, Structure Classification Databases and Structure Database. **Keywords:** Biological Databases, Nucleic Acid Database, Protein Databases, Specialised Genome Database, Structure Classification Database, Structure Databases.	15
Unit II	Data Acquisition and Information Retrieval from Biological Databases 2.1 Data Acquisition - concept and purposes. 2.2 Information Retrieval from Biological Databases: Integrated information Retrieval (Entrez System), Retrieving database entries. 2.3 The NCBI data model: Introduction, Seq-id, Sequence, collection of sequence, annotation of sequence, describing sequence. 2.4 GenBank Sequence Database: Introduction to structure, Primary and secondary database, Format vs Content: Computer vs. Human, Databases, Genbank Flat file, GCG. **Keywords:** Entrez, NCBI, Sequence, Seq-id,GenBank	15
Unit III	Sequence Alignment and Database Searching 3.1Sequence Alignment And Database Searching: Introduction, Evolutionary Basis of Sequence Alignment, 3.2Optimal alignment method, Substitution Score and Gap Penalty, Statistical Significance of Alignment. Database similarity searching, FASTA, BLAST, Database searching Artefacts, Position Specific Scoring Matrices. 3.3 Multiple Sequence Alignment (MSA): About MSA, Structural or Evolutionary Alignment, ways to align Sequences, Tools. **Keywords:** Sequence Alignment, FASTA, BLAST, Optimal alignmentmethod.	15
UnitIV	**Phylogenetic Analysis, Predictive Methods and Comparative Genome Analysis** 4.1 Phylogenetic Analysis: Fundamental of Phylogenetic model, Tree interpretation - Paralogies and orthologues, Tree building and Tree evaluation, Phylogenetic software. 4.2Predictive Method using Nucleotide Sequence: Introduction, Marking repetitive DNA, Database search, Codon bias detection, detecting functional site in DNA. 4.3Predictive Method using Protein Sequence: Protein identification based on composition , Physical properties based on sequence, Motif and pattern , Secondary structure and folding classes, specialized structure or features, Tertiary structures. 4.4Structure Database: Introduction to Structure, PDB, MMDB, Structure file format, visualizing structure information, Structure viewers, structure similarity searching,	15

	Advanced structure modelling. 4.5Comparative Genome Analysis: Introduction, application, genome analysis and annotation. **Keywords**: Phylogenetic Analysis, Predictive Method, Motif, PDB, MMDB, Comparative Genome Analysis.	

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1.Bioinformatics, Andreas D. Baxevanis, David S. Wishart, Gary D.Bade, Wiley, United Kingdom, 2019. 2.Essential Bioinformatics, Xiong, Jin, Cambridge End Semester Press, United States,2014 3.Bioinformatics: Sequence and Genome Analysis, Mount, D. W., CBS Publishers &Distributors, India, 2005. 4.Introduction to Bioinformatics, Lesk, Arthur M, Oxford End Semester Press, USA, 2019. 5th edition 5.Bioinformatics: methods and applications: (Genomics, Proteomics and Drug Discovery), Mendiratta, N., Rastogi, P., Rastogi, S. C, PHI Learning, India, (2013). 6.Bioinformatics: Principles and applications, Ghosh, Z., Mallik, B., Oxford Press, New Delhi, India, 2012. 7.Bioinformatics and Functional Genomics, Pevsner, Jonathan, Wiley, United Kingdom, 2015.3rd edition.
Suggested equivalent online courses: 1. NPTEL :: Biotechnology - NOC: Bioinformatics: Algorithms and Applications 2. Bio-Informatics - HTM - YouTub

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part D: Assessment and Evaluation (Theory)		
Maximum Marks: **100** Continuous Comprehensive Evaluation(CCE): **25** End Semester Exam (UE): **75**		
Internal sive **Assessment(CCE) Continuous Comprehen Evaluation**	Four Class lest ot 4 marks each	16
	Assignment/Presentation	04
	Overall performance in the semester	05
	Total	**25**
External Assessment: End Semester Exam.	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (B) : Two Long Questions (500 Words Each)	02 X 015=30

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course**Class:** B.Sc. Semester :Second **Session:** 2021 -2022		
Subject: Bioinformatics		
1	**Course Code**	S1-BINF2P
2	**Course Title**	**Practical in General Introduction to Bioinformatics (Minor)**
3	**Course Type (Core/Elective/Generic Elective/ Vocational/...)**	Core Course
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12[1]
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** The students shall be able to : 1.Retrieve the DNA/Protein sequences from databases and analyze them using bioinformaticstools. 2. Perform multiple sequence alignment using bioinformatics tools. 3.Visualize the structures of proteins.
6	**Credit Value**	Practical - 2
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 2 hours per week (Total 30		
Paper II: Practical in General Introduction to Bioinformatics		
Practical	Topic	No of Lectures
	1. Introduction to NCBI. 2. Using Entrez to search Literature Databases. 3. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored. 4. Retrieving Protein sequence from GenPept (NCBI) andExpasy. 5. Analyzing Protein Sequences. 6. Analyzing DNA sequence. 7. Sequence alignment using BLAST (Basic LocalAlignment SearchTool). 8. Sequence alignment using FASTA. 9. Multiple sequence alignment using CrustalW. 10.Introduction to the structure database PDB. 11.Visualization of the protein structure using VMD. 12. Secondry structure prediction using GOR algorithm.	30

Part C: Learning Resources
Text Books, Reference Books, Other Resources
1.Bioinformatics, Andreas D. Baxevanis, uaviuBade, Wiley, United Kingdom, 2019. 2.Essential Bioinformatics, Xiong, Jin, Cambridge End Semester Press, United States, 2014 3.Bioinformatics: Sequence and Genome Analysis, Mount, D. W., CBS Publishers & Distributors. India, 2005. 4.Introduction to Bioinformatics, Lesk, Arthur M, Oxford End Semester Press, USA, 2019. 5th edition 5Bioinformatics: methods and applications: (Genomics, Proteomics and Drug Discovery), Mendiratta, N., Rastogi, P., Rastogi, S. C, PHI Learning, India, (2013). 6.Bioinformatics: Principles and applications, Ghosh, Z., Mallik, B., Oxford Press, New Delhi, India, 2012. 7.Bioinformatics and Functional Genomics, Pevsner, Jonathan, Wiley, United Kingdom, 2015. 3rd edition.

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part D: Assessment and Evaluation (Theory)			
Suggest Continuous Evaluation Methods:			
Internal Assesment	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva voce on Practical	15
Attendance	5	Practical Record file	10
Assignment (Charts/Model/ Seminar/ Ruler/ Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial visit)	10	Table work /Experiments	50
Total	25		75

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester: Second Session:** 2021 -2022		
Subject: Bioinformatics (Open Elective)		
1	**Course Code**	**S2-BINF1T (OE)**
2	**Course Title**	**General Introduction to Bioinformatics**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	**Core Course**
4	**Pre-requisite (If any)**	To study this course, a student must have Biology and/or Mathematics as one of the subjects in class 12
5	**Course Learning Outcomes (CLO)**	**Students shall be able to -** The students shall be able to : 1.Get the general overview of internet protocols and general introduction of bioinformatics. 2.Acquire the knowledge about the biological databases, sequence alignments, data retrieval system, phylogenetic analysis and comparative genome analysis. 3.Join as lab assistant/ technical assistant in any R&D project in Life sciences.
6	**Credit Value**	Theory — **4**
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

BSc II Semester Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
General Introduction to Bioinformatics (Open Elective)		
Unit	Topic	**Lectures**
Unit I	Sequence Alignment and Database Searching 3.1Sequence AlignmentAnd Database Searching: Introduction, Evolutionary Basis of Sequence Alignment, 3.2Optimal alignment method, Substitution Score and Gap Penalty, Statistical Significance of Alignment. Database similarity searching, FASTA, BLAST, Database searching Artefacts, Position Specific Scoring Matrices. 3.3 Multiple Sequence Alignment (MSA): About MSA, Structural or Evolutionary Alignment, ways to align Sequences, Tools. **Keywords:** Sequence Alignment, FASTA, BLAST, Optimal alignmentmethod.	15
Unit II	**Phylogenetic Analysis, Predictive Methods and Comparative Genome Analysis** 4.1 Phylogenetic Analysis: Fundamental of Phylogenetic model, Tree interpretation - Paralogies and orthologues, Tree building and Tree evaluation, Phylogenetic software. 4.2Predictive Method using Nucleotide Sequence: Introduction, Marking repetitive DNA, Database search, Codon bias detection, detecting functional site in DNA. 4.3Predictive Method using Protein Sequence: Protein identification based on composition , Physical properties based on sequence, Motif and pattern , Secondary structure and folding classes, specialized structure or features, Tertiary structures. 4.4Structure Database: Introduction to Structure, PDB, MMDB, Structure file format, visualizing structure information, Structure viewers, structure similarity searching, Advanced structure modelling. 4.5Comparative Genome Analysis: Introduction, application, genome analysis and annotation. **Keywords**: Phylogenetic Analysis, Predictive Method, Motif, PDB, MMDB, Comparative Genome Analysis.	15

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1.Bioinformatics, Andreas D. Baxevanis, David S. Wishart, Gary D.Bade, Wiley, United Kingdom, 2019. 2.Essential Bioinformatics, Xiong, Jin, Cambridge End Semester Press, United States,2014 3.Bioinformatics: Sequence and Genome Analysis, Mount, D. W., CBS Publishers &Distributors, India, 2005. 4.Introduction to Bioinformatics, Lesk, Arthur M, Oxford End Semester Press, USA, 2019. 5th edition 5.Bioinformatics: methods and applications: (Genomics, Proteomics and Drug Discovery), Mendiratta, N., Rastogi, P., Rastogi, S. C, PHI Learning, India, (2013). 6.Bioinformatics: Principles and applications, Ghosh, Z., Mallik, B., Oxford Press, New Delhi, India, 2012. 7.Bioinformatics and Functional Genomics, Pevsner, Jonathan, Wiley, United Kingdom, 2015.3rd edition.
Suggested equivalent online courses: 1. NPTEL :: Biotechnology - NOC: Bioinformatics: Algorithms and Applications 2. Bio-Informatics - HTM - YouTub

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Bioinformatics

Year 2021-2022

Part D: Assessment and Evaluation (Theory)		
Maximum Marks: **100** Continuous Comprehensive Evaluation(CCE): **25** End Semester Exam (UE): **75**		
Internal sive **Assessment(CCE) Continuous Comprehen Evaluation**	Four Class lest ot 4 marks each	16
	Assignment/Presentation	04
	Overall performance in the semester	05
	Total	**25**
External Assessment: End Semester Exam.	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (B) : Two Long Questions (500 Words Each)	02 X 015=30

Govt. Holkar (Model Autonomous) Science College, Indore
Department: Biotechnology
Year – 2021-2022
Program B.Sc. II Year Bioinformatics

Title of the Paper(Course) Paper-I INTRODUCTIONS TO COMPUTER AND PROGRAMING
Course Code 202-I
Course Objectives: To equipped students with fundamental knowledge and concepts ofcomputers and basics programming skills.
Course Outcomes: After the completion of this course students will have understanding of–
CO1: This course gives a basic knowledge about the computer and different type of computer system.
CO2: Student gets the information about hard ware part of the **computer** which helps to start professional carrier.
CO3: Course gives the idea about the different **operating system**. Its installation and package related information student can pursue as a profession also.
CO4: To understand data presentation techniques and basic knowledge of **computer programming** and application designing.
CO5: To understand the use of the internet and its essential components of**multimedia.**

UNIT I Introduction to computers
Overview and function of computers, Characteristics of computers, History of computers Evolution. Generation of modern computer, Classification of computer, Micro-computers Mini computers main frame, Super computers, special purpose computer (comparison in their memory, power, cost and size) PC type, Tower, Desktop, Notebook, Laptops, Handheld, Palmtop, PDA, Type of modern computers, workstations servers.

UNIT II Computer components and number system
Components of a computer, Input devices, Output devices CPU, Memories (RAM and ROM), Secondary storage devices, Hard disk, Magnetic tapes, Zip drives, Digital tapes, CD-ROM, DVD, Blu-ray, Number system: Introduction, Decimal. Binary, Octal, Hexadecimal Number systems and thier inter conversion.

UNIT III Operating system (OS) and software Development
Hardware and software definitions introduction to O/S, Functions, Classification real time single user single task, single user multi task, Basic description about DOS, WINDOWS, Windows server NT/2000, UNIX/ LINUX MVS, Overview of software development software development phases, problem definition, analysis algorithm design and representation coding and debugging (simple description about each phase)

UNIT IV flow chart, pseudo codes and programming languages
Basic Flowchart symbols and their meaning Pseudo codes definition and importance, syntax and semantics, Programming approaches, Procedural, Object oriented programming languages, Definition, categories low level languages, Machine languages Advantages and disadvantages, Interpreters, Compilers and translators, Overview of compilation process, types of High level languages. Introduction to PERL.
Unit V Multimedia and Internet
Multimedia, Introduction, Characteristics, Elements and application, the internet and its resources, World Wide Web (WWW), associated tools, services, resources and various terminologies an overview of computer viruses, Virus definitions symptoms, transmission danger and general precautions

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Program B.Sc. II Year Bioinformatics

Title of the Paper (Course) Paper-II STRUCTURAL BIOINFORMATICS **Course Code** 202-II

Course Objectives: To understand the levels of structural organization of macro molecules and experimental methods of structural determination. To know the approaches for structural analysis.

Course Outcomes: After the completion of this course students will have understanding of–

CO1: To understand the basics of **Macromolecular structural** properties.

CO2: This course helps to get knowledge about the biological interaction.

CO3: Student have enhanced own skill related **biophysical techniques** and experimental methods also gives a opportunity of job and research and lab practices.

CO4: This course also provide knowledge about the innovative technology of **Proteomics and genomics**.

UNIT I: Macromolecular structural

Nucleic acids: DNA and RNA, Protein: Primary, Secondary, Tertiary and Quaternary structures, Amino acids, Ramchandran plot.

UNIT II: Macromolecular Interactions

Protein-Protein, Protein-Nucleic acid, Protein- Carbohydrates, Structure of Ribosome.

UNIT III: Principles of Protein folding

Overview of experimental techniques to study macro molecular structure, Methods to study 3D structure: X-Ray, NMR, Cryo electron microscopy, Microarray, MALDI-TOFF.

UNIT IV: Proteomics

Proteomics, Homology Modelling, Protein tertiary structure: Prediction, Methodology.

UNIT V: Genomics

Introduction, Genome mapping assembly, Annotative and Comparison, Comparative Genomics, Drug research in the era of genome sequencing.

Govt. Holkar (Model Autonomous) Science College, Indore
Department: Biotechnology
Year – 2021-2022
Program B.Sc. II Year Bioinformatics

Paper: BI 203 PRACTICAL
LIST OF PRACTICALS:

1. Create your Email Id.
2. Explore the MS excel in MS Office.
3. Explore and create Word Document.
4. Create the power point presentation in MS Office.
5. To determine similarities and differences between the PDB entries of the protein which have been identified by X- Ray crystallography and NMR.
6. Find ORFs in all six reading frames of a given DNA sequence.
7. To conduct secondary structure prediction using J-Pred secondary structure prediction severs.
8. Predict secondary structure using Gor server.
9. To perform homology Modelling: Swiss Model, Modeller, Hex Docking Server.
10. To perform Ramachandran Plot: RamPage.
11. To use various HTML Tags.
12. Using perl perform string concatenation.
13. Using perl perform Transcription and Translation.

Govt. Holkar (Model Autonomous) Science College, Indore
Department: Biotechnology
Year – 2021-2022
Program B.Sc. III Year Bioinformatics

Title of the Paper (Course) Paper-I BIOSTATISTICS **Course Code** 302-I
Course Objectives: To review the basic concepts of statistics relevant to biology data handling.
Course Outcomes: After the completion of this course students will have understanding of-
CO1: Basics of **Biostatics** and its important variable.
CO2: They will perform the data collection, Interpretation and the representation of data in large scale very efficiently.
CO3: Students have idea of retrieval of statistical output from the big data.
CO4: They can use the statistical inference of the **Research hypothesis** with the correlation and the regression.
CO5: **Statistical analysis** and the Hypothesis testing is a job oriented field for the ward.

UNIT I Introduction
Biostatistics: Definition, standard terms, population sample, unit, variable, parameters, limitations and uses of statistics.

UNIT II
Data Collection: Data and its collection, classification of data, purpose of classification, advantage, types of classification, Tabulation of data, Objectives of tabulation, rules of tabulation, Difference between classification and Tabulation, Diagrammatic presentation of data: Line diagram, Bar diagram, Percentage bar diagram, Pie diagram, Graphical representation of data: Histogram, Frequency curve, frequency polygon, Ogive curve.

UNIT III
Central Tendency and Probability: Mean, Mode, Median and their merits, Mean deviation, measures of dispersion, Range, Standard deviation and its relative measures, Probability Distribution, Basics of Binomial, Poisson and Normal distribution and their application to Biology.

UNIT IV
Correlation and regression analysis: Concepts of correlation, coefficient of correlation, Types of correlation: Scatter diagram or Dot diagram method, Karl pearson's coefficient of correlation, Spearman's rank correlation coefficient, Probable error in correlation, Regression: meaning, linear regression, regression Coefficient and its properties, Regression equations, Fitting, Prediction, Difference between Correlation and regression.

UNIT V
Statistical Analysis: Test of significance, Null hypothesis, alternative hypothesis, simple hypothesis and Composite hypothesis, two types of error: single tail and two tailed test.
Large sample test, Test of significance of a single mean and difference between two means, Student's ''t'' test, Test of significance of a single mean and difference between means when $a1 = n2$ and $n1 \neq n2$
Chi square test for goodness of fitness, Analysis of variance, meaning, assumptions, one-way
Classification and two-way classification (simple problem).

Govt. Holkar (Model Autonomous) Science College, Indore
Department: Biotechnology
Year – 2021-2022
Program B.Sc. III Year Bioinformatics

Title of the Paper (Course) Paper-II MATHEMATICS FOR BIOLOGICAL SCIENCES
Course Code 302-II
Course Objectives: To review the basic concepts of mathematics relevant to biology.
Course Outcomes: After the completion of this course students will have understanding of-
CO1: Basic knowledge of Series and logarithmic numerical data which is useful for competitive exams.
CO2: This course covered logical interpretation of structural dimension.
CO3: It gives basic knowledge of Calculus.
CO4: Numerical computation is a major area of machine learning methodology.
CO5: Trigonometry and analytical Geometry is essential for geological studies and geographical studies.

Unit I Series

Basic series and series A P, Standard AP, Sum of first n terms of AP, GP, standard GP, sum of n terms in GP, Geometric mean, HP, Basic logarithmic and exponential series.

Unit II Vectors and Matrices

Sets, inverse of a matrix, matrix, method, Cramer's rule, vectors, addition and subtraction, dot product, cross product, gradient, divergence, curl.

Unit III Basic Calculus

Differentiation and integration, concept of limit, continuity, differentiation, maxima and minima, introduction to partial differentiation, integral calculus, definite integral.

Unit IV Numerical Computation

Errors in computer arithmetic, normalization, polynomial interpolation, solution of non-linear equations, Errors, convergence of solution, Iterative methods for system of linear equations, Numerical differentiation and integration.

Unit V Trigonometry and Analytical Geometry

Trigonometric ratios, De Morgan's theorem, the general equation of a straight line, slope of a line, intercept of a line, angle between two lines, intersection of two lines, The general equation of a circle.

Govt. Holkar (Model Autonomous) Science College, Indore
Department: Biotechnology
Year – 2021-2022
Program B.Sc. III Year Bioinformatics

BI 303: PRACTICAL

LIST OF PRACTICALS:

1. Find Mean Median mode Using excel.
2. Study formulas in excel.
3. Construct Bar Diagram and Pie Chart.
4. Construct Ogives.
5. Construct Histogram.
6. Perform Correlation analysis.
7. Find Standard deviation.
8. Binomial Theorem.
9. Find Chi test.
10. Find T test.
11. Genetics problems: Probability based, Frequency based, Genetic Maps.

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Biotechnology

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

B.Sc.: -

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part A: Introduction			
Program: Certificate Course **Class:** B.Sc. **Semester:** FIRST **Session:** 2021 -2022			
Subject: Biotechnology (Major)			
1	**Course Code**	**CORETH-1-SI-BTEC1 T**	
2	**Course Title**	**Cell Biology and Biochemistry**	
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	**Core Course**	
4	**Pre-requisite (If any)**	To study this course, a student must have had the subject Biology in 12th**class.**	
5	**Course Learning Outcomes (CLO)**	**Course Objective: -The** Main Objective of the course will be to build the basic foundation for studying Biotechnology. The Demand For Trained workforce in Biotechnology is ever growing in Fundamental Research and Industry Sector. Academic and Research Sectors also Require Interdisciplinary trained manpower to foster the Biotechnology Revolution. The restructured syllabus combines basic principles of Chemical and Biological sciences in light of advancements in technology. The curriculum aims to impart basic knowledge with emphasis on its applications to make the students ready for industries and research work in concerned field **Learning Outcome :-**At the end of the paper. a student should be able to : 1.Understand basics of cell biology. 2.Appreciate the importance of bonding and spatial arrangements of molecules for proper functioning and stability. 3.Understand both the physical as well as chemical properties of biomolecules 4. The Student Could Pursue a career in biochemical testing. The decrease of increase in the amount of some of the biomolecules can have clinical significance. 5. Students can also go in for medical Laboratory Technique Courses, opening opportunities in hospitals and pathological laboratories,	
6	**Credit Value**	Theory — **4**	
7	**Total Marks**	Maximum Marks: 25 + 75	Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
B.Sc. I Semester Paper : Cell Biology and Biochemistry (Major)		
Unit	Topic	**Number of Lectures**
Unit I	**Cell as a Basic Unit:** 1. **Historical background of the Cell** 1.1 History of Cell Biology. 1.2 Cell Structure. 1.3 Cell Theory. 2. **Prokaryotic Cell and Cell Organells:** 2.1.Ultrastructure of Prokaryotic Cell. 2.2.Structure and function of cell organelles: Flagella, Pili, Cell wall. Cytoplasmic membrane. Nuclear region, Ribosomes, Vacuoles. Metachromatic granules. Spores and Cysts, Microtubules, Microfilaments, Centriole. 2.3 Difference between Prokaryotic and Eukaryotic cells. **Key Words:** -Cell theory, Prokaryotic Cell	12
Unit II	**Cell Organelles and Cell Cycle :** 1. **Eukaryotic Cell and Cell Organells:** 1.1. Ultratructure of Eukaryotic cell (Plant and Animal cells). 1.2 Structure and function of cell organelles: Cell membrane. Mitochondria. Chloroplast,Endoplasmic reticulum, Golgi bodies, Lysosomes. Peroxisomes, Nucleus. 2. **Cell Cycle:** 2.1. Cell cycle and Cell division. 2.2. Apoptosis or Cell death **Key Words:**-Eukaryotic cell. Cell organelles. Cell cycle, Apoptosis	12
Unit III	Molecular Structure of Water : 1. Water structure and Buffer: 1.1 Properties of Water. 1.2 Interaction of Water. 1.3 Role of Water in Bio molecular Structure. 1.4 Acid and Bases, Buffer solutions. 2. Chemical Bonds: 2.1 Chemical Bonds (Ionic Bond. Covalent Bond. Coordinate Bond. Non Covalent Bonds, Hydrogen Bond) **Key Words:**- Water, Buffer, Chemical bonds.	12
Unit IV	**Biomolecules:** Sources. Nomenclature. Classification, Structures. Characteristics, and Functions: 1. Carbohydrates. 2.Lipids, 3.Proteins and Nucleic Acids. **Key Words:** -Carbohydrates, Proteins, Lipids, Nucleic Acids.	12
Unit V	**Tools and Techniques** 1.1 Principle and Applications of Light Microscopy, Centrifugation. Chromatography (Paper. Thin layer and Column). Colorimeter and Spectrophotometer.	12

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1. Industrial Biotechnology - B.D. Singh 2. Textbook of Biochemistry - S.P. Singh 3. Cell and Molecular Biology - P.K. Gupta 4. Cell Biology - P.S. Verma and Agrawal 05. Cell and Molecular Biology. - S.C.Rastogy 06. Cell Biology. - P.S. Verma and Agrawal
Suggested equivalent online courses : 1. https://pubs.acs.org/loi/bichaw (for Biochemistry), 2. https://pubs.acs.orE/loi/bipret, https://Ruides.lib.uh.edu/biotech (for biotechnology) 3. http://www.freebookcentre.net/BioloRv/BioTechnoloRv-8ooks.html e books on biotechnology 4. https://www.phindia.com/Books/5howeBooks/MTExNA/BiotechnoloRve books on biotechnology 5. https://bookauthority.orR/books/best-biotechnoloRv-ebooks e books on biotechnology

Part D: Assessment and Evaluation (Theory)		
Maximum Marks: **100** Continuous Comprehensive Evaluation(CCE): **25** University Exam (UE): Time :**02.00 Hours**		10 25 75
Internal Assessment Continuous Comprehen Evaluation(CCE)	Class lest	15
	Assignment/Presentation	04
	Total	**25**
External Assessment: University Exam.	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (C) : Two Long Questions (500 Words Each)	02 X 015=30

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** FIRST **Session:** 2021 -2022		
B.Sc. I Semester PaperPractical: Cell Biology and Biochemistry (Major)		
1	**Course Code**	**CORE- PR-1-SI-BTEC1 P**
2	**Course Title**	**Lab work for Cell Biology and Biochemistry**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	**Core Course**
4	**Pre-requisite (If any)**	To study this course, a student must have had the subject Biology in 12TH class.
5	**Course Learning Outcomes (CLO)**	**Course Objective:** -The Main Objective of the course will be to give hands-on practical knowledge in Biotechnology. The Demand for Trained workforce in Biotechnology is ever growing in Fundamental Research and Industry Sector. Academic and Research Sectors also Require Interdisciplinary trained manpower to foster the Biotechnology Revolution. The curriculum aims to impart basic knowledge with emphasis on its applications to make the students ready for industries and research work in concerned field. **Learning Outcome:** - At the end of the paper, a student will be able to 1.Understand basic techniques of cell biology. 2.Know the physical as well as chemical properties of biomolecules 3.Pursue a career in biochemical testing. The decrease of increase in theamount of some of the biomolecules can have clinical significance. 4.Take medical Laboratory Technique Courses, opening opportunities inhospitals and pathological laboratories.
6	**Credit Value**	Practical – 2
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part B: Content of the Practical Course
Total numbers of Lectures (in hours per week): 2 hours per week **B.Sc. I Semester Paper Practical: Cell Biology and Biochemistry (Major)**
Credits - 2 (Practical: 30 hours)

Scheme of Practical Examination: - Max. Marks (25 + 75 = 100)

(A) Internal Assessment: -Max. Marks 25

1. Class Interaction. 05
2. Quiz. 05
3. Seminar. 07
4. Assignments(Charts. Rural Service. Technology Dissemination/Excursion/ Lab Visit/Industrial Training. 08

(B) External Assessment: -Max. Marks 15

1. Major experiment 10
2. Minor Experiment -1 10
3. Minor experiment-2 15
4. Spotting. 15
5. Viva – Voce 10
6. Practical Record.

List of Experiments/Exercise.

1. To study the plant cell structure using various plant materials.
2. To study the animal cell structure using cheek cells.
3. To Prepare Onion root tip for the stages of Mitosis.
4. To Prepare and study the different stages of Mitosis and Meiosis.
5. To analyze Carbohydrates Quantitatively
6. To analyze proteins Quantitatively
7. To analyze lipids Quantitatively
8. To Prepare Buffers.
9. To Separate plant pigments by Paper Chromatography.
10. To Separate amino acids by TLC.

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** FIRST**Session:** 2021 -2022		
Subject: Biotechnology (Minor)		
1	**Course Code**	**CORETH-2-SI-BTEC2T**
2	**Course Title**	Microbiology and Immunology
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	To study this course a student must have had the subject Biology in class 12th.
4	**Pre-requisite (If any)**	Course Objectives: To create general understanding about microbiology and immunology
5	**Course Learning Outcomes (CLO)**	**Course Objectives**: To create general understanding about microbiology and immunology 1. The students will be able to understand microbial diversity and Nutrition. 2.The students will be able to understand immune system.Immune responses and Vaccination. 3.The students will be able to describe role of immune system in both maintaining health and contributing to disease. 4.The students will be able to understand immunological techniques. **Learning Outcomes:** At the end of the course student will familiar with - 1.Microbial diversity and nutrition. 2.Immune system, its properties and types. 3.Immunoglobulin structure, types and functions and can applythe concept of hypersensitivity and vaccination for differentdiseases. 4 Perform various immunological techniques.
6	**Credit Value**	4
7	**Total Marks**	Max.Marks 25+75 Min. Marks 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part B: Content of the Course		
B.Sc. I Semester Paper :Microbiology and Immunology(Minor)Total numbers of Lectures – 60		
Unit	Topic	Number of Lectures
Unit I	History , Basic concepts of Microbiology and Culture Media preparation **1. History. Basic concepts of Microbiology:** 1.1Fundamental, History and evolution of microbiology. Development of microbiology. Application of microbiology in Human welfare. 1.2Classification, General characteristic and structure of Bacteria, Fungi and Viruses. **2. Media Preparation:** 2.1Methods and Types: Culture. Minimal, Selective, differential. Transport media. 2.2Synchronous. Batch and Continuous culture. **Key Worlds:** Classification of Microorganisms. Media Preparation.	12
Unit II	Microbial Growth and Growth measurement: **1.Microbial Growth :** 1.1.Definition of growth. Mathematical expression of growth ,Growth Curve, Generation time. Growth yield. Effect of nutrients on growth. 1.2.Factor affecting growth: Nutrient. Temperature. Oxygen. pH. Osmotic pressure. **2.Growth measurement:** 2.1 Measurement of Growth (Direct and Indirect methods) : cell number, Cell Mass and Cell Activity. 2.2. Cell Count: Turbidometric method. Plate count method . Membrane count method . Dry weight and Wet method by measurement of cellular activity. Key Worlds: Growth. Measurement.	14
Unit III	**Basics of Immunology:** 1. Basics of Immunology : 1.1.Concept of Innate and Acquired immunity. Phygocytosis complement and Inflammatory responses. 1.2.Immune cells and organs : Structure. Function and Properties of immune cells - Stem cell, T-cell, B-cell . NK-cell . Macrophagus , Neutrophil. Eosinophil .Basophil. Mastcell.Dentric cell. 1.3. Immune organ: Bone marrow, Thymus. Lymph Node, Spleen, Lymphatic System. **Key Worlds:** Immunity. Immune cells.	10
Unit IV	**Immunoglobulins and Immune response:** **1. Immunoglobulins** 1.1.Antigens. Characteristics of an antigen: Foreignness. Molecular size , Chemical composition and Heterogeneity , Antigen Adjuvants , Epitopes, Haptens. 1.2.Antibodies: Structure, Types. Functions and Properties of antibodies Antigenic determinant on antibodies(Isotypic, Allotypic , Idiotypic). Monoclonal. Polyclonal and Chimeric antibody. **2.Immune response :** 2.1. Generation of immune response: Primary and Secondary immune response, generation of Humoral response (Plasma and Memory cell), Generation of cell mediated immune response (self MHC restriction, T-cell activation, Co-stimulatory signals). Killing Mechanisms by CTL and NK cells, Introduction to tolerance. **Key Worlds**: Antigens. Antibody.	15
Unit V	**Microbial, Immunological Techniques and Vaccination:** 1.Microbial Techniques : 1.1. Principle, Working and applications of instruments -Laminar airflow. Autoclave, Hot air oven. **2.Immunological techniques:** 2.1. RIA, ELISA, Western blotting. Principles of Precipitation. Agglutination. Immunodiffsion. Immunoelectophorosis. **3.Vaccination:** 3.1. Vaccines and vaccination: Rubella.Varicella(Chickenpox), Polio.Diptheria.Hepatitis vaccine. Key Worlds: RIA, ELISA, Laminarair flow. Autoclave, Vaccine.	10

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: Suggested Readings - 1. Fundamentals of microbiology and immunology; A.K.Banerjee and Nirmalaya Banerjee, New Central Book Agency, New Delhi 2. Modern concepts of microbiology; H.D. Kumar and Swati Kumar., Vikas Publishing House Pvt Ltd. .2nd Edition. 3. Microbiology ;M.J. Pelczar, E.C.S. Chan and N.R.Krieg . McGraw Hill Book company. 1993, 5th edition 4. A text book of microbiology ;R.C.Dubey and D.K.Maheshwari , S Chand and Company Ltd 2004. Ist edition. 5. Microbiology ;P.D.Sharma, Rastogi Publication.Meerut. 6. General Microbiology Vol I and II; C.B. Powar and H.F.Dagniwala . Himalaya Publication. 7. Microbiology Fundamental and Applications; S.S.Purohit, Agrobias, 7TH Edition. 8. Immunology ;K.R. Joshi, Agrobios. 5th edition.
Suggested digital platforms web links 1 http://www.freebookcentre.net >...free microbiology books downloadjEbooks online Textbooks 2 http://open.oregonstate.education>...General Microbiology- Open Textbook-Open Textbooks 3 http://www.freebookcentre.net>...Immune System and Immunology (PDF63P)|downIoad book 4 http://hmmcollege.ac.in>3...PDF Introduction to Immunology 5 http://www.malecentrum.sk>...PDK IMMUNOLOGY &MICROBIOLOGY

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part D: Assessment and Evaluation (Theory)		
Maximum Marks: **100** Continuous Comprehensive Evaluation(CCE): **25** University Exam (UE): Time :**02.00 Hours**		10 25 75
Internal Assessment Continuous Comprehen Evaluation(CCE)	Class lest	15
	Assignment/Presentation	04
	Total	**25**
External Assessment: University Exam.	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (C) : Two Long Questions (500 Words Each)	02 X 015=30

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** FIRST **Session:** 2021 -2022		
Subject: Biotechnology (Minor)		
1	**Course Code**	**CORE-PR-2-SI-BTEC 2P**
2	**Course Title**	Lab on Microbiology and Immunology
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	Core Course
4	**Pre-requisite (If any)**	To study this course a student must have had the subject Biology in class 12^{th}.
5	**Course Learning Outcomes (CLO)**	**Course Objective:** The objective of the course is to prepare students competent in subject through in-depth lecture and laboratory practices- 1The students will be able to identify microbes using modern techniques. 2.The students will acquire skill and competence in microbiological and immunological laboratory practices applicable to microbiological research or clinical methods of immunology, including accurately reporting observations and analysis. **Course Learning Outcomes**: On completion of this course, learners will be able to have sufficient scientific understanding of microbiology and immunology- 1 Students apply concept. Principle and types of sterilization methods viz performing microbiological experiments. 2 Students apply the concept and characteristics of antiseptic, disinfected and their mode of action in day to day life. 3 Students will apply principle, working and applications of instruments - Laminar airflow. Autoclave, Hot air oven etc
6	**Credit Value**	2
7	**Total Marks**	Maximum Marks: 25+75 Minimum Passing Marks: 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part B : Content of the Practical Course	
Total numbers of Lectures (in hours per week) :2 hours per week	
Topics	Hours
List ofPracticals] To perform Aseptic technique. Cleaning of glassware's, preparation of Cotton Plugging and Sterilization. 2.To prepare Bacterial and Fungal media. 3.To isolate microbes from Air. Water and Soil. 4.To Study dilution and plating by Pour Plate. Spread Plate methods. 5.To Study microorganisms by Staining method - Simple staining. Gram staining. Endospore staining, Fungal staining. Negative staining 6.To identify bacteria based on staining. Shape and Size. 7.To enumerate microorganism - Total and Viable count. 8.To study Antibiotic sensitivity of microbes by the use of antibiotic discs. 9.To isolate and identify pathogenic bacteria from sewage and waste water. 10.To Determine growth curve and generation time of E. coli. 11.To identify of human blood groups. 12.To enumerate total WBC of the given blood sample by hemocytometer. 13.To enumerate differential Leukocyte of the given blood sample. 14.To enumerate total RBC of the given blood sample by hemocytometer. 15.To isolate and Identify aquatic Fungi from Local water body.	Total 30

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1 Laboratory Techniques in Modern Biology ;N.Swarup . S.C. Pathak , S. Arora , Kalyani Publication. New delhi. 2 Integrated Methodologies in Biology :ShashiShrivatava .P. Banerjee . Arun Prakashan. Gwalior. 3 Experiment in Microbiology Plant Pathology and BiotechnologyiK.R.Anejaa, New Age International ,New Delhi, 2007. 4 Laboratory Manual of Biotechnology ;P.N.Swamy , Rastogi Publication ,Meerut. 5 Practical Microbiology ;R.C.Dubey , D.K.Maheshwari , S Chand &Company. Delhi. 6 Manual of Experiments in Biotechnology ;Leena Lakhani. SheebaKhan , Kailash PustakSadan. Bhopal.
Suggested digital platforms web links lhttp://lipguides.uphsc.edu>...ebooks Microbiology Immunology & Biochemistry 2http://bookauthoritv.orft>...Microbiology eBook Suggested equivalent online courses :

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** FIRST **Session:** 2021 -2022		
Subject: Biotechnology (Open Elective)		
1	**Course Code**	**CORE- TH-2 SI BTEC 2T (OE)**
2	**Course Title**	Microbiology
3	**Course Type (Core/Elective/Generic Elective/V ocational/...)**	To study this course a student must have had the subject Biology in class 12th.
4	**Pre-requisite (If any)**	Course Objectives: To create general understanding about microbiology and immunology
5	**Course Learning Outcomes (CLO)**	Course Objectives: To create general understanding about microbiology and immunology 1 .The students will be able to understand microbial diversity and Nutrition. 2.The students will be able to understand immune system.Immune responses and Vaccination. 3.The students will be able to describe role of immune system in both maintaining health and contributing to disease. 4.The students will be able to understand immunological techniques. Course Learning Outcomes: At the end of the course student will familiar with - 1.Microbial diversity and nutrition. 2.Immune system, its properties and types. 3.Immunoglobulin structure, types and functions and can apply the concept of hypersensitivity and vaccination for different diseases. 4 Perform various immunological techniques.
6	**Credit Value**	4
7	**Total Marks**	Max.Marks 25+75 Min. Marks 33

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part B: Content of the Course		
Total numbers of Lectures – 60		
Unit	Topic	**Number of Lectures**
Unit I	History , Basic concepts of Microbiology and Culture Media preparation **1. History .Basic concepts of Microbiology:** 1.1Fundamental, History and evolution of microbiology. Development of microbiology. Application of microbiology in human welfare. 1.2Classification, General characteristic and structure of Bacteria, Fungi and Viruses. **2. Media Preparation:** 2.1Methods and Types: Culture. Minimal, Selective, differential. Transport media. 2.2Synchronous. Batch and Continuous culture. **Key Worlds:** Classification of Microorganisms. Media Preparation.	15
Unit II	Microbial Growth and Growth measurement: **1.Microbial Growth:** 1.1.Definition of growth. Mathematical expression of growth ,Growth Curve, Generation time. Growth yield. Effect of nutrients on growth. 1.2.Factor affecting growth: Nutrient. Temperature. Oxygen. pH. Osmotic pressure. **2.Growth measurement:** 2.1 Measurement of Growth (Direct and Indirect methods) . cell number, Cell Mass and Cell Activity. 2.2. Cell Count. Turbidometric method. Plate count method . Membrane count method . Dry weight and Wet method by measurement of cellular activity. Key Worlds: Growth. Measurement.	15

Part C: Learning Resources

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Text Books, Reference Books, Other Resources
Suggested Readings: Suggested Readings - 1. Fundamentals of microbiology and immunology; A.K.Banerjee and Nirmalaya Banerjee, New Central Book Agency, New Delhi 2. Modern concepts of microbiology; H.D. Kumar and Swati Kumar., Vikas Publishing House Pvt Ltd. .2nd Edition. 3. Microbiology ;M.J. Pelczar, E.C.S. Chan and N.R.Krieg . McGraw Hill Book company. 1993, 5th edition 4. A text book of microbiology ;R.C.Dubey and D.K.Maheshwari , S Chand and Company Ltd 2004. Ist edition. 5. Microbiology ;P.D.Sharma, Rastogi Publication.Meerut. 6. General Microbiology Vol I and II; C.B. Powar and H.F.Dagniwala . Himalaya Publication. 7. Microbiology Fundamental and Applications; S.S.Purohit, Agrobias, 7TH Edition. 8. Immunology ;K.R. Joshi, Agrobios. 5th edition.
Suggested digital platforms web links 1 http://www.freebookcentre.net >...free microbiology books downloadjEbooks online Textbooks 2 http://open.oregonstate.education>...General Microbiology- Open Textbook-Open Textbooks 3 http://www.freebookcentre.net>...Immune System and Immunology (PDF63P)|downIoad book 4 http://hmmcollege.ac.in>3...PDF Introduction to Immunology 5 http://www.malecentrum.sk>...PDK IMMUNOLOGY &MICROBIOLOGY

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Year – 2021-2022

Part D: Assessment and Evaluation (Theory)		
Suggested equivalent online courses : Maximum Marks: **100** Continuous Comprehensive Evaluation(CCE): **25** University Exam (UE): 75 Marks		10 25 75
Internal Assessment Continuous Comprehen Evaluation(CCE)	Class lest Assignment/Presentation	15 10
	Total	**25**
External Assessment: University Exam. Time: 2:00 hours	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (C) : Two Long Questions (500 Words Each)	02 X 015=30 Total 75
Any remarks/suggestions:		

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part A: Introduction			
Program: Certificate Course **Class:** B.Sc. **Semester:** SECOND**Session: 2021 -2022**			
Subject: Biotechnology (Major)			
1	**Course Code**	**S2-03-I**	
2	**Course Title**	**Microbiology and Immunology (Theory)**	
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	To study this course a student must have had the subject Biology in class 12th.	
4	**Pre-requisite (If any)**	Course Objectives: To create general understanding about microbiology and immunology	
5	**Course Learning Outcomes (CLO)**	**Course Objectives**: To create general understanding about microbiology and immunology 1. The students will be able to understand microbial diversity and Nutrition. 2. The students will be able to understand immune system. Immune responses and Vaccination. 3.The students will be able to describe role of immune system in both maintaining health and contributing to disease. 4. The students will be able to understand immunological techniques. Course Learning Outcomes: At the end of the course student will familiar with - 1. Microbial diversity and nutrition. 2. Immune system, its properties and types. 3. Immunoglobulin structure, types and functions and can apply the concept of hypersensitivity and vaccination for different diseases. 4 Perform various immunological techniques.	
6	**Credit Value**	4	
7	**Total Marks**	Max.Marks40 (CCE) + 60(End Semester or theory Exam. External Evaluation Total =100	Min. Marks 35

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part B: Content of the Course		
B.Sc. II Semester Paper:Microbiology and Immunology(Major)Total numbers of Lectures – 60		
Unit	Topic	Number of Lectures
1	History, Basic concepts of Microbiology and Culture Media preparation **1. History. Basic concepts of Microbiology:** 1.1Fundamental, History and evolution of microbiology. Development of microbiology. Application of microbiology in Human welfare. 1.2Classification, General characteristic and structure of Bacteria, Fungi and Viruses. **2. Media Preparation:** 2.1Methods and Types: Culture. Minimal, Selective, differential. Transport media. 2.2Synchronous, Batch and Continuous culture. **Key Worlds:** Classification of Microorganisms. Media Preparation.	11
2	Microbial Growth and Growth measurement: **1.Microbial Growth:** 1.1.Definition of growth. Mathematical expression of growth . Growth Curve. Generation time. Growth yield. Effect of nutrients on growth. 1.2. Factor affecting growth: Nutrient. Temperature. Oxygen. pH. Osmotic pressure. **2.Growth measurement:** 2.1 Measurement of Growth (Direct and Indirect methods) : cell number, Cell Mass and Cell Activity. 2.2. Cell Count: Turbidometric method. Plate count method . Membrane count method . Dry weight and Wet method by measurement of cellular activity. Key Worlds: Growth. Measurement.	14
3	**Basics of Immunology:** 1. Basics of Immunology: 1.1.Concept of Innate and Acquired immunity.Phygocytosis complement and Inflammatory responses. 1.2.Immune cells and organs : Structure. Function and Properties of immune cells - Stem cell, T-cell, B-cell . NK-cell . Macrophagus , Neutrophil. Eosinophil .Basophil. Mastcell.Dentric cell. 1.3. Immune organ: Bone marrow, Thymus. Lymph Node, Spleen, Lymphatic System. **Key Worlds:** Immunity. Immune cells.	10
4	**Immunoglobulins and Immune response:** **1. Immunoglobulins** 1.1.Antigens: Characteristics of an antigen: Foreignness. Molecular size , Chemical composition and Heterogeneity , Antigen Adjuvants , Epitopes, Haptens. 1.2.Antibodies. Structure. Types, Functions and Properties of antibodies Antigenic determinant on antibodies(Isotypic, Allotypic , Idiotypic). Monoclonal. Polyclonal and Chimeric antibody. **2.Immune response :** 2.1. Generation of immune response: Primary and Secondary immune response, generation of Humoral response (Plasma and Memory cell), Generation of cell mediated immune response (self MHC restriction, T-cell activation, Co-stimulatory signals). Killing Mechanisms by CTL and NK cells, Introduction to tolerance. Key Worlds: Antigens. Antibody.	15

5	**Microbial, Immunological Techniques and Vaccination:** 1.Microbial Techniques : 1.1. Principle. Working and applications of instruments -Laminar airflow. Autoclave, Hot air oven. **2.Immunological techniques:** 2.1. RIA, ELISA, Western blotting. Principles of Precipitation. Agglutination. Immunodiffsion. Immunoelectophorosis. **3.Vaccination:** 3.1. Vaccines and vaccination: Rubella, Varicella (Chickenpox), Polio. Diptheria. Hepatitis vaccine. **Key Worlds:** RIA, ELISA, Laminar air flow. Autoclave, Vaccine.	10

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

Suggested Readings -

1. Fundamentals of microbiology and immunology; A.K.Banerjee and Nirmalaya Banerjee, New Central Book Agency, New Delhi
2. Modern concepts of microbiology; H.D. Kumar and Swati Kumar., Vikas Publishing House Pvt Ltd. .2nd Edition.
3. Microbiology ;M.J. Pelczar, E.C.S. Chan and N.R.Krieg . McGraw Hill Book company. 1993, 5th edition
4. A text book of microbiology ;R.C.Dubey and D.K.Maheshwari , S Chand and Company Ltd 2004. Ist edition.
5. Microbiology ;P.D.Sharma, Rastogi Publication.Meerut.
6. General Microbiology Vol I and II; C.B. Powar and H.F.Dagniwala . Himalaya Publication.
7. Microbiology Fundamental and Applications; S.S.Purohit, Agrobias, 7TH Edition.
8. Immunology ;K.R. Joshi, Agrobios. 5th edition.

Suggested digital platforms web links

1 http://www.freebookcentre.net >...free microbiology books downloadjEbooks online Textbooks
2 http://open.oregonstate.education>...General Microbiology- Open Textbook-Open Textbooks
3 http://www.freebookcentre.net>...Immune System and Immunology (PDF63P)|download book
4 http://hmmcollege.ac.in>3...PDF Introduction to Immunology
5 http://www.malecentrum.sk>...PDK IMMUNOLOGY &MICROBIOLOGY

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** SECOND **Session:** 2021 -2022		
Subject: Biotechnology Practical (Major)		
1	**Course Code**	**S2-02-I**
2	**Course Title**	Lab on Microbiology and Immunology
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	Core Course
4	**Pre-requisite (If any)**	To study this course a student must have had the subject Biology in class 12^{th}.
5	**Course Learning Outcomes (CLO)**	**Course Objective :** The objective of the course is to prepare students competent in subject through in-depth lecture and laboratory practices- 1The students will be able to identify microbes using modern techniques. 2.The students will acquire skill and competence in microbiological and immunological laboratory practices applicable to microbiological research or clinical methods of immunology, including accurately reporting observations and analysis. **Course Learning Outcomes**: On completion of this course, learners will be able to have sufficient scientific understanding of microbiology and immunology- 1 Students apply concept. Principle and types of sterilization methods viz performing microbiological experiments. 2 Students apply the concept and characteristics of antiseptic, disinfected and their mode of action in day-to-day life. 3 Students will apply principle, working and applications of instruments - Laminar airflow. Autoclave, Hot air oven etc
6	**Credit Value**	2
7	**Total Marks**	Maximum Marks: 40+60 Minimum Passing Marks: 35

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part B : Content of the Practical Course	
Total numbers of Lectures (in hours per week) :2 hours per week	
Topics	Hours
List ofPracticals] To perform Aseptic technique. Cleaning of glassware's, preparation of Cotton Plugging and Sterilization. 2.To prepare Bacterial and Fungal media. 3.To isolate microbes from Air. Water and Soil. 4.To Study dilution and plating by Pour Plate. Spread Plate methods. 5.To Study microorganisms by Staining method - Simple staining. Gram staining. Endospore staining, Fungal staining. Negative staining 6.To identify bacteria based on staining. Shape and Size. 7.To enumerate microorganism - Total and Viable count. 8.To study Antibiotic sensitivity of microbes by the use of antibiotic discs. 9.To isolate and identify pathogenic bacteria from sewage and waste water. 10.To Determine growth curve and generation time of E. coli. 11.To identify of human blood groups. 12.To enumerate total WBC of the given blood sample by hemocytometer. 13.To enumerate differential Leukocyte of the given blood sample. 14.To enumerate total RBC of the given blood sample by hemocytometer. 15.To isolate and Identify aquatic Fungi from Local water body.	Total 30

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1 Laboratory Techniques in Modern Biology ;N.Swarup . S.C. Pathak , S. Arora , Kalyani Publication. New delhi. 2 Integrated Methodologies in Biology :ShashiShrivatava .P. Banerjee . Arun Prakashan. Gwalior. 3 Experiment in Microbiology Plant Pathology and BiotechnologyiK.R.Anejaa, New Age International ,New Delhi, 2007. 4 Laboratory Manual of Biotechnology ;P.N.Swamy , Rastogi Publication ,Meerut. 5 Practical Microbiology ;R.C.Dubey , D.K.Maheshwari , S Chand &Company. Delhi. 6 Manual of Experiments in Biotechnology ;Leena Lakhani. SheebaKhan , Kailash PustakSadan. Bhopal.
Suggested digital platforms web links lhttp://lipguides.uphsc.edu>...ebooks Microbiology Immunology & Biochemistry 2http://bookauthoritv.orft>...Microbiology eBook Suggested equivalent online courses :

Part D: Assessment and Evaluation (Theory)			
Internal Assessment	Marks	External Assessment	Marks
Class interaction /Quiz	10	Viva-voce on Practical	15
Attendance	5	Practical Record File	10
Assignment (Charts/Models/Seminar /Rural Service /Technology Dissemination/Report of Excursion/Lab Visits/Survey/Industrial Visit)	10	Table Work Experiment	50
Total	25	Total	75

Suggested Continuous Evaluation Methods:

1. Major experiment 15
2. Minor experiment-1 10
3. Minor experiment-2 10
4. Spotting 15
5. Viva-voce 15
6. Practical Record. 10

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part A: Introduction			
Program: Certificate Course **Class:** B.Sc. **Semester:** SECOND **Session:** 2021 -2022			
Subject: Biotechnology (Minor)			
1	**Course Code**	**S2-03-M**	
2	**Course Title**	**Cell Biology and Biochemistry (Theory)**	
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	**Core Course**	
4	**Pre-requisite (If any)**	To study this course, a student must have had the subject Biology in 12th **class.**	
5	**Course Learning Outcomes (CLO)**	Course Objective:-The Main Objective of the course will be to build the basic foundation for studying Biotechnology. The Demand For Trained workforce in Biotechnology is ever growing in Fundamental Research and Industry Sector. Academic and Research Sectors also Require Interdisciplinary trained manpower to foster the Biotechnology Revolution. The restructured syllabus combines basic principles of Chemical and Biological sciences in light of advancements in technology. The curriculum aims to impart basic knowledge with emphasis on its applications to make the students ready for industries and research work in concerned field-Learning Outcome :-At the end of the paper. a student should be able to : 1.Understand basics of cell biology. 2.Appreciate the importance of bonding and spatial arrangements of molecules for proper functioning and stability. 3.Understand both the physical as well as chemical properties of biomolecules 4. The Student Could Pursue a career in biochemical testing. The decrease of increase in the amount of some of the biomolecules can have clinical significance. 5. Students can also go in for medical Laboratory Technique Courses, opening opportunities in hospitals and pathological laboratories,	
6	**Credit Value**	Theory — **4**	
7	**Total Marks**	Maximum Marks: 40(CCE)+60 (End Semester or Theory Exam) External Evaluation Total=100	Minimum Passing Marks: 35

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part B: Content of the Course		
Total numbers of Lectures (in hours per week): 4 hours per week (Total 60hours)		
B.Sc. II Semester Paper: Cell Biology and Biochemistry (Minor)		
Unit	Topic	**Number of Lectures**
Unit I	**Cell as a Basic Unit:** 1. **Historical background of the Cell** 1.1 History of Cell Biology. 1.2 Cell Structure. 1.3 Cell Theory. **2. Prokaryotic Cell and Cell Organells:** 2.1. Ultrastructure of Prokaryotic Cell 2.2 Structure and function of cell organelles: Flagella, Pili, Cell wall, Cytoplasmic membrane. Nuclear region, Ribosomes, Vacuoles. Metachromatic granules. Spores and Cysts, Microtubules, Microfilaments, Centriole. 2.3 Difference between Prokaryotic and Eukaryotic cells. **Key Words:** -Cell theory, Prokaryotic Cell	15
Unit II	**Cell Organelles and Cell Cycle:** 1. **Eukaryotic Cell and Cell Organells:** 1.1. Ultratructure of Eukaryotic cell (Plant and Animal cells) 1.2 Structure and function of cell organelles: Cell membrane. Mitochondria. Chloroplast, Endoplasmic reticulum, Golgi bodies, Lysosomes. Peroxisomes, Nucleus. 2. **Cell Cycle:** 2.1. Cell cycle and Cell division. 2.2. Apoptosis or Cell death **Key Words:**-Eukaryotic cell. Cell organelles. Cell cycle, Apoptosis	15
Unit III	Molecular Structure of Water : 1. Water structure and Buffer: 1.1 Properties of Water. 1.2 Interaction of Water. 1.3 Role of Water in Bio molecular Structure. 1.4 Acid and Bases, Buffer solutions. 2. Chemical Bonds: 2.1 Chemical Bonds (Ionic Bond. Covalent Bond. Coordinate Bond. Non Covalent Bonds. Hydrogen Bond) **Key Words:**- Water, Buffer, Chemical bonds.	15
Unit IV	**Biomolecules:** Sources. Nomenclature. Classification. Structures. Characteristics, and Functions: 1. Carbohydrates. 2. Lipids, 3. Proteins and Nucleic Acids. **Key Words:**-Carbohydrates, Proteins, Lipids, Nucleic Acids.	12
Unit V	**Tools and Techniques** 1.1 Principle and Applications of Light Microscopy, Centrifugation. Chromatography (Paper. Thin layer and Column). Colorimeter and Spectrophotometer.	12

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1. Industrial Biotechnology - B.D. Singh 2. Textbook of Biochemistry - S.P. Singh 3. Cell and Molecular Biology - P.K. Gupta 4. Cell Biology - P.S. Verma and Agrawal 05. Cell and Molecular Biology. - S.C.Rastogy 06. Cell Biology. - P.S. Verma and Agrawal
Suggested equivalent online courses : 1. https://pubs.acs.org/loi/bichaw (for Biochemistry), 2. https://pubs.acs.orE/loi/bipret, https://Ruides.lib.uh.edu/biotech (for biotechnology) 3. http://www.freebookcentre.net/BioloRv/BioTechnoloRv-8ooks.html e books on biotechnology 4. https://www.phindia.com/Books/5howeBooks/MTExNA/BiotechnoloRve books on biotechnology 5. https://bookauthority.orR/books/best-biotechnoloRv-ebooks e books on biotechnology

Part D: Assessment and Evaluation (Theory)		
Maximum Marks: **100** Continuous Comprehensive Evaluation(CCE): **25** University Exam (UE): Time :**02.00 Hours**		10 25 75
Internal Assessment Continuous ComprehenEvaluation(CCE)	Class lest	15
	Assignment/Presentation	04
	Total	**25**
External Assessment: University Exam.	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (C) : Two Long Questions (500 Words Each)	02 X 015=30

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part A: Introduction		
Program: Certificate Course **Class:** B.Sc. **Semester:** SECOND**Session:** 2021 -2022		
B.Sc. II Semester PaperPractical : Cell Biology and Biochemistry (Minor)		
1	**Course Code**	**S2-03-M**
2	**Course Title**	**Lab work for Cell Biology and Biochemistry**
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	**Core Course**
4	**Pre-requisite (If any)**	To study this course, a student must have had the subject Biology in 12TH class.
5	**Course Learning Outcomes (CLO)**	**Course Objective:**-The Main Objective of the course will be to give hands-on practical knowledge in Biotechnology. The Demand For Trained workforce in Biotechnology is ever growing in Fundamental Research and Industry Sector. Academic and Research Sectors also Require Interdisciplinary trained manpower to foster the Biotechnology Revolution. The curriculum aims to impart basic knowledge with emphasis on its applications to make the students ready for industries and research work in concerned field. **Learning Outcome :**-At the end of the paper, a student will be able to 1.Understand basic techniques of cell biology. 2.Know the physical as well as chemical properties of biomolecules 3.Pursue a career in biochemical testing. The decrease of increase in theamount of some of the biomolecules can have clinical significance. 4.Take medical Laboratory Technique Courses, opening opportunities inhospitals and pathological laboratories.
6	**Credit Value**	Practical – 2
7	**Total Marks**	Maximum Marks: 40+60 Minimum Passing Marks: 35

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part B : Content of the Practical Course
Total numbers of Lectures (in hours per week) :2 hours per week **B.Sc. II Semester PaperPractical : Cell Biology and Biochemistry (Minor)**
Credits - 2 (Practical: 30 hours)

Scheme of Practical Examination: - Max. Marks (25 + 75 = 100)

(A) Internal Assessment. : -Max. Marks 25

1. Class Interaction. 05
2. Quiz. 05
3. Seminar. 07
4. Assignment(Charts. Rural Service. Technology Dissemination/Excursion/ Lab Visit/Industrial Training. 08

(B) External Assessment:-Max. Marks 15

1. Major experiment 10
2. Minor Experiment -1 10
3. Minor experiment-2 15
4. Spotting. 15
5. Viva – Voce 10
6. Practical Record.

List of Experiments/Exercise.

1. To study the plant cell structure using various plant materials.
2. To study the animal cell structure using cheek cells.
3. To Prepare Onion root tip for the stages of Mitosis.
4. To Prepare and study the different stages of Mitosis and Meiosis.
5. To analyze Carbohydrates Quantitatively
6. To analyze proteins Quantitatively
7. To analyze lipids Quantitatively
8. To Prepare Buffers.
9. To Separate plant pigments by Paper Chromatography.
10. To Separate amino acids by TLC.

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part A: Introduction			
Program: Certificate Course **Class:** B.Sc. **Semester:** II**Session:** 2021 -2022			
Subject: Biotechnology (Open Elective)			
1	**Course Code**	S3-03-O	
2	**Course Title**	Immunology (Theory)	
3	**Course Type (Core/Elective/Generic Elective/Vocational/...)**	To study this course a student must have had the subject Biology in class 12th.	
4	**Pre-requisite (If any)**	Course Objectives: To create general understanding about microbiology and immunology	
5	**Course Learning Outcomes (CLO)**	**Course Objectives**: To create general understanding about microbiology and immunology 1 .The students will be able to understand microbial diversity and Nutrition. 2. The students will be able to understand immune system.Immune responses and Vaccination. 3.The students will be able to describe role of immune system in both maintaining health and contributing to disease. 4. The students will be able to understand immunological techniques. Course Learning Outcomes: At the end of the course student will familiar with - 1. Microbial diversity and nutrition. 2. Immune system, its properties and types. 3. Immunoglobulin structure, types and functions and can apply the concept of hypersensitivity and vaccination for different diseases. 4 Perform various immunological techniques.	
6	**Credit Value**	4	
7	**Total Marks**	Maximum Marks: 40(CCE)+60 (End Semester or Theory Exam) External Evaluation Total=100	Min. Marks 35

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part B: Content of the Course

B.Sc. I Semester Paper :Microbiology and Immunology(Minor)Total numbers of Lectures – 60

Unit	Topic	Number of Lectures
Unit I	**Basics of Immunology:** 1. Basics of Immunology : 1.1.Concept of Innate and Acquired immunity. Phygocytosis complement and Inflammatory responses. 1.2.Immune cells and organs : Structure. Function and Properties of immune cells - Stem cell. T-cell, B-cell . NK-cell . Macrophagus , Neutrophil. Eosinophil .Basophil. Mastcell.Dentric cell. 1.3. Immune organ: Bone marrow, Thymus. Lymph Node, Spleen, Lymphatic System. **Immunoglobulins and Immune response:** **1. Immunoglobulins** 1.1.Antigens: Characteristics of an antigen: Foreignness. Molecular size , Chemical composition and Heterogeneity , Antigen Adjuvants , Epitopes, Haptens. 1.2.Antibodies: Structure, Types, Functions and Properties of antibodies Antigenic determinant on antibodies(Isotypic, Allotypic , Idiotypic). Monoclonal. Polyclonal and Chimeric antibody. **Key Worlds:** Immunity. Immune cells.	15
Unit II	**2.Immune response :** 2.1. Generation of immune response: Primary and Secondary immune response, generation of Humoral response (Plasma and Memory cell). Generation of cell mediated immune response (self MHC restriction, T-cell activation, Co-stimulatory signals). Killing Mechanisms by CTL and NK cells, Introduction to tolerance. Key Worlds: Antigens. Antibody. **Microbial, Immunological Techniques and Vaccination:** 1.Microbial Techniques : 1.1. Principle. Working and applications of instruments -Laminar airflow. Autoclave, Hot air oven. **2.Immunological techniques:** 2.1. RIA, ELISA, Western blotting. Principles of Precipitation. Agglutination. Immunodiffsion. Immunoelectophorosis. **3.Vaccination:** 3.1. Vaccines and vaccination: Rubella.Varicella(Chickenpox), Polio.Diptheria.Hepatitis vaccine. Key Worlds: RIA, ELISA, Laminar air flow. Autoclave, Vaccine.	15

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology

Part D: Assessment and Evaluation (Theory)		
Suggested equivalent online courses : Maximum Marks: **100** Continuous Comprehensive Evaluation(CCE): **25** University Exam (UE): 75 Marks		10 25 75
Internal Assessment Continuous ComprehenEvaluation(CCE)	Class lest Assignment/Presentation	15 10
	Total	**25**
External Assessment: University Exam. Time: 2:00 hours	Section (A): Three Very Short Questions (50 Words Each)	03 X 03= 09
	Section (B) : Four Short Questions (200 Words Each)	04 X 09=36
	Section (C) : Two Long Questions (500 Words Each)	02 X 015=30 Total 75
Any remarks/suggestions:		

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

Program:B.Sc.									**Class:B.Sc. II Year**
Paper	Title of the Paper	Paper code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total minimum	Maximum	Minimum
Paper I	Biophysics and Biochemistry	C203 – I	40	28	10	3	33	50	17
PaperII	Bioinstrumentation, Biostatistics and bioinformatics	C203-II	40		10	3			

ExpertsMembers(Name &Signature)			
S.No.	Name	Designation	Signature
1	Dr. KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr. Bhavesh Patel	SubjectExpert	
4	Dr. R. K. Garg	SubjectExpert	
5	Mr.NiteshJasani	RepresentativefromIndustry	
6	Dr.Rekha Sharma	Member	
7	Mrs.FaridaJohar	Alumni	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

PartA:IntroductionforCode			
Program:BScBiotechnology	**Class: B.Sc.**	**YearII**	**Session 2021-22**
Subject:Biotechnology			
CourseCode	203 – I		
CourseTitle	Paperl: **BiophysicsandBiochemistry**		
CourseType	Core Course		
Pre-requisite(IfAny)	Tostudy thiscourse, astudent musthavePassed B.Sc. IYear inBiotechnology.		
Course LearningOutcome	Afterthe completionofthiscourse studentswillhave understandingof– **CO1:**Tostudyof fundamentalsofbioenergetics. **CO2:**TostudyVariousBiophysicalmethods andtheirapplications. **CO3:**Toknowthebasicconceptofbiochemistry,differenttypesofbonds,Structureandfunction, Concept ofpH, acid,baseandbuffer **CO4:**ToKnowtheClassification,structureandpropertiesofcarbohydrates,lipids,Aminoacids, Proteins andnucleicacids. **CO5:**Mechanismofenzymecatalysis,enzyme kinetics andenzymeregulation.		
CreditValue	4		
TotalMarks	Max.Marks:50	MinMarks:17	

Experts Members(Name&Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr. Bhavesh Patel	SubjectExpert	
4	Dr. R. K. Garg	SubjectExpert	
5	Mr.NiteshJasani	RepresentativefromIndustry	
6	Dr.Rekha Sharma	Member	
7	Mrs.FaridaJohar	Alumni	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

PartB: Content oftheCourse	
Total Numberof lecture Hours-60	
Unit	**Topics**
Unit I	**Thermodynamics:** ThermodynamicSystem,Equilibrium,thermodynamiclawsandtheirapplications,Differenttypesofprocesses,thermodynamicvariablesandEntropy. Thermodynamicpotentialsandrelations,Maxwell'sequations,Fundamentalequationofheatflow.
Unit II	**General Biophysical methods:** Measurement of pH, Radioactive labeling & counting,Autoradiography,Diffusion,Sedimentation,Osmosis,Viscosity-definitions,factorsinfluencing them and their application in biology. Bragg's equation, Reciprocal lattice,Millerindices&UnitCell,ConceptofdifferentCrystalstructure,determinationofcrystal structure.
Unit III	**FundamentalsofBiochemistry:**Biochemistryasmolecularlogicoflivingbeings.Axiomsof living matter, Major organic Compounds of animate objects a general view. Chemicalelements,structureofatoms,moleculesandchemicalbonds,ionic,covalent,coordinate andhydrogenbonds.Structure,functionandpropertiesofwater,waterasuniversalsolvent, Acids,basesandsalts, pH and buffers.
Unit IV	**Biomolecules:**ntroductionandoccurrence Classification,Properties,importanceofcarbohydrate,lipids, proteins, aminoacidsand nucleicacidsandvarious typesofRNA's
Unit V	**Enzymes:** Structure, classification and function–Active site, energy ofactivation, transitionstatehypothesis,lockandkeyhypothesis,inducedfithypothesis,ConceptofKm–Michaelismenten equation. Various types of enzyme inhibition and identification usingdouble reciprocal plot. Introduction to Allosteric enzymes. Definition of holoenzyme,apoenzyme,coenzyme,cofactor,prostheticgroupandtheirexamples,Conceptof ribozyme,multiple forms, isozymesandabzymes.

Experts Members(Name&Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr. Bhavesh Patel	SubjectExpert	
4	Dr. R. K. Garg	SubjectExpert	
5	Mr.NiteshJasani	RepresentativefromIndustry	
6	Dr.Rekha Sharma	Member	
7	Mrs.FaridaJohar	Alumni	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

PartC:Learning Resources
TextBooks, ReferenceBook,OtherResource
Recommended Books: 1. PrinciplesofBiochemistry,Lehninger. 2. Fundamentalsof Biochemistry.J.L. Jain 3. Biochemistry,VoetandVoet. 4. Textbook ofBiochemistry –S.P. Singh. 5. Biophysics:MohanP.Arora. 6. Biophysics:Pattabh&Gautham 7. Biochemistry:A.C. Deb. 8. Biomolecule:Mohan P. Arora 9. Principlesofbiochemistry (2005),Nelson &cox

PartD:AssessmentandEvaluation (Theory)		
SuggestedContinuousEvaluationMethods Maximum Marks: 50 marks Continuous Comprehensive Evaluation (CCE): 10 marksUniversityExam (UE):40 marks		
Internal Assessment: ContinuousComprehensive Evaluation(CCE)	**Test/Assignment/Presentation**	**Total10 Marks**
External Assessment: University (UE)Time 3:00 hours	Section(A):Oneobjectivefromeachunit(Totalfive MCQ) Section(B):Onelongquestionfromeachunit (Total 5 questions)	05 X 01 =05 05 X 07 =35
	Total	50Marks

Experts Members(Name&Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr. Bhavesh Patel	SubjectExpert	
4	Dr. R. K. Garg	SubjectExpert	
5	Mr.NiteshJasani	RepresentativefromIndustry	
6	Dr.Rekha Sharma	Member	
7	Mrs.FaridaJohar	Alumni	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

PartA:IntroductionforCode				
Program:BScBioinformatics		**ClassBSc**	**YearII**	**Session 2021-22**
Subject:Biotechnology				
1	**Course Code**	203-II		
2	**CourseTitle**	PaperII:**Bioinstrumentation,Biostatistics and bioinformatics**		
3	**CourseType**	Core Course		
4	**Pre-requisite(IfAny)**	To study this course, a student must have Passed B.Sc.I Year in Bioinformatics.		
5	**Course LearningOutcome**	After the completion of this course students will have understanding of-**CO1**:The basics knowledge Microscopy and separation of biomolecules by centrifugation. **CO2**:Youhave the basics knowledgeaboutChromatography andelectrophoresis. **CO3**:Youhaveideaaboutspectrophotometry andcolorimetry. **CO4**: ThebasicsconceptofBiostatisticsinthefieldofbiology. **CO5**:YouhaveideaaboutComputerandBasicBioinformatics.		
6	**CreditValue**	4		
7	**TotalMarks**	Max.Marks:50		Min Marks :17

Experts Members(Name&Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr. Bhavesh Patel	SubjectExpert	
4	Dr. R. K. Garg	SubjectExpert	
5	Mr.NiteshJasani	RepresentativefromIndustry	
6	Dr.Rekha Sharma	Member	
7	Mrs.FaridaJohar	Alumni	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

PartB: Content oftheCourse	
Total Numberof lecture Hours-60	
Unit	**Topics**
Unit I	**Microscopy–** Light,Phasecontrast,fluorescenceandElectronmicroscopyCentrifugationTechnique,Principlestypes& separationofbiologicalmolecules.
Unit II	**ChromatographyandElectrophoresis,Chromatography:**Principlesandapplication, Principle and application of electrophoresis, Agarose gel electrophoresis, Immunoelectrophoresis,Blotting: Southern,Western andNorthern Blotting.
Unit III	Spectrophotometry,Colorimetry(UVandVisible),RadioandNonradioLabelling,Autoradiography
Unit IV	**Biostatistics** –Introduction,Scope, applicationand useofStatisticcollectionandclassificationofdatasummarizationandpresentationofdata.Arithmetic mean,median,standarddeviation.Probability,definition.Randomvariableanditsdistribution.Binomialprobability distribution.
Unit V	**Computer:**Generalintroduction(characteristics,capabilities,generations).Hardware-organization of hardware (input devices, memory, control unit arithmetic logic unit, outputdevices); software: (system software; application software, languages – low level, high level),internetapplication. **BasicBioinformatics:**Introductiontointernet,searchEngines(Google,Yahoo,Entrezetc).Biological Database:Sequencedatabase(EMBL,Genbank,DDBJ,- UNIPORT,PIR,TrEMBL),Proteinfamily/domaindatabases(PROSITE,prints,pfam,BLOCK,etc), Cluster databases–An Introduction, Specialised databases (KEGG, etc), Database Technologies (flat-file),Structuraldatabase(PDB)

Experts Members(Name&Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr. Bhavesh Patel	SubjectExpert	
4	Dr. R. K. Garg	SubjectExpert	
5	Mr.NiteshJasani	RepresentativefromIndustry	
6	Dr.Rekha Sharma	Member	
7	Mrs.FaridaJohar	Alumni	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

PartC:Learning Resources		
TextBooks, ReferenceBook,OtherResource		
RecommendedBooks: 1. AtextbookofBioinformaticsby Sharma &Munjal&Shankar. 2. BioinformaticsbyCSV Murthy 3. Basic Bioinformaticsby S.Ignacimuthu, S.J. 4. Bioinformatics: Concepts.Skills andApplicationbyS.C.Rastogi.N.Mendiratta& ParagRastogi. 5. PracticalGuideforbasic Bioinformatics&BiostatisticsbyP.Tiwari&P.Panday 6. Biostatistics byB.Prasad. 7. StatisticalMethodsby S.PGupta. 8. Fundamentals of Statistics by S.C. Gupta.Biostaticsby P.N. Arora.		
PartD:AssessmentandEvaluation (Theory)		
SuggestedContinuousEvaluationMethods Maximum Marks: 50 marks Continuous Comprehensive Evaluation (CCE): 10 marksUniversityExam (UE):40 marks		
Internal Assessment: Continuous ComprehensiveEvaluation(CCE)	Test/Assignment/Presentation	Total 10 Marks
External Assessment: University (UE)Time 3:00 hours	Section(A):Oneobjectivefromeachunit(Totalfive MCQ) Section(B):Onelongquestionfromeachunit (Total 5 questions)	05 X 01 =05 05 X 07 =35
	Total	50Marks
Anyremarks / Suggestion		

Experts Members(Name&Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr. Bhavesh Patel	SubjectExpert	
4	Dr. R. K. Garg	SubjectExpert	
5	Mr.NiteshJasani	RepresentativefromIndustry	
6	Dr.Rekha Sharma	Member	
7	Mrs.FaridaJohar	Alumni	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

PartA:IntroductionforCode				
Program:BScBioinformatics		**Class:BSc**	**Year:Second**	**Session:2021-22**
Subject:Biotechnology				
1	**CourseCode**	PRBT203		
2	**CourseTitle**	Practical		
3	**CourseType**	Core Course		
4	**Prerequisite (IfAny)**	Tostudythiscourse,astudentmusthavePassedB.Sc.IYearinBiotechnology.		
5	**Course Learning Outcome (CLO)**	**CourseObjectives:**Tounderstandthebasicconceptofinstrumentation and techniques. **CourseOutcomes:**Afterthecompletionofthiscoursestudentswillhaveunderstanding of- **CO1:** Tounderstandthe working principleof variousinstruments. **CO2:**Studenthaveenhancedownskillrelatedbiophysicaltechniquesand experimentalmethodsalsogivesanopportunityofjobandresearchandlab practices. **CO3:**Toenhancethebasicknowledge of computerused in biology. **CO4:**Thiscoursealsoprovidesjoborientknowledgeabouttheinnovative techniquesand testmethod. **CO5:**TounderstandthetoolsandtechniqueslikeNCBIusedin biotechnology.		
6	**CreditValue**	2		
7	**TotalMarks**	Max.Marks:50		Min Marks :17

Experts Members(Name&Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr. Bhavesh Patel	SubjectExpert	
4	Dr. R. K. Garg	SubjectExpert	
5	Mr.NiteshJasani	RepresentativefromIndustry	
6	Dr.Rekha Sharma	Member	
7	Mrs.FaridaJohar	Alumni	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

PartB: Content oftheCourse		
Total Numbersof lectures(inhours perweek):4 hoursperweek(Total60 Hours)		
Practical	**Topics**	**No of Lecture hours**
	Topics 1. Principles and working knowledge of instruments like colorimeter, pHmeter, Centrifuge,Spectrophotometer,Microscopeetc. 2. Qualitativeanalysisof Carbohydrates, ProteinsandLipids. 3. QualitativeestimationofProteinbyFolin-Lowrymethod. 4. Quantitativeestimationofsugarby NelsonSmogyi'smethod. 5. Determination ofenzymeactivityby amylase. 6. StudytheeffectofpHonenzymeactivity. 7. Studytheeffectoftemperatureonenzyme activity. 8. Separation ofaminoacidsbyTLC 9. Separation ofleafpigmentsbyPaperChromatography. 10. Estimation ofHemoglobin. 11. RBCcounting by haematocytometer. 12. WBCcountingby Differential/or totalcellcount. 13. Measurementofbleedingandclottingtime. 14. Measurementof HeminCrystals. 15. Estimation of Betacarotene incarrots. 16. Estimationof ascorbic acid inlemon juice. 17. Determination ofiodinenumber offatsample. 18. Determination of phosphorus content in plant material (Colorimetricmethod). 19. Computerinput andoutput devices. 20. PrepareaMarksheetof yourclassSubjects 21. Design your classtimetable. 22. Preparea barchart,piechartforanalysisofElectionResult. 23. Exercisebasedonpowerpointpresentation. 24. Design a presentation illustrating insertion of pictures, word art & clipart 25. UseMS wordto insertatableintodocument. 26. Problem based on Mean,Median,Mode. 27. Hardy WeinbergLawappliedonPopulationGenetics. 28. Problembased onProbability. 29. Exercisebased onstandard Deviation. 30. Biologicaldataresourcesanddata retrieval. 31. IntroductiontoNCBI. 32. Retrieving DNA Sequence from GenBank and analyzing variousformatsofthedatastored. 33. AnalyzingProtein Sequences. 34. AnalyzingDNA Sequence.	24

ExpertsMembers(Name&Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr.KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr.BhaveshPatel	SubjectExpert	
4	Dr.R. K.Garg	Subject Expert	
5	Mr.NiteshJasani	Representative fromIndustry	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

6	Dr. RekhaSharma	Member	
7	Mrs. FaridaJohar	Alumni	

Govt. Holkar(Model Autonomous) Science College, Indore

Department: Biotechnology &

Year – 2021-2022

PartC:Learning Resources
TextBooks, ReferenceBook,OtherResource
Recommended Books:

PartD:AssessmentandEvaluation(Practical)	
Suggested ContinuousEvaluationMethods:	
SchemeforPracticalExamination	
1. MajorExercise	15Marks
2. MinorExercise	10 Marks (05+05)
3. Spotting(Related of theorypapers)	10
4. Viva-voceExamination	10
5. LabJournals (Sessionals)	05
TOTALMARKS	**50**

Experts Members(Name&Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. KiranBillore	Chairman	
2	Dr. A.Nighojkar	VCMember	
3	Dr. Bhavesh Patel	SubjectExpert	
4	Dr. R. K. Garg	SubjectExpert	
5	Mr.NiteshJasani	RepresentativefromIndustry	
6	Dr.Rekha Sharma	Member	
7	Mrs.FaridaJohar	Alumni	

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Program: B.Sc. Biotechnology Class: B.Sc. III Year									
Paper	**Title of the Paper**	**Paper code**	**Theory**					**Practical**	
			External	**Min**	**CCE**	**Min**	**Total min**	**Max**	**Min**
Paper I	Molecular Biology & Genetic Engineering	C303-I	40	28	10	3	33	50	17
Paper II	Applied Biotechnology	C303-II	40		10	3			
Internship			**Report**		**Viva**			**Max**	**Min**
			50		50			100	33

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R. K. Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Part A: Introduction for Code			
Program: B.Sc.Biotechnology	**Class: B.Sc.**	**Year III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	303 - I		
Course Title	Paper I: **Molecular Biology & Genetic Engineering**		
Course Type	Core Course		
Pre-requisite (If Any)	To study this course a student must have Passed BSc II Year in Biotechnology		
Course Learning Outcome	**CO1:** Idea of genome organization and DNA kinetics. **CO2:**Basic concept of DNA, it's structure, Replication and recombination. **CO3:** Prokaryotic and eukaryotic transcription and their regulation **CO4:**Post Transcriptional modification and translation **CO5:** Various types of mutations and their mechanism.		
Credit Value	4		
Total Marks	Max. Marks: 50	Min Marks: 17	

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R. K. Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Part B: Content of the Course	
Total Number of lecture Hours-60	
Unit	**Topics**
Unit I	DNA and RNA. Chemical Structure. Types and Properties. Experimental Proof of DNA as Genetic Material, Genome- Concept, Plant, Animal, Bacterial and Viral Genome. DNA replication. Types, Experimental Proof of semi conservative replication, Replicon- Concept. proteins and enzymes involved in replication in prokaryotes and eukaryotes, Modes of DNA replication. Unidirectional, Bidirectional, Types of DNA replication, Y shaped. ø Mode. rolling circle mechanism.
Unit II	Eukaryotic chromosomal organization. Euchromatin, Heterochromatin, chromatin structure, nucleosomes, histone and non-histone proteins, Histone modifications. Introduction to epigenetics.
Unit III	**Origin of life:** Classical experiments and current concepts. Evolution of Biological macromolecules, Evolution of early forms, Mendelian genetics: Mendel's Law, Chromosomal basis of heredity, Chromosomal analysis, allelic variation, dominance, linkage and crossing over.
Unit IV	**Introduction to Recombinant DNA technology:** Scope & importance, Gene Cloning, PCR. Introduction to Restriction endonuclease, Vectors for DNA transfer and their types: Plasmids, Phagemids, Cosmids, BAC. Gene Amplification.
Unit V	**Plasmids:**Types Properties and cloning vectors. Recombinant DNA Techniques and cloning with Restriction endonuclease and recombinant DNA. Mutation, Types of mutations: Point mutation (Base pair change, Frame shift, Deletion). Transcription, Translation and gene expression in eukaryotes (yeast), Alternate Splicing.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R. K. Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Part C: Learning Resources Year 2021-2022
Text Books, Reference Book, Other Resource
Recommended Books: 1. Pathfinder Life Science Fundamentals and Practice Part I by Pranav Kumar 2. Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007. 3. J.D. Watson, N.H. Hopkins, J.W Roberts, J. A. Seitz & A.M. Weiner; Molecular Biology of the Gene, 6th Edition, Benjamin Cummings Publishing Company Inc, 2007. 4. Alberts et al; Molecular Biology of the Cell, 4th edition, Garland, 2002. 5. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998.

Part D: Assessment and Evaluation(Theory)		
Suggested Continuous Evaluation Methods Maximum Marks: 50 marks Continuous Comprehensive Evaluation (CCE): 10 marks University Exam (UE): 40 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Test/Assignment/Presentation	Total 10 Marks
External Assessment: University (UE) Time 3:00 hours	Section (A): One objective from each unit (Total five MCQ) Section (B): One long question from each unit (Total 5 questions)	05 X 01 = 05 05 X 07 = 35
	Total	50 Marks

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R. K. Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

7	Mrs. Farida Johar	Alumni	

Part A: Introduction for Code				
Program: B.Sc. Biotechnology		**Class B.Sc.**	**Year III**	**Session 2021-22**
Subject: Biotechnology				
1	**Course Code**	C303-II		
2	**Course Title**	Paper- II **Applied Biotechnology**		
3	**Course Type**	Core Course		
4	**Pre-requisite (If Any)**	To study this course a student must have Passed BSc II Year in Biotechnology		
5	**Course Learning Outcome**	**CO1:** Basic knowledge of Microbial contamination & Spoilage. **CO2:** Basic knowledge about plant tissue culture and in vitro culture. **CO3:** Basic knowledge about Immunity, Immunoglobulin's and animal cell culture technology. **CO4:**Basic concept of Fermentation, Types of fermentation and fermenters. **CO5:**Basic concept of Environment and Environmental Biotechnology.		
6	**Credit Value**	4		
7	**Total Marks**	Max. Marks: 50		Min Marks :17

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R. K. Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Part B: Content of the Course		
Total Number of lecture Hours-60		
Unit	**Topics**	**No of Lecture hours**
Unit I	**Microbial Biotechnology:** Food Microbiology-Microbial contamination & Spoilage, Food preservation. Industrial Production of Ethyl Alcohol, Penicillin, Cyanocobalamin, Glutamic Acid, Citric Acid, Amylase, Protease.	**12**
Unit II	**Plant Biotechnology:** Introduction to plant tissue culture, Nutritional requirements, In vitro culture. Single cell Culture, Anther culture, Ovule culture, Somatic embryogenesis, Organogenesis, Protoplast culture. Somatic hybridization, Genetic manipulation of plants using Agrobacterium tumefaciens.	**14**
Unit III	**Immunology and Animal Biotechnology:** Immunity – Innate and Acquired, Host defense mechanism. Infection and its types, Organs and Cells of immune system, Vaccines and its types. Antigens -Properties and types, Adjuvants, Immunoglobulins- Structure, types and functions, Generation of Antibodies, Primary and Secondary response, Agglutination and Precipitation reactions. History, Equipment and materials for animal cell culture technology. Physical requirement for animal cell and their growth curve in culture. Commonly used cell lines – their organization and characteristics, Differentiation of cells. Organ culture – techniques, advantage and applications. Application of animal biotechnology: Methods of transfection and cell fusion of animal cells, Selectable markers, HAT selection, Transgenic animals, Stem cell culture. Transplantation of cultured cells, Bioreactors for large scale production of animal cells.	**10**
Unit IV	**Fermentation Technology:** Fermentation Technology. Primary and Secondary Screening, Strain Improvement. Inoculum Development, Industrial Sterilization process, Scale-up and Harvest and Recovery. Types of fermentation – batch, continuous, fed batch process: Submerged and Solid-State fermentation process. Basic design of fermenter and factors affecting fermenter design. Types of fermenters- Fluidized, Packed Bed, Air lift Fermenter, Tray Fermenter and Tower Fermenter.	**15**
Unit V	**Environment Biotechnology:** Environment: Basic concept, Significance, Public awareness, Environmental pollution. Assessment of water quality, Treatment of waste-water – Primary secondary and tertiary treatment. Solid waste management (composting, vermi-composting, methane production). Biopesticides- Bacterial and Fungal, genetically modified crops, Biofertilizers – Nitrogen fixers, PSB, Mycorrhiza and VAM, Microbial leaching, Microbial Enhanced Oil Recovery. Bioremediation and biodeterioration. Modern fuels: Methanogenic bacteria and biogas. Microbial hydrogen production.	**10**

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Part C: Learning Resources
Text Books, Reference Book, Other Resource
Books Recommended: 1. J. Hammond, P. McGarvey and V. Yusibov (Eds.): Plant Biotechnology. Springer verlag, 2. T-J. Fu, G. Singh, and W.R. Curtis (Eds.); Plant Cell and Tissue Culture for the Production of Food Ingredients. Kluwer Academic/Plenum Press. 1999. 3. H. S. Chawla: Biotechnology in Crop Improvement. International Book Distributing Company. 1998. 4. Culture of Animal cells, (3rd Edition), Freshney, Wiley-Liss. 5. Animal Cell Culture – Practical Approach, Ed. John R.W. Masters, OXFORD. 6. Cell Growth and Division: A Practical Approach. Ed. R. Basega, IRL Press. 7. Kuby Immunology

Part D: Assessment and Evaluation(Theory)

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Suggested Continuous Evaluation Methods Maximum Marks: 50 marks Continuous Comprehensive Evaluation (CCE): 10 marks University Exam (UE): 40 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Test/Assignment/Presentation	Total 10 Marks
External Assessment: University (UE) Time 3:00 hours	Section (A): One objective from each unit (Total five MCQ) Section (B): One long question from each unit (Total 5 questions)	05 X 01 = 05 05 X 07 = 35
	Total	50 Marks
Any remarks / Suggestion		

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R. K. Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Part A: Introduction for Code				
Program: B.Sc. Biotechnology		**Class: B.Sc.**	**Year: Third**	**Session: 2021-22**
Subject: Biotechnology				
1	**Course Code**	PRBT303		
2	**Course Title**	Practical		
3	**Course Type**	Core Course		
4	**Prerequisite (If Any)**	To study this course, a student must have Passed B.Sc. II Year in Biotechnology.		
5	**Course Learning Outcome (CLO)**	**Course Objectives:** To understand the levels of structural organization of macro molecules and experimental methods of structural determination. To know the approaches for structural analysis. **Course Outcomes:** After the completion of this course students will have understanding of– **CO1:** Basics of Macromolecular structural properties. **CO2:** To get knowledge of the molecular interaction. **CO3:** Student enhanced own skill related biophysical techniques and experimental methods. **CO4:** Basicsof innovative technology of PCR and Electrophoresis.		
6	**Credit Value**	2		
7	**Total Marks**	Max Marks:50		Min Marks :17

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R. K. Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Part B: Content of the Course		
Total Numbers of lectures (in hours per week): 4 hours per week (Total 60 Hours)		
Practicals	**Topics**	**No. of Lecture hours**
	1. Chromosomal DNA Isolation from Plant Cells. 2. Chromosomal DNA isolation from Animal cells. 3. Genomic DNA isolation from Micro-organisms. 4. Analysis of Isolated DNA by agarose gel electrophoresis. 5. Spectrophotometric analysis of DNA and DNA melting. 6. UV as a physical mutagen 7. Gradient Plate Technique 8. Estimation of DNA using diphenylamine method. 9. Estimation of RNA using Orcinol method. 10. Isolation of RNA from Yeast. 11. Isolation of plasmid DNA from bacteria. 12. Effect of UV radiation on microbial cell 13. Demonstration of repair mechanism in microbes. 14. Bacteriophage and determination of latent period of infection 15. Isolation of total RNA from plant tissue by SDS phenol method. 16. Elution of DNA from agarose gel band. 17. Transformation in E-Coli cell. 18. Growth of plant tissue into undifferentiated mass of callus. 19. Preparation of animal cell culture media. 20. Separation and culture of lymphocyte from blood. 21. Demonstration of fermenter. 22. Preparation of wine. 23. Extraction of citric acid from Aspergillus. 24. Production of ethanol by yeast 25. Demonstration of PCR. 26. Immobilization of microbial cells. 27. Extraction and preparation of lactic acid. 28. Extraction and preparation of citric acid. 29. Demonstration of Radial Immuno diffusion analysis. 30. Isolation of microorganism from polluted site/industrial waste. 31. Blood group analysis.	24

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R. K. Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Govt. Holkar (Model Autonomous) Science College, Indore

Department: Biotechnology & Bioinformatics

Year - 2021-2022

Part C: Learning Resources
Text Books, Reference Book, Other Resource
Recommended Books: 1. Practical Biotechnology: Principles and Protocols, by Supriya Dash & Swagat Kumar Das H N Thatoi, I K International Publishing House 2. Molecular Biology & Biotechnology (A Practical Manual) Sunil D Purohit & Neelu Joshi, edition 2007

Part D: Assessment and Evaluation(Practical)	
Suggested Continuous Evaluation Methods:	
Scheme for Practical Examination	
1. Major Exercise	12 Marks
2. Minor Exercise	10 Marks
3. Minor Exercise	10 Marks
4. Spotting (Related of theory papers)	08
5. Viva-voce Examination	05
6. Practical Record	05
TOTAL MARKS	**50**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R. K. Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

M.Sc.: -

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Programme: MSc. (Biotechnology) **Class : M.Sc. I Sem**

S. No	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
1	Core 1	Paper I (Biochemistry)	BT-11	4	25	9	75	26	100	35
2	Core 2	Paper II (Cell and Development Biology)	BT-12	4	25	9	75	26	100	35
3	Core 3	Paper III (Microbiology)	BT-13	4	25	9	75	26	100	35
4	Core 4	Paper IV (Biostatistics & Bioinformatics)	BT-14	4	25	9	75	26	100	35
5	Practical -1	Practical (based on Theory paper I & II)	PRBT-11	3			75		75	26
6	Practical-2	Practical (based on Theory paper III & IV)	PRBT-12	3			75		75	26
7	Seminar 1	Seminar 1		1			25		25	09
8	Seminar2	Seminar 2/Field trip/Industrial Visit		1			25		25	09
				24	100		500		600	

Experts Members (Name & Signature)			
S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

<table>
<tr><th colspan="6">Part A: Introduction</th></tr>
<tr><td>Program:</td><td colspan="2">Class: M.Sc.</td><td colspan="2">Semester: I</td><td>Session 2021-22</td></tr>
<tr><td colspan="6">Subject: Biotechnology</td></tr>
<tr><td>Course Code</td><td colspan="5">BT-11</td></tr>
<tr><td>Course Title</td><td colspan="5">Paper I:(Biochemistry)</td></tr>
<tr><td>Course Type</td><td colspan="5">Core Course</td></tr>
<tr><td>Pre-requisite (If any)</td><td colspan="5">B.Sc. in any Life Science Stream</td></tr>
<tr><td>Course Learning Outcomes</td><td colspan="5">Course Outcomes: After the completion of this course students will have understanding of
CO1: Classification, structure and properties of amino acids and proteins.1
CO2: Mechanism of enzyme catalysis, enzyme kinetics and enzyme regulation.
CO3: Classification, structure and properties of carbohydrates and lipids.
CO4: Structure of cell membrane and its various functions.
CO5: Fundamental chemical principles that govern complex biological systems as well as role ofbiomolecules in metabolic pathways.</td></tr>
<tr><td>Credit Value</td><td colspan="5">4</td></tr>
<tr><td>Total Marks</td><td colspan="5"><table>
<tr><th>CCE (Max)</th><th>CCE (Min)</th><th>External AssessmentsMax</th><th>External Assessments Min</th><th>Total Max</th><th>Total Min</th></tr>
<tr><td>25</td><td>9</td><td>75</td><td>26</td><td>100</td><td>35</td></tr>
</table></td></tr>
</table>

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Amino acids –** Classification, structure, properties and function Protein classification,structural levels of protein & their properties Structure-function relationships in model proteins like ribonuclease A, myoglobin, hemoglobin, chymotrypsin etc.; Tools to characterize expressed proteins.
Unit II	**Enzyme catalysis** – general principles of catalysis; Quantitation of enzyme activity and efficiency; Enzyme characterization and Michaelis-Menten kinetics; Relevance of enzymes in metabolic regulation, activation, inhibition and covalent modification; Single substrate enzymes.
Unit III	**Carbohydrate** - mono, di, and polysaccharides; Classification structure properties and function, cellular structure, energy storage, signaling; Glycosylation of other biomolecules - glycoproteins and glycolipids; Lipids - structure and properties of important members of storage and membrane lipids; their organization; lipoproteins.
Unit IV	**Bio membrane organization** - sidedness and function; Membrane bound proteins - structure, properties and function; phase transitions in lipids, polysaccharides, comparison between different membrane models, diffusion and permeability, carrier transport, ion transport, active and passive transport, ion pumps, water transport, use of liposomes for membrane models and drug delivery systems.
Unit V	**Bioenergetics-basic principles;** Equilibrium and concept of free energy; Coupled processes; Glycolytic pathway; Kreb's cycle; Oxidative phosphorylation. Photosynthesis; Elucidation of metabolic pathways of central metabolism (urea cycle and beta oxidation); entry/exit of various biomolecules from central pathways; Principles of metabolic regulation; Regulatory steps; Signals and second messengers.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Texts/References: 1. V.Voet and J.G.Voet, Biochemistry, 3rd edition, John Wiley, New York, 2004. 2. A.L. Lehninger, Principles of Biochemistry, 4th edition, W.H Freeman and Company, 2004. 3. L. Stryer, Biochemistry, 5th edition, W.H. Freeman and Company, 2002. Suggested Digital platform: www.freebookcentre.net>....free biochemistry books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

<table>
<tr><th colspan="6">Part A: Introduction</th></tr>
<tr><td>Program:</td><td colspan="2">Class: M.Sc.</td><td colspan="2">Semester: I</td><td>Session 2021-22</td></tr>
<tr><td colspan="6">Subject: Biotechnology</td></tr>
<tr><td>Course Code</td><td colspan="5">BT-12</td></tr>
<tr><td>Course Title</td><td colspan="5">Paper II (Cell and Development Biology)</td></tr>
<tr><td>Course Type</td><td colspan="5">Core Course</td></tr>
<tr><td>Pre-requisite (If any)</td><td colspan="5">B.Sc. in any Life Science Stream</td></tr>
<tr><td>Course Learning Outcomes</td><td colspan="5">Course Outcomes: After the completion of this course students will have understanding of –
CO1: Microscopy and membrane structure and its function.
CO2: Basics concept of cell organelles and their origin and evolution.
CO3: The basics knowledge of end membrane system and their motility.
CO4: Cell cycle and development of drosophila.
CO5: The basics knowledge of plant Meristem organization and Differentiation of specialized cells.</td></tr>
<tr><td>Credit Value</td><td colspan="5">4</td></tr>
<tr><td>Total Marks</td><td colspan="5">
<table>
<tr><th>CCE (Max)</th><th>CCE (Min)</th><th>External AssessmentsMax</th><th>External Assessments Min</th><th>Total Max</th><th>Total Min</th></tr>
<tr><td>25</td><td>9</td><td>75</td><td>26</td><td>100</td><td>35</td></tr>
</table>
</td></tr>
</table>

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Cell Theory & Methods of Study:** Structure of Prokaryotic and Eukaryotic cells Microscope and its modifications – Light, phase contrast and interference, Fluorescence, Confocal, Electron (TEM and SEM), Electron tunneling and Atomic Force Microscopy, etc. Sub cellular fractionation and criteria of functional integrity. Membrane Structure and Function: Structural models; Composition and dynamics and function of Plasma Membrane, Transport of ions and macromolecules; Pumps, carriers and channels; Endo- and Exocytosis Extracellular matrix in plants and animals Membrane carbohydrates and their significance in cellular recognition; Cellular junctions and adhesions; Structure and functional significance of plasmodesmata.
Unit II	**Organelles:** Nucleus – Structure and function of nuclear envelope, lamina and nucleolus, Macromolecular trafficking, Chromatin organization and packaging; Mitochondria – structure, organization of respiratory chain complexes, ATP synthase, Structure-function relationship; Mitochondrial DNA and male sterility; Origin and evolution; Chloroplast– Structure function relationship; Chloroplast DNA and its significance; Chloroplast biogenesis; Origin and evolution.
Unit III	**Endo-membrane System and Cellular Motility:** Structure and function of microbodies, Golgi apparatus Lysosomes and Endoplasmic Reticulum; Organization and role of Cytoskeleton; Cell shape and motility; Actinbinding proteins and their significance; Muscle organization and function; Molecular motors; inter mediate filament.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit IV	**Cellular Movements and Pattern Formation and Pattern Formation:** Cell cycle and control mechanisms cellular responses to environmental signals in plant and animals. Differentiation of germ layers, Cellular polarity; Maternal gene effects; Zygotic gene effects; Homeotic gene effects in Drosophila; Embryogenesis and early pattern formation in plants; Cell lineages and developmental control genes in Caenorhabditis. apomixes.
Unit V	**Differentiation of Specialized Cells:** Stem cell differentiation, Blood cell formation, Fibroblasts and their differentiation; Phase changes in Salmonella; Mating cell types in yeast; Surface antigen changes in Trypanosomes; Heterocyst differentiation in Anabaena; Sex determination in Drosophila. Plant Meristem Organization and Differentiation: Organization of Shoot Apical Meristem (SAM); Organization of Root Apical Meristem (RAM); Pollen germination and pollen tube guidance; Phloem differentiation; Self-incompatibility and its genetic control; Embryo and endosperm development;

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Texts/References: 1. Lodish*et al*., Molecular cell Biology, 4th Edition, W.H. Freeman & Company, 2000. 2. Smith & Wood, Cell Biology, 2nd Edition, Chapman & Hall, London, 1996. 3. Watson *et al.,* Molecular Biology of the gene, 5th Edition, Pearson Prentice Hall. USA, 2003. 4. B. M. Turner, Chromatin & Gene regulation, 1st Edition, Wiley-Blackwell, 2002. 5. Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007. www.freebookcentre.net>....freeCell Biology books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: I**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-13**		
Course Title	**Paper III (Microbiology)**		
Course Type	**Core Course**		
Pre-requisite (If any)	**B.Sc. in any Life Science Stream**		
Course Learning Outcomes	Course Outcomes: After the completion of this course students will have understanding of – CO1. Classification of microorganism and their structure. CO2. Various media and culturing techniques. CO3. Microbial growth, itstypes, parameters and factors affecting. CO4. Mechanism of pathogenesis and mode of action of toxins. CO5.Virology and mycology.		

Total Marks	**CCE (Max)**	**CCE (Min)**	**External AssessmentsMax**	**External Assessments Min**	**Total Max**	**Total Min**
	25	**9**	**75**	**26**	**100**	**35**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Microbial Diversity &Systematics:** Concepts in classification of microorganisms, Classical and modern methods, Identification and Classification of Bacteria according to Bergey's manual. Ultrastructure of Archaea (Methanococcus); Eubacteria (*E. coli*); Unicellular Eukaryotes (Yeast).
Unit II	**Microbial Techniques:** Principles of microbial nutrition, Types of culture media. Cultivation of microorganisms: Pure culture and enrichment culture methods. Culture collection and maintenance of cultures. Theory and practice of sterilization.
Unit III	**Microbial Growth:**mathematical expression of growth and study of microbial growth curve. Batch, fed-batch, continuous culture, synchronous growth. Growth as affected by environmental factors like temperature, acidity, alkalinity, water availability and oxygen. Methods of growth estimation.
Unit -IV	**Microbial Interactions and Infection:** Host–Pathogen interactions; Mechanism of pathogenesis. Pathogenicity islands and their role in bacterial virulence. Types of toxins and their structure and mode of action.
Unit -V	**Virology and Mycology:** Structure and Classification of Bacterial, Plant, Animal viruses. Satellite viruses, Viroids, Virusoids. Prions Structure, Classification and general features of fungi.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. Pelczar MJ Jr., Chan ECS and KreigNR., Microbiology, 5th Edition, Tata McGraw Hill, 1993.
2. Maloy SR, Cronan JE Jr., and Freifelder D, Microbial Genetics, Jones Bartlett Publishers, Sudbury, Massachusetts, 2006.
3. Crueger and A Crueger, (English Ed., TDW Brock); Biotechnology: A textbook of Industri Microbiology, Sinaeur Associates, 1990.
4. G Reed, Prescott and Dunn's, Industrial Microbiology, 4th Edition, CBS Publishers, 1987.
5. M.T. Madigan and J.M. Martinko, Biology of Microorganisms, 11th Edition, Pearson Prenti Hall, USA, 2006.

www.freebookcentre.net>....freeMicrobiologybooks download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction

Program:	**Class: M.Sc.**	**Semester: I**	**Session 2021-22**

Subject: Biotechnology

Course Code	**BT-14**
Course Title	**Paper IV (Biostatistics and Bioinformatics)**
Course Type	**Core Course**
Pre-requisite (If any)	**B.Sc. in any Life Science Stream**
Course Learning Outcomes	Course Outcomes: After the completion of this course students will have understanding of – CO1: Applications of biological data for statistical analysis and major output from the biological big data. CO2: Statistical analysis is now days a research-oriented branch for the students. CO3: Basic knowledge about the computational data management and data organization. CO4: How to deal with biological data, management of biologicaldatabase and also use for the analysis CO5: Basic concepts of machine learning and use techniques like phylogeneticconstruction.
Credit Value	4

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B: Content of the Course

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Fundamental Concept in Applied probability:** Exploratory Data Analysis, Probability: Random experiments, Sample space, Probability theory, conditional probability, Sampling: Definition, Size of sample, Central limit theorem, Means & Variance for proportions. Test of significance:
Unit II	**Hypothesis testing:**Type of hypothesis, two type of errors, Level of significance, Critical Region, P Value, Test of equality of two population means, Test of hypothesis for proportion, Chi Square test: Test of hypothesis for population variance, Test of Independence of factors, Analysis of Variance (ANOVA).
Unit III	**DBMS Concepts:** Data Abstraction, Database System Architecture, Schemas, Physical Data Organization - Hashed, Index File, B-tree. Data Models, Data browsing and Data retrieval. Definition and scope of Computational Biology and Bioinformatics. Major Bioinformatics Resources: (Sequence Database and Genome Database) NCBI, EBI, PIR, SWISSPROT Gene Bank, EMBL, KEGG, TIGR OMIM. Sequence Alignment: Pairwise Sequence Alignment Tool: FASTA and BLAST, Multiple Sequence Alignment Tool: CLUSTAL W.
Unit-IV	**Introduction to Data mining:** Classification, Clustering, Data Warehousing, Applications of Data Mining. Cluster Analysis: Type of Clustering, K Means Clustering, Hierarchical Clustering, Application. Phylogenetic Analysis: Methods and its Application. Sequence Comparison; Sequence pattern; regular expression-based pattern; Theory of profiles and their use in sequence analysis: Markov models; Concept of HMMS; Baum-Welch algorithm, Bayesian algorithm, Pattern Recognition methods.
Unit -V	**Microarray Technique:** Principle, Type, Experimental design, standardization, Normalization, Data analysis, Annotation, application. Structure Determination by; X Ray Crystallography, NMR Spectroscopy, Cryo Electron Microscope, PDB (Protein Data bank) and NDB (Nucleic Acid Data Bank) : File Format for storage and dissemination of molecular structure. **Method of Protein Modeling:** Ab initio Protein Modeling, Homology Modeling, Protein Threading and Protein Structure Prediction: Structure- Structure Comparison, Side Chain Prediction, Force fields, Molecular energy Minimization: Monte Carlo and Molecular Dynamics

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C : Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. Wayne W. Daniel, Biostatistics: A foundation for Analysis in the Health Sciences, 8th Edition, Wiley, 2004.
2. B. L. Agarwal: Basic Statistics: New age international Publication. 4th Edition
3. Prem S. Mann, Introductory Statistics, 6th Edition, Wiley, 2006.
4. John A. Rice, Mathematical Statistics and Data Analysis, 3rd Edition, John A. Rice, Duxbury Press, 2006.
5. Campbell and Heyer, Discovering Genomics, Proteomics, & Bioinformatics, 2nd Edition, Benjamin Cummings, 2002.
6. CynthiaGibas and Per Jambeck, Developing Bioinformatics Computer Skill, 1st Edition, O'Reilly Publication, 2001.

www.freebookcentre.net>....freeMicrobiology books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: I**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**PRBT-11**		
Course Title	**PRACTICAL - I (BASED ON THEORY PAPER -I &II) BIOCHEMISTRY AND CELL & DEVELOPMENTAL BIOLOGY**		
Course Type	**Core Course**		
Pre-requisite (If any)	**B.Sc. in any Life Science Stream**		
Course Learning Outcomes	Learning Outcomes: at the end of the paper students will be able to: CO1. Understand Basic Technique of Biochemistry and Cell Biology CO2. Know the physical as well as chemical properties of Biomolecules. CO3.Pursue Career in Biochemical Testing.		
Credit Value	**3**		
Total Marks	**Max Marks 75**		**Min Passing Marks 26**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B: Content of the Practical Course

List of experiments / Exercise

1. To prepare an Acetic-NaAcetate Buffer system and validate the Henderson-Hasselbach equation.
2. To determine an unknown protein concentration by plotting a standard graph of BSA using UV-Vis Spectrophotometer and validating the Beer- Lambert's Law.
3. Titration of Amino Acids and separation of aliphatic, aromatic and polar amino acids by TLC.
4. To determine an unknown sugar concentration by Nelson Somogyii's and DNS method.
5. Determination of enzyme activity and studying the effect of temperature, pH, enzyme concentration substrate concentration on enzyme activity.
6. Isolation of biomolecules from natural sources.
7. Microscopy: Bright field, phase contrast and fluorescence microscopy.
8. Microtomy.
9. Subcellular fractionation and marker enzymes.
10. Histochemical techniques.
11. Mitosis and Meiosis
12. Vital Staining of mitochondria.
13. Demonstration of barr body.
14. Isolation and estimation of enzymes from various sources.
15. **Viable cell counting using haematocytometer.**
16. **Study of animal cell structures using cheek cell.**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: I**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**PRBT-12**		
Course Title	**PRACTICAL - II (BASED ON THEORY PAPER -III &IV) MICROBIOLOGY & BIOSTATISTICS AND BIOINFORMATICS**		
Course Type	**Core Course**		
Pre-requisite (If any)	**B.Sc. in any Life Science Stream**		
Course Learning Outcomes	Learning Outcomes: at the end of the paper students will be able to: CO1. Understand Basic Technique of Microbiology & Bioinformatics CO2. Know about protein Database. CO3. Know about Phylogenetic Analysis CO4. Know about Primer Designing.		
Credit Value	**3**		
Total Marks	**Max Marks 75**		**Min Passing Marks 26**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B: Content of the Practical Course

List of experiments / Exercise Practical:Microbiology Practical Code: PRBT-12

1. Sterilization, disinfection, safety in microbiological laboratory.
2. Preparation of media for growth of various microorganisms.
3. Isolation of bacteria from air, water and soil.
4. Staining of microorganisms.
5. Enumeration of microorganisms.
6. Growth curve, measure of bacterial population by turbidometry and studying the effect of temperature, pH, carbon and nitrogen.
7. Isolation and identification of fungus.
8. Isolation of bacteriophage.
9. Antibiotic sensitivity test by disc/well diffusion method.
10. Isolation of actinomycetes form soil.
11. Isolation of yeast from curd sample.
12. Isolation of bacteria from air, water and soil.
13. **Isolation of Azotobacter from garden soil.**

Practical:Biostatistics and Bioinformatics:

1. MS Excel: Enter Data, Edit Data, Copy Data, and Move Data.
2. MS Excel: Bar Diagram, Histogram, Scatter Plot
3. MS Excel: Statistical Function (Mean, S.D., Correlation, Regression, Coefficients)
4. Protein Database:NCBI, Swiss Prot
5. Nucleotide Database:GeneBank
6. Literature Database: PubMed
7. Pathway Database: KEGG
8. Domain Database: COGs, InterPro Scan
9. Pairwise Alignment Tool: BLAST
10. Multiple Sequence Alignment Tool: Clustal W
11. Phylogenetic Analysis: Phylip
12. ProteinModeling:SwissModel, PS2 Server
13. Docking: Hex Docking Server
14. Primer Designing.
15. Ligplot interactions

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Programme: MSc. (Biotechnology) **Class : M.Sc. II Sem**

S. No	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
1	Core 5	Paper V (Molecular Biology)	BT-21	4	25	9	75	26	100	35
2	Core 6	Paper VI (Bacterial Genetics and Genetic Engineering)	BT-22	4	25	9	75	26	100	35
3	Core 7	Paper VII (Immunology)	BT-23	4	25	9	75	26	100	35
4	Core 8	Paper VIII (Analytical Techniques)	BT-24	4	25	9	75	26	100	35
5	Practical -3	Practical based on Theory paperV&VI	PRBT-21	3			75		75	26
6	Practical-4	Practical based on Theory paper VII&VIII	PRBT-22	3			75		75	26
7	Seminar 3	Seminar 3		1			25		25	09
8	Seminar 4	Seminar 4/Field trip/Industrial Visit		1			25		25	09
				24	100		500		600	

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: II**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-21**		
Course Title	**Paper V (Molecular Biology)**		
Course Type	**Core Course**		
Pre-requisite(If any)	**B.Sc. in any Life Science Stream**		
Course Learning Outcomes	Course Outcomes: After the completion of this course students will have understanding of – CO1: Idea of genome organization and DNA kinetics. CO2: Basic concept of DNA, its structure, Replication and recombination. CO3: Prokaryotic and eukaryotic transcription and their regulation CO4: Post Transcriptional modification and translation CO5: Various types of mutations and their mechanism.		
Credit Value	4		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Genome organization:** Organization of bacterial genome; Structure of eukaryotic chromosomes; Heterochromatin and Euchromatin; DNA re-association kinetics (Cot curve analysis); Repetitive and unique sequences; Satellite DNA; DNA melting and buoyant density;
Unit II	**DNA Structure;**Replication; Repair & Recombination: Structure of DNA - A-, B-, Z- and triplex DNA; Replication initiation, elongation and termination in prokaryotes and eukaryotes; Enzymes and accessory proteins; Replication of single stranded circular DNA; and DNA repair- enzymes; Photoreactivation; Excision repair; Mismatch correction; SOS repair; Recombination: Homologous and non-homologous; Site specific recombination; Chi sequences in prokaryotes; FLP/FRT and Cre/Lox recombination.
Unit III	**Prokaryotic& Eukaryotic Transcription:** Prokaryotic Transcription; Transcription unit; Promoters- Constitutive and Inducible; Operators; Regulatory elements; Initiation; Elongation; Termination-Rho-dependent and independent; Anti-termination; Transcriptional Regulation-Positive and negative; Operon concept-lac, trp, ara, his, and gal operons; Transcriptional control in lambda phage; Eukaryotic transcription and regulation; RNA polymerase structure and assembly; RNA polymerase I, II, III; Eukaryotic promoters and enhancers; General Transcription factors; TATA binding proteins (TBP) and TBP associated factors (TAF); Activators and repressors; regulation of gene expression in eukaryote including Transcriptional and post-transcriptional gene silencing.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit -IV	**Post Transcriptional Modifications:** Processing of hnRNA, tRNA, rRNA; 5'-Cap formation; 3'-end processing and polyadenylation; Splicing; RNA editing; Nuclear export of mRNA; mRNA stability; Catalytic RNA. Translation &Transport: Translation machinery; Composition and assembly; Universalgenetic code; Degeneracy of codons; Termination codons; Genetic code in mitochondria; Wobble hypothesis; Mechanism of initiation, elongation and termination; Co- and post-translational modifications; Transport of proteins and molecular chaperones; Protein stability; Protein turnover and degradation.
Unit -V	**Bacterial mutants and mutations:** Isolation; Useful phenotypes (auxotrophic, conditional, lethal, resistant); Mutation and Types of mutations (base pair changes; frameshift; insertions; deletions; tandem duplication); Mutation rate; Mutagenic agents; Mechanisms of mutagenesis; Assay of mutagenic agents (Ames test) Genetic variation: genome polymorphism; uses of polymorphism

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Texts/References: 1. Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007. 2. J.D. Watson, N.H. Hopkins, J.W Roberts, J. A. Seitz & A.M. Weiner; Molecular Biology of the Gene, 6th Edition, Benjamin Cummings Publishing Company Inc, 2007. 3. Alberts et al; Molecular Biology of the Cell, 4th edition, Garland, 2002. 5. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998. www.freebookcentre.net>....freeMolecular Biology books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

<table>
<tr><td colspan="5">Part A: Introduction</td></tr>
<tr><td>Program:</td><td>Class: M.Sc.</td><td>Semester: II</td><td colspan="2">Session 2021-22</td></tr>
<tr><td colspan="5">Subject: Biotechnology</td></tr>
<tr><td>Course Code</td><td colspan="4">BT-22</td></tr>
<tr><td>Course Title</td><td colspan="4">Paper VI (Bacterial Genetics and Genetic Engineering)</td></tr>
<tr><td>Course Type</td><td colspan="4">Core Course</td></tr>
<tr><td>Pre-requisite (If any)</td><td colspan="4">B.Sc. in any Life Science Stream</td></tr>
<tr><td>Course Learning Outcomes</td><td colspan="4">Course Outcomes: After the completion of this course students will have understanding of –
CO1: Bacterial recombination, Gene mapping and transposable genetic elements.
CO2: Structure, function and types of bacteriophages and plasmid.
CO3: Basic concepts in genetic engineering and recombinant DNA technology.
C04: Various types of vectors and their properties.
CO5: Versatile tools and techniques used in genetic engineering and their applications</td></tr>
<tr><td>Credit Value</td><td colspan="4">4</td></tr>
<tr><td>Total Marks</td><td colspan="4">
<table>
<tr><th>CCE (Max)</th><th>CCE (Min)</th><th>External Assessments Max</th><th>External Assessments Min</th><th>Total Max</th><th>Total Min</th></tr>
<tr><td>25</td><td>9</td><td>75</td><td>26</td><td>100</td><td>35</td></tr>
</table>
<table>
<tr><th colspan="4">Experts Members (Name & Signature)</th></tr>
<tr><th>S.No.</th><th>Name</th><th>Designation</th><th>Signature</th></tr>
<tr><td>1</td><td>Dr. Kiran Billore</td><td>Chairman</td><td></td></tr>
<tr><td>2</td><td>Dr. A. Nighojkar</td><td>VC Member</td><td></td></tr>
<tr><td>3</td><td>Dr. Bhavesh Patel</td><td>Subject Expert</td><td></td></tr>
<tr><td>4</td><td>Dr. R K Garg</td><td>Subject Expert</td><td></td></tr>
<tr><td>5</td><td>Mr. Nitesh Jasani</td><td>Representative from Industry</td><td></td></tr>
<tr><td>6</td><td>Dr. Rekha Sharma</td><td>Member</td><td></td></tr>
<tr><td>7</td><td>Mrs. Farida Johar</td><td>Alumni</td><td></td></tr>
</table>
</td></tr>
</table>

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Gene transfer in bacteria**: History; Transduction – generalized and specialized; Conjugation – F, F', Hfr; F transfer; Hfr-mediated chromosome transfer; Transformation – natural and artificial transformation; Merodiploid generation; Gene mapping by recombination Transposable genetic elements; Insertion sequences; Composite and Complex transposons; Replicative and non-replicative transposition; Genetic analysis using transposons
Unit II	**Bacteriophages and Plasmids:** Bacteriophage–structure; Assay; Lambda phage – genetic map, lysogenic and lytic cycles; Gene regulation; Filamentous phages such as M13; Plasmids – natural plasmids and types of Plasmids; their properties and phenotypes; Plasmid biology - copy number and its control; Incompatibility; Antibiotic resistance markers on plasmids (mechanism of action and resistance); Restriction-modification systems: History; Types of systems and their characteristics; Methylation dependent restriction systems; applications.
Unit III	**Basics Concepts of Genetic Engineering**: Restriction Enzymes; DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase; Cohesive and blunt end ligation; Linkers; Adaptors; Homopolymerictailing; Labeling of DNA: Nick translation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques: Northern, Southern and Colony hybridization, Fluorescence in situ hybridization; Chromatin Immunoprecipitation; DNA-Protein Interactions-Electromobility shift assay; DNaseIfootprinting; Methyl interference assay.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit -IV	**Cloning Vectors** : Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Bluescript vectors, Phagemids; Lambda vectors; Insertion and Replacement vectors; EMBL; Cosmids; Artificial chromosome vectors (YACs; BACs); Animal Virus derived vectors-SV-40; vaccinia/bacculo& retroviral vectors; Expression vectors; pMal; GST; pET-based vectors; Protein purification; His-tag; GST-tag; MBP-tag etc.; Intein-based vectors; Inclusion bodies; Baculovirus and pichia vectors system, Plant based vectors, Ti and Ri as vectors, Yeast vectors, Shuttle vectors.
Unit -V	**Cloning Methodologies:** Insertion of Foreign DNA into Host Cells; Transformation; Construction of libraries; Isolation of mRNA and total RNA; cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Jumping and hopping libraries; Southwestern and Farwestern cloning; Protein-protein interaction and Yeast two hybrid system; Phage display; Principles in maximizing gene expression.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Texts/References: 1. S.R. Maloy, J.E. Cronan, D. Friefelder, Microbial Genetics, 2nd Edition, Jones and Bartlett Publishers, 1994. 2. N. Trun and J. Trempy, Fundamental Bacterial Genetics, Blackwell publishing, 2004. 5. Hartl L D and Jones B, Analysis of genes and genomes, 3rd Edition, Jones and Bartlett Publishers, 1994. 6. S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press, 2001. 7. J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001. 8. Brown TA, Genomes, 3rd ed. Garland Science 2006 9. Campbell AM &Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings 2007 10. Primrose S &Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006. www.freebookcentre.net>....freeGenetic Engineering books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: II**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-23**		
Course Title	**Paper-VII (Immunology)**		
Course Type	**Core Course**		
Pre-requisite(If any)	**B.Sc. in any Life Science Stream**		
Course Learning Outcomes	Course Outcomes: After the completion of this course students will have understanding of – CO1: Design a model of Immunoglobulins. Describe which cell types and organs present in the immune response. CO2: Illustrate various mechanisms that regulate immune responses and maintain tolerance. CO3: Adverse effect of immune system including Allergy, hypersensitivity and autoimmunity. CO4: Apply basic techniques for identifying antigen antibody interactions. CO5: Immunological response against tumor and blood transfusion, Elucidate the reasons for immunization and aware of different vaccination		
Credit Value	4		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Immunology-** fundamental concepts and anatomy of the immune system. History and Evolution of Immune System Components of innate and acquired immunity; Phagocytosis; complement and inflammatory responses; Haematopoesis; Organs and cells of the immune system- primary and secondary lymphoid organs; Lymphatic system; Lymphocyte circulation; Lymphocyte homing; Mucosal and Cutaneous Associated Lymphoid tissue. (MALT&CALT).
Unit II	**Immunogens, Immunoglobulins and Immune response :** Immuno-chemistry of Antigens - immunogenicity, antigenic determinants, Immunoglobulins-basic structure, classes & subclasses of immunoglobulin's.; Multigene organization of immunoglobulin genes; B-cell receptor; Immunoglobulin superfamily; Basis of self –non-self-discrimination; B cell maturation, activation and differentiation; Generation of antibody diversity; T-cell maturation, activation and differentiation and T-cell receptors; Functional T Cell Subsets; Cell-mediated immune responses, ADCC.
Unit III	**Antigen-antibody interactions**: Antigen – Antibody interaction, affinity, cross reactivity, specificity. Precipitation, agglutination and complement mediated immune Reactions. Immuno assays: RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, and immunoelectron microscopy

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit -IV	**Immune Response to Viral, Bacterial & Protozoan diseases, Vaccinology**: Active and passive immunization; Live, killed, attenuated, sub unit vaccines; Vaccine technology Toxins-Toxoids, Hapten-carrier system. system; Role and properties of adjuvants. Recombinant DNA and protein-based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines.
Unit -V	**Clinical Immunology:** Major Histocompatibility Complex and HLA typing Hypersensitivity – Type I, II, III and IV; Autoimmunity; Types of autoimmune diseases. Transplantation – Immunological basis of graft rejection; Clinical transplantation and immunosuppressive therapy; Tumor immunology – Tumor antigens; Immune response to tumors and tumor evasion of the immune system. Cancer cells and Immunodeficiencies.

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Texts/References: 1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002. 2. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002. 3. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., 1999. 4. Paul, Fundamental of Immunology, 4th edition, Lippencott Raven, 1999. 5. Goding, Monoclonal antibodies, Academic Press. 1985. www.freebookcentre.net>....freeImmunology books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: II**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-24**		
Course Title	**Paper- VIII (ANALYTICAL TECHNIQUE)**		
Course Type	**Core Course**		
Pre-requisite(If any)	**B.Sc. in any Life Science Stream**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of CO1: Buffers; Ultrafiltration and other membrane techniques &Spectroscopy Techniques and You will have the basics knowledge about buffers and spectroscopy with all detail knowledge about its applications and instrumentation. CO2: Chromatography Techniques Electrophoresis techniques with all detail knowledge about its applications and instrumentation. CO3: Basics knowledge of Centrifugation and its types with all detail knowledge about its applications and instrumentation. CO4: The basics concept of Radioactivity and its applications. CO5: About Advanced Techniques like Protein crystallization, MADI-TOF and Mass spectrometry.		
Credit Value	4		

Total Marks	**CCE (Max)**	**CCE (Min)**	**External Assessments Max**	**External Assessments Min**	**Total Max**	**Total Min**
	25	**9**	**75**	**26**	**100**	**35**

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Basic Techniques:** Buffers; Methods of cell disintegration; Enzyme assays and controls; Detergents and membrane proteins; Dialysis, Ultrafiltration and other membrane techniques Spectroscopy Techniques: UV, Visible and Raman Spectroscopy; Theory and application of Circular Dichroism; Fluorescence; MS, NMR, PMR, ESR and Plasma Emission spectroscopy.
Unit II	**Chromatography Techniques**: TLC and Paper chromatography; Chromatographic methods for macromolecule separation - Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography; HPLC and FPLC; Criteria of protein purity Electrophoretic techniques: Theory and application of Polyacrylamide and Agarose gel electrophoresis; Capillary electrophoresis; 2D Electrophoresis; Disc gel electrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis.
Unit III	**Centrifugation:** Basic principles; Mathematics & theory (RCF, Sedimentation coefficient etc.); Types of centrifuges - Microcentrifuge, High speed & Ultracentrifuges; Preparative centrifugation; Differential & density gradient centrifugation; Applications (Isolation of cell components); Analytical centrifugation; Determination of molecular weight by sedimentation velocity & sedimentation equilibrium methods.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit -IV	**Radioactivity:** Radioactive & stable isotopes; Pattern and rate of radioactive decay; Units of radioactivity; Measurement of radioactivity; Geiger-Muller counter; Solid & Liquid scintillation counters (Basic principle, instrumentation & technique); Brief idea of radiation dosimetry; Cerenkov radiation; Autoradiography; Measurement of stable isotopes; Falling drop method; Applications of isotopes in biochemistry; Radiotracer techniques; Distribution studies; Isotope dilution technique; Metabolic studies; Clinical application; Radioimmunoassay.
Unit -V	**Advanced Techniques:** Protein crystallization; Theory and methods; API-electrospray and MADI-TOF; Mass spectrometry; Enzyme and cell immobilization techniques; DNA & Peptide Synthesis.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

\

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. Freifelder D., Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman & Company, San Fransisco, 1982.
2. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, 5th Edition, Cambridge University Press, 2000.
3. D. Holme& H. Peck, Analytical Biochemistry, 3rd Edition, Longman, 1998.
4. R. Scopes, Protein Purification - Principles & Practices, 3rd Edition, Springer Verlag, 1994.
5. Selected readings from Methods in Enzymology, Academic Press
www.freebookcentre.net>....freeAnalytical Technique books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: II**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**PRBT-21**		
Course Title	**PRACTICAL - I (Based on theory paper V &VI)** **Molecular Biology and Bacterial Genetics and Genetic Engineering**		
Course Type	**Core Course**		
Pre-requisite (If any)	**B.Sc. in any Life Science Stream**		
Course Learning Outcomes	Learning Outcomes: at the end of the paper students will be able to: 1.Basic Technique of Molecular Biology and Bacterial Genetics and Genetic Engineering 2.To learn isolation of DNA 3.Pursue Career in Genetics and Genetic Engineering		
Credit Value	**3**		
Total Marks	**Max Marks 75**		**Min Passing Marks 26**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B: Content of the Practical Course

List of experiments / Exercise

1. Isolation of bacterial genomic DNA.
2. Plasmid DNA isolation and DNA quantitation: Plasmid minipreps
3. Restriction digestion.
4. Preparation of competent cells.
5. Agarose gel electrophoresis.
6. Restriction Enzyme digestion of DNA
7. Purification of DNA from an agarose gel
8. DNA Ligation
9. Transformation of E. coli with standard plasmids, Calculation of transformation efficiency
10. Cloning of genomic DNA in standard plasmid vectors
11. Confirmation of the insert, Miniprep of recombinant plasmid DNA Restriction mapping
12. Transformation of yeast *Saccharomyces cerevisiae*
13. Estimation of DNA by diphenyl amine method.
14. Estimation of RNA by orcinol method.
15. Isolation of DNA from plant and animal cell.
16. Isolation of mutant by gradient plate technique
17. UV radiation as a mutagenic agent.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: II**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**PRBT-22**		
Course Title	**Practical - II (Based on theory paper -VII &VIII)** **Immunology and Analytical Techniques**		
Course Type	**Core Course**		
Pre-requisite (If any)	**B.Sc. in any Life Science Stream**		
Course Learning Outcomes	Learning Outcomes: at the end of the paper students will be able to: 1. Basic Technique of Immunology and Analytical Techniques 2.To learn Immunology and Analytical Techniques 3.Pursue Career in Immunology and Analytical Techniques		
Credit Value	**3**		
Total Marks	**Max Marks 75**		**Min Passing Marks 26**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B: Content of the Practical Course

List of experiments / Exercise

1. Selection of animals, Preparation of antigens, Immunization and methods of bleeding, Serum separation, Storage.
2. Antibody titre by ELISA method.
3. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.
4. Complement fixation test.
5. Isolation and purification of IgG from serum.
6. SDS-PAGE, Immunoblotting, Dot blot assays.
7. Blood smear identification of leucocytes by Giemsa stain.
8. Separation of leucocytes by dextran method.
9. Demonstration of Phagocytosis of latex beads.
10. Separation of mononuclear cells by Ficoll-Hypaque.
11. Lymphoproliferation by mitogen / antigen induced.
12. Immunodiagnostics using commercial kits.
13. Purification and Separation Techniques - Ammonium Sulfate Precipitation Ion-exchange Chromatography, Gel Filtration Affinity Chromatography, TLC.
14. Blood group/widal/VDRL.
15. Latex agglutination test.
16. **Rocket Immuno-electrophoresis.**
17. **Differential WBCs counting.**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Programme: MSc. (Biotechnology) **Class : M.Sc. III Sem**

S. No	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
1	Core 9	Paper - IX Enzyme Technology	BT-31	4	25	9	75	26	100	35
2	Core 10	Paper- X Plant Biotechnology	BT-32	4	25	9	75	26	100	35
3	Elective 1/1	Paper XI Environmental Biotechnology	BT-33	4	25	9	75	26	100	35
	Elective 1/2	Stem Cell Biology								
4	Elective 2/1	Paper XII Food Biotechnology	BT-34	4	25	9	75	26	100	35
	Elective 2/2	Pharmacogenomics								
5	Open Elective interdisplinary	Paper XIII Option from given list	OE	4	25	9	75	-	100	35
6	Practical -1	Practical based on core Theory paper IX&X	PRBT-31	3	-	-	75	-	75	26
7	Practical-2	Practical based on elective Theory paper XI&XII	PRBT-32	3	-	-	75	-	75	26
				26	125		525		650	

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-31**		
Course Title	**Paper- IX (ENZYME TECHNOLOGY)**		
Course Type	**Core Course**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	**Course Outcomes:** After the completion of course, students will have understanding of CO1: Theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell. CO2: Describe the mechanisms of enzyme catalysis. CO3: Chemical principles of enzyme catalysis, including cofactor chemistry; show insight in the action of enzymes as biocatalysts and in factors that influence enzyme activity; CO4: Kinetics of enzymatic reactions; show awareness of the influence of enzyme structure on catalytic properties; CO5: Purification, handling and characterization of proteins; - show insight in the physio-chemical properties of proteins that underlie purification methods		
Credit Value	4		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction** to enzymology and historical developments in enzymology. Enzyme classification, IUBMB enzyme classification. Enzyme Activity: Techniques of enzyme isolation, Principle and techniques of enzyme assay, factors affecting enzyme activity.
Unit II	**Intracellular localization of enzymes Mechanism of Enzyme Action**: Investigation of active site Enzyme activators, co-enzymes and co-factors in enzyme catalysis Purification of enzyme: Techniques of separation and purification, test of homogeneity
Unit III	**Enzyme Kinetics, Bioenergetics and Catalysis Single substrate kinetics**: Equilibrium and steady state kinetics, significance of Km, Vmax&Kcat. Multisubstrate reaction kinetics: General rate equation, ordered, random order and ping-pong mechanisms.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit -IV	**Enzyme inhibition and its kinetics:** Reversible and irreversible inhibition, competitive, non-competitive and uncompetitive, mixed, partial and substrate inhibition. Thermal kinetics: Effect of temperature on reaction rate, enzyme stability, Arrhenius equation and activation energy.
Unit -V	**Allosteric enzymes and sigmoidal kinetics**: Co-operativity, MWC & KNF models, enzyme memory and pneumonical enzymes. Isoenzymes, multienzyme complex and multifunctional enzymes, and their physiological significance. Biosensors; Enzymes as analytical reagents. Ribozymes and catalytic antibodies.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. Enzymes: Dixon & Webb
2. Biological Chemistry: Mahler &Cordes
3. Principles of Biochemistry: Lehninger
4. Methods in Enzymology: Relevant volumes
5. Enzymes: Boyer
6. Handbook of Enzymes: Dr. Anil Kumar
7. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry: Trevor Palmer

www.freebookcentre.net>....freeEnzyme Technology books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-32**		
Course Title	**Paper- X (Plant Biotechnology)**		
Course Type	**Core Course**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of- CO1: In-vitro plant culture technique. Callus culture, Embryo culture technique. CO2: Plant transformation method and techniques for gene transfer. CO3: Plant Transformation for productivity and performance as well as to know virus resistance, disease resistance plants. CO4: Metabolic Engineering and Industrial Products like Plant secondary metabolites, Edible vaccine, and to understand the various technique to enhance their production. CO5: Molecular Marker aided-Breeding techniques like rDNA techniques RFLP maps,RAPD markers, STS, AFLP,		
Credit Value	**4**		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction to cell and Tissue Culture:** Tissue culture media (Composition and preparation), tissue culture as a technique to produce novel plants and hybrids. Initiation and maintenance of callus and suspension culture; single cell clones. Organogenesis; somatic embryogenesis; transfer and establishment of whole plants in soil. Shoot-tip culture: rapid clonal propagation and production of virus-free plants. Embryo culture and embryo rescue. Protoplast isolation, culture and fusion; selection of hybrid cells and regeneration of hybrid plants; symmetric and asymmetric hybrids, cybrids. Anther, Pollen and Ovary culture for production of haploid plants and homozygous lines.
Unit II	**Plant transformation Technology**:Basis of tumor formation, hairy root, features of Ti and Ri plasmids, mechanisms of DNA transfer, role of virulence genes, use of Ti and Ri as vectors, binary vectors, use of 35S and other promoters, genetic markers, use of reporter genes with introns, use of scaffold attachment regions methods of nuclear transformation, viral vectors and their application, Multiple gene transfers, Vectors-less or Direct DNA transfer, Particle bombardment, Electroporation, microinjection, transformation of monocots, Transgene stability and gene silencing. Chloroplast transformation**:** Vectors, advantages.
Unit III	**Application of plant Transformation for productivity and performance**: Herbicide resistance, insect resistance, virus resistance, disease resistance, nematode resistance, abiotic stress, post-harvest losses, long shelf life of fruits and flowers, male sterile lines, bar and barnase systems.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit -IV	**Metabolic Engineering and Industrial Products**: Plant secondary metabolites, control mechanisms and manipulation of phenylpropanoid pathway, shikimate pathway; alkaloids, polyhydraxybutyrate, therapeutic proteins, lysosomal enzymes, antibodies, edible vaccines, purification strategies, oleosin partitioning technology.
Unit -V	**Molecular Marker Aided-Breeding:** Basic techniques or rDNA techniques RFLP maps, linkage analysis, RAPD markers, STS, microsatellites, SCAR (sequence characterized amplified regions), SSCP (single strand conformational polymorphism), AFLP, QTL, map-based cloning, molecular marker assisted selection. Cryopreservation, slow growth and DNA Banking for germplasm conservation. Plant breeder right: UPOV 369,370,372. Plant genome mapping: physical & molecular map, Gene tagging.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

\

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. J. Hammond, P. McGarvey and V. Yusibov (Eds.): Plant Biotechnology. Springer verlag,
2. T-J. Fu, G. Singh, and W.R. Curtis (Eds.); Plant Cell and Tissue Culture for the Production of Food Ingredients. Kluwer Academic/Plenum Press. 1999.
3. H. S. Chawla: Biotechnology in Crop Improvement. International Book Distributing Company. 1998.
4. R.J. Henry: Practical Application of Plant Molecular Biology. Chapman and Hall. 1996.
5. P.K. Gupta: Elements of Biotechnology. Rastogi and Co. Meerut. 1996.
6. S.S. Bhojwani and M.K. Razdan: Plant tissue culture: Theory and practice, a revised edition (1996)

www.freebookcentre.net>....freePlant Biotechnologybooks download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-33**		
Course Title	**ELECTIVE - I Paper – XI 1/1 (ENVIRONMENTAL BIOTECHNOLOGY)**		
Course Type	**ELECTIVE –1/1**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: after the completion of course, students will have understanding of CO1: The basics knowledge of Environment: basic concept and issues, Pollution: Types of pollution, methods for measurement of pollution CO2: You have idea about Air and Water pollution: Air pollution and its control through Biotechnology, CO3: You have idea basics knowledge Treatment schemes for waste water of dairy, distillery, tannery, sugar and antibiotic industries. CO4: The basics concept uses of microbes in the treatment of Environment. CO5: You have idea about Bioremediation, Biopesticides& Global environmental problems.		
Credit Value	**4**		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Environment: basic concept and issues, Pollution**: Types of pollution, methods for measurement of pollution, Methodology for environment management – the problem-solving approach, its limitation.
Unit II	**Air and Water pollution**: Air pollution and its control through Biotechnology, Water as scarce natural resources, Need for water management, Measurement of water pollution, Source of water pollution. Marine Pollution: Sources of marine pollution and its control. Waste water treatment: physical, chemical and biological treatment processes. Microbiology of waste water treatment.
Unit III	**Aerobic process:** Activated sludge, Oxidation ditches, Trickling filter, Towers, Rotating disc, Rotating drums, and Oxidation ponds. Anaerobic digestion, Anaerobic filters, up flow anaerobic sludge blanket reactor. Treatment schemes for waste water of dairy, distillery, tannery, sugar and antibiotic industries.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit -IV	**Microbiological degradation of xenobiotic in Environment.** Ecological consideration, decay behavior &degradative plasmid. Hydrocarbons, Oil pollution, Surfactants, Pesticides. Introduction to algal biotechnology: Resource potential of algae, commercial utility of algae. Algae as a source of food, pigments and micronutrients. Environmental applications of algae for Biofuel, biofertilizer and waste water treatment,Potash Mobilizing bacteria & NPK Consortia
Unit -V	**Bioremediation of contaminated soils and waste land**, Biopesticides in integrated pest management, Soil waste source and management (composting, vermiculture, methane production). Global environmental problems, Ozone depletion, UV-B, Greenhouse effect, Acid rain, their impact and Biotechnological approaches for management

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

\

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Texts/References: 1.Environmental Biotechnology by Rajmohan Joshi (Author) 2.Environmental Biotechnology: Basic Concepts and Applications 2nd Revised edition Edition (English, Paperback, Indu Shekhar Thakur) by Indu Shekhar Thakur (Author) 3.Environmental Biotechnology by M. H. Fulekar (Author) 4.Biotechnology Expanding Horizons Latest Edition 2021 (Paperback, B. D. Singh) www.freebookcentre.net>....freeEnvironmental Biotechnology books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-33**		
Course Title	**ELECTIVE - I Paper – XI 1/2 (STEM CELL BIOLOGY)**		
Course Type	**ELECTIVE –1/2**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	**Course Outcomes:** after the completion of course, students will have understanding of CO1: The basics knowledge of Stem Cell Biology CO2:Stem Cell characterization and application of stem cell. CO3: Basics knowledge of Treatment human stem cell research CO4: The basics concept of human embryonic stem cells CO5: About tissue system failure		
Credit Value	4		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction to Stem Cells** :Basic biology of stem cells. Types & sources of stem cell with characteristics: embryonic, adult, hematopoietic, fetal, cord blood, placenta, bone marrow, primordial germ cells, cancer stem cells, induced pluripotent stem cells. Stem cell niche.
Unit II	**Stem cell characterizations**: isolation & characterizations, markers & their identification, growth factor requirements and their maintenance in culture. Feeder and feeder free cultures. Cell cycle regulators in stem cells
Unit III	**Embryonic Stem Cells:**Blast cyst and inner cell mass cells; Organogenesis; Mammalian Nuclear Transfer Technology; Stem cell differentiation; stem cells cryopreservation
Unit -IV	**Application of stem Cells:**Overview of embryonic and adult stem cells for therapy neurodegenerative diseases; Parkinson's, Alzheimer, Spinal Code Injuries and other brain Syndromes; Tissue system Failures; Diabetes; Cardiomyopathy; Kidney failure; Liver failure; Cancer; Hemophilia etc
Unit -V	**Human Embryonic Stem Cells and Society:** Human stem cells research. Ethical consideration. Stem cell religion consideration. Stem cell-based therapies': Pre-clinical regulatory consideration and Patient advocacy.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References

1. Ann A.Kiessling, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential,Jones and Bartett, 2003.
2. Peter J.Quesenberry, Stem Cell Biology and Gene Therapy, 1st Edition, Willy-Less, 1998.
3. Robert Lanja, Essential of Stem Cell Biology, 2nd Edition, academic Press, 2006.
4. A.D.Ho., R.Hoffiman, Stem cell Transplantation Biology Processes Therapy, Willy-VCH, 2006.
5. C.S.Potten, stem Cells, Elsevier, 2006.

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-34**		
Course Title	**ELECTIVE - II Paper – XII 2/1(FOOD BIOTECHNOLOGY)**		
Course Type	**ELECTIVE –2/1**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of CO1: Food Processing and nutritive value of food. CO2: Concept of Food Preservation and New Preservation Technologies. CO3: Types of Food Spoilage & Food Borne Diseases. CO4: Fermented Food Products. CO5: Microbial analysis of food.		
Credit Value	4		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction to Food Processing:** Biotechnology in relation to the food industry, nutritive value of food, and types of microorganisms associated with food, its sources, types and behavior in foods. Morphology and structure of microorganism in food – yeast. Mold and bacterial cell. Importance of microorganism in food.
Unit II	**Food Preservation:** Bioprocessing of meat, fisheries, vegetables, dairy products, enzymes and chemicals used in food processing, New Preservation Technologies.
Unit III	**Food Spoilage & Food Borne Diseases:** Microbial spoilage of food, Food -borne infections &Intoxications.
Unit -IV	**Fermented Food Products**: Dairy products, non-beverage plant products, beverages and related products of baking. Microbes as food, Probiotics, prebiotics, single cell proteins, single cell oil.
Unit V:	**Quality Control:** Microbial analysis of food. Quality control, Food Hygiene, Food Regulations and Standards.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Texts/References: 1. Roger A., Gordan B., and John T., Food Biotechnology, 1989. 2. Frazier, Food Microbiology. 3. G. Reed, Prescott and Dunn's Microbiology, CBS Publishers, 4. Introductory Food Microbiology, Author – H.A. Modi. www.freebookcentre.net>...freeFood microbiology books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-34**		
Course Title	**ELECTIVE - II Paper – XII 2/2(Pharmacogenomics)**		
Course Type	**ELECTIVE –2/2**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of CO1: Pharmacogenomics, benefits, practical applications. CO2: Concept ofdrugs legislation and safety CO3:Genetic biomarkers. CO4: Techniques in pharmacogenomics. CO5: Drugs and Cosmetics Act.		
Credit Value	**4**		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Pharmacogenomics,** benefits, practical applications, the promise of Pharmacogenomics today leading to personalized medicines, human genetic variation-example of CYP gene variation leading to variable metabolism of drugs, distribution of variation, mutation and its kinds, natural selection, variation in ethnic groups races.
Unit II	**Pharmacology,** clinical pharmacology, drugs, drugs legislation and safety, types of drugs-examples of latest drugs, drug potency and efficacy and toxicity, ADME of drug-drug absorption, drug distribution, drug metabolism and drug excretion, drug therapeutic levels, therapeutic index, drug abuse, drug response in patients by correlating gene expression, regulation of gene expression, polymorphism, alleles, single nucleotide polymorphism, genotyping.
Unit III	**Genetic biomarkers-** biomarkers on drug development, biomarkers in clinical development, biomarkers for molecular diagnostics-example of cancer biomarkers, pharmacogenetics and drug development
Unit -IV	**Techniques inpharmacogenomics**: Protein purification. Mono, poly clonal antibodies. Molecular biology in receptor identification. Antisense oligonucleotides, molecular targets Ofdrug action. Qualitative testing, titrimetric analysis.
Unit V:	**Drugs and Cosmetics Act**, Drug Price Control order, Application for Investigational New Drug (IND), Application for New Drug Discovery (NDD) according to Indian Control Authority & USFDA guidelines

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References

1. Wu R and Lin M, Statistical & Computational Pharmacogenomics, CRC Press, 2008
2. Yan Q, Pharmacogenomics in Drug Discovery and Development, Springer-Verlag New York, LLC,
3. Meyer UA and Tyndale RF, Pharmacogenomics, 2nd Edition, CRC Press, 2005.
4. Innocenti F, Pharmacogenomics: Methods and Applications, Springer-verlag New York, LLC, 2005
5. Rothstein MA and Collins FS, Pharmacogenomics: Social, Ethical and Clinical Dimensions, Wiley John & Sons, Inc., 2003

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction

Program:	Class: M.Sc.	Semester: III	Session 2021-22

Subject: Biotechnology

Course Code: OE

Course Title: OPEN ELECTIVE Paper-XIII

Name of Department responsible for framing of syllabus	Title of Paper	Paper Code
Bioinformatics	Basic of Bioinformatics	OE-BB
Biochemistry	Biochemical Techniques	OE-BT
Geology	Remote Sensing	OE-RS
Botany	Environmental Biology	OE-EB
Microbiology	Basic of Microbiology	OE-BM
Mathematics	Mathematical Modeling	OE-MM
Computer Science	Computer Application	OE-CA
Statistics	Bio-statistical Techniques	OE-ST
Chemistry	Health Chemistry	OE-HC
Language (English)	Communication Skills	OE-CS
Respective Departments	In-House Project	

Course Type: Open Elective interdisciplinary Paper-XIII

Pre-requisite(If any): M.Sc. Previous. (Biotechnology)

Credit Value: 4

Total Marks:

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**OE-BB**		
Course Title	**Open Elective (BasicOf Bioinformatics)**		
Course Type	**OPEN ELECTIVE**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of CO1: The basics knowledge of Bioinformatics. CO2: Basics concept NCBI. CO3: About types of Protein Structure. CO4: Data base Analysis Tool. CO5: Drug Discovery and design.		
Credit Value	4		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction to Bioinformatics and Biological database:** What is Bioinformatics and its relation with molecular biology Applications of Bioinformatics. Nucleic acid Databases (NCBI), Protein databases (Primary, Secondary and Composite). Specialized Genome databases: (SGD). Structure Databases (CATH, SCOP) File Format (, PDB, Swiss-Prot)
Unit II	**Sequence Alignments:** Introduction to Sequences, Alignments and Dynamic Programming; Local Alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST Algorithm), and multiple sequence alignment (Clustal W algorithm).
Unit III	**Structural Bioinformatics:** Protein Structure: Primary, Secondary, Super Secondary, Domains, Tertiary, Quaternary, Ramachandran plot. Protein Secondary Structure Classification Databases: CATH, SCOP, Protein Secondary Structure prediction methods: GOR, Chou-Fosman., Visualization Tool (Rasmol, Spdbv)., *Protein Tertiary structure prediction methods*:Homology Modeling, Fold Recognition, Abintio Method, Protein folding.
Unit -IV	**Motif and Domain database and Phylogenetic analysis:** Motif database and analysis tools, Domain database and analysis tools. **Phylogeny:** Introduction to Phylogenetic analysis, Concept of Phylogenetic tree.
Unit V:	**System Biology:** Introduction, associated disciplines, interactomics, Metabolic pathway database (KEGG), Drug Discovery and design:Target identification, target validation, lead identification, lead optimization, preclinical pharmacology and toxicology.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

Suggested Reading

1) A text book of Bioinformatics by sharma&Munjal& Shankar.
2) Bioinformatics by CSV Murthy
3) Basic Bioinformatics by S. lgnacimuthu, S.J.
4) Bioinformatics: Concepts. Skills and Application by S.C. Rastogi.N. Mendiratta&ParagRastogi.
5) Practical Guide for basic Bioinformatics & Biostatistics by P. tiwari& P. Panday
6) Biostatistics By B. Prasad.
7) Statistical Methods By S.P Gupta.
8) Fundamentals of Statistics by S.C. Gupta.

www.freebookcentre.net>....freeBioinformaticbooks download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**PRBT-31**		
Course Title	**Practical - I (Based on theory paper -IX&X)** **ENZYME AND PLANT BIOTECHNOLOGY**		
Course Type	**Elective**		
Pre-requisite (If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Learning Outcomes: at the end of the paper students will be able to: C01. Technique of Enzyme and plant biotechnology C02.To learn isolation of Enzyme C03.Pursue Career in Enzyme and plant biotechnology		
Credit Value	**3**		
Total Marks	**Max Marks 75**		**Min Passing Marks 26**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B: Content of the Practical Course

List of experiments / Exercise

1. To study the effect of pH, temp., Substrate concentration, enzyme concentration, Inhibitor concentration on enzyme activity.
2. SDS and Native PAGE of enzyme.
3. To determine enzyme activity of SGOT/SGPT/ALP/ACP.
4. Enzyme immobilization.
5. Estimation of peroxides/catalane activity.
6. Estimation of urease activity.
7. Preparation of media.
8. Surface sterilization.
9. Organ Culture.
10. Callus propagation, organogenesis, transfer of plants to Soil.
11. Protoplast isolation and culture.
12. Another culture, production of Haploids. Cytological examination of regenerated plants.
13. Agro bacterium culture, selection of transform ants, reporter gene (GUS) assays.
14. Preparation of tissue culture medium and membrane filtration.
15. **Establishment of primary culture from leaves.**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**PRBT-32**		
Course Title	**Practical –II (BASED ONELECTIVE PAPERS) ENVIRONMENTAL BIOTECHNOLOGY, STEM CELL BIOLOGY, FOOD BIOTECHNOLOGY AND PHARMACOGENOMICS**		
Course Type	**Elective**		
Pre-requisite (If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Learning Outcomes: at the end of the paper students will be able to: C01. Technique of Food environment biotechnology C02.To learn isolation of micro-organism C03.Pursue Career in Food and Environment biotechnology		
Credit Value	3		
Total Marks	**Max Marks 75**		**Min Passing Marks 26**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B: Content of the Practical Course

List of experiments / Exercise

1. Water analysis (BOD, COD,DO,Cl^-, TDS, TSS).
2. MPN.
3. Isolation of Rhizobium from Root nodules.
4. Isolation of Azotobacter from soil.
5. Spirulina cultivation.
6. Isolation of microbes from air/water/soil.
7. Methylene blue reduction test for milk.
8. Isolation & estimation of starch from potato.
9. To determine spoilage of food.
10. SPC of Milk.
11. To determine the total vitamin C content of citrus fruit.
12. Preparation of activated human T cell.
13. Generating induced pluripotent stem cell from activated t cell.
14. Expansion of ipscs.
15. Isolation of active constituent from plant materials
16. Qualitative estimation of active constituent
17. Qualitative Analysis of synthetic cosmetics
18. Food adulteration test
19. **Isolation of yeast.**
20. **Isolation of Lactobacillus from milk.**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Programme: MSc. (Biotechnology) **Class: M.Sc. IV Sem**

S. No	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
1	Core 11	Paper XIV Bioprocess Technology	BT-41	4	25	9	75	26	100	35
2	Core 12	Paper -XV Animal Biotechnology	BT-42	4	25	9	75	26	100	35
3	Elective 3/1	Paper XVI A) Cancer Genetics	BT-43	4	25	9	75	26	100	35
	Elective 3/2	B) Bio nanotechnology								
4	Elective 4/1	Paper XVII A) Genomics, Proteomics, IPR &Biosafety	BT-44	4	25	9	75	26	100	35
	Elective 4/2	B) Engineering Principles/Project								
5	Practical -7	Practical based on Theory Paper -XIV & XV	PRBT-41	3	-	-	75	-	75	26
6	Practical-8	Practical based on elective Theory Paper XVI &XVII	PRBT-42	3	-	-	75	-	75	26
7	Internship			4	-	-	-	-	-	-
				26	125		525		650	

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: IV**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-41**		
Course Title	**Paper – XIV- (BIOPROCESS TECHNOLOGY)**		
Course Type	**Core Course**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of CO1: The basics knowledge of Bioprocess Technology and industrially important microbes. CO2: Bio-separation and Treatment of effluent and its disposal. CO3: Types of fermentation processes and Bioreactors. CO4: Microbial Technology. CO5: Industrial production.		
Credit Value	**4**		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Basic principle of Bioprocess Technology:** Isolation, screening and maintenance of industrially important microbes; Microbial growth and death kinetics (an example from each group, particularly with reference to industrially useful microorganisms); Strain improvement for increased yield and other desirable characteristics
Unit II	**Upstream and Downstream processing:** Media formulation; Sterilization; Aeration and agitation in bioprocess; Scale up and scale down process. Bio-separation - filtration, centrifugation, sedimentation, flocculation; Cell disruption; Liquid liquid extraction; Purification by chromatographic techniques; Reverse osmosis and ultra filtration; Drying; Crystallization; Storage and packaging; Treatment of effluent and its disposal.
Unit III	**Concepts of basic mode of fermentation processes**: Bioreactor designs; Types of fermentation and fermenters; Concepts of basic modes of fermentation - Batch, fed batch and continuous; Solid substrate, surface and submerged fermentation; Measurement and control of bioprocess parameters.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit -IV	**Microbial Technology – I:** Microbial processes-production of primary (ethanol, organic acid – lactic acid; amino acids – glutamic acid and lysine; vitaminB12) and secondary metabolites (antibiotics – penicillin and streptomycin).
Unit -V	**Microbial Technology – II:** Industrial production, recovery, stability and formulation of bacterial and fungal enzymes-amylase, protease, Enzyme and whole cell Immobilization ofand their industrial applications. Use of microbes in mineral benification and oil recovery, Single Cell Proteins, Bioinsecticides, Biofertilizers.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

\

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. Jackson AT., Bioprocess Engineering in Biotechnology, Prentice Hall, Engelwood Cliffs, 1991.
2. Shuler ML and Kargi F., Bioprocess Engineering: Basic concepts, 2nd Edition, Prentice Hall, Engelwood Cliffs, 2002.
3. Stanbury RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1997.
4. Baily JE and Ollis DF., Biochemical Engineering fundamentals, 2nd Edition, McGraw-Hill Book Co., New York, 1986.
5. Aiba S, Humphrey AE and Millis NF, Biochemical Engineering, 2nd Edition, University of Tokyo press, Tokyo, 1973.
6. Comprehensive Biotechnology: The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine, Vol 1, 2, 3 and 4. Young M.M., Reed Elsevier India Private Ltd, India, 2004.
7. Mansi EMTEL, Bryle CFA. Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd, UK, 2007.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: IV**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-42**		
Course Title	**Paper - XV – (ANIMAL BIOTECHNOLOGY)**		
Course Type	**Core Course**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of CO1: Basic components of prokaryotic and eukaryotic cells, and observe and correctly identify cellular structures using different microscopic techniques. CO2: Cellular components of Prokaryotic and eukaryotic cell and experimental work as well as in job oriental techniques in cell function. CO3: The key roles of mitosis and meiosis during the life cycle. Compare and contrast different life cycle strategies, focusing on the human life cycle. CO4: Distinguish between passive and active transport; they can explain how the substances are directly or indirectly transported across a membrane. CO5: Concept of Cancer cell and causative agent in cell biology. As well as to know Apoptosis and their mechanism, and how it help in cancer treatment.		
Credit Value	4		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Structure and organization of animal cell**, Equipment and materials for animal cell culture technology. Introduction to the balanced salt solutions and simple growth medium, Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium. Role of carbon dioxide. Role of serum and supplements. Serum and protein free defined media and their application.
Unit II	**Measurement of viability and cytotoxicity**, Biology and characterization of the cultured cells, measuring parameters of growth. Basic techniques of mammalian cell culture *in vitro;* disaggregation of tissue and primary culture, maintenance of cell culture; cell separation. Primary and established cell line cultures.
Unit III	**Scaling-up of animal cell culture**, Cell synchronization. Cell fusion, Cell cloning and micromanipulation, Cell transformation. Somatic cell genetics. Bioreactors for large scale production, Design & types of bioreactors

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit -IV	**Organ and histotypic cultures**, Three-dimensional culture and tissue engineering, Measurement of cell death, Apoptosis.
Unit -V	**Transfection of mammalian cells,** Application of animal cell culture: Production of biopharmaceuticals, Cell culture-based vaccines, Stem cell cultures, embryonic stem cells andtheir applications, Transgenic animals

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

\

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. Culture of Animal cells, (3rd Edition), Freshney, Wiley-Liss.
2. Animal Cell Culture – Practical Approach, Ed. John R.W. Masters, OXFORD.
3. Cell Growth and Division: A Practical Approach. Ed. R. Basega, IRL Press.
4. Cell Culture Lab Fax. Eds. M Butler and M. Dawson, Bios Scientific Publications Ltd. Oxford.
5. Animal Cell Culture Techniques. Ed. Marin Clynes, Springer.
6. Methods in Cell Biology, Vol. 57, Animal Cell Culture Methods. Ed. Jenni P Mather and David Barnes.Academic Press.

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: IV**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-43**		
Course Title	**ELECTIVE – III Paper- XVI 3/1(CANCERGENETICS)**		
Course Type	**Elective 3/1**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of C01: The basics knowledge of tumors and biochemical and structural changes in cancer cell. C02: Concept of oncogenes and their amplification. C03: Types of cancer and different types of syndromes. C04: Tumor progression and their proliferation. C05: Gene therapy and there counseling		
Credit Value	4		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction:** Types and general characteristics of tumors; Chromosomal aberrations in neoplasia; Cell cycle check points and cancer. Mutagenesis and mutation (types, mechanism and detection) biochemical and structural changes in cancer cell.
Unit II	**Cell Transformation and tumorigenesis:** Oncogenes and their amplification; Tumour Suppressor genes; DNA repair genes and genetic instability; Epigenetic modifications, telomerase activity, centrosome malfunction; Genetic heterogeneity and clonal evolution
Unit III	**Types of Cancer:** Retinoblastoma, Wilm'sTumour, Li-Fraumeni syndrome, colorectal cancer, breast cancer, Genetic predisposition to sporadic cancer
Unit -IV	**Tumour progression**: Angiogenesis and metastasis; Tumour specific markers,
Unit -V	**Cancer and environment**: physical, chemical and biological carcinogenesis; Cancer risk assessment, gene therapy and counseling.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. Alberts et al., The Science of Genetics, saunders, 1999
2. Alberts et al., Molecular biology of the cell, Garland 2008.
3. Benjamin, Genetics: A Conceptual Approach, 3rd Edition, Freeman, 2007.
4. Berg and Singer, Genes and Genome, 1998.
5. Black, Microbiology: Principles and Explorations, 6th Edition Wiley, 2004
6. Cowell, Molecular Genetics of Cancer, 2nd Revised Edition, Bios, 2001

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: IV**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-44**		
Course Title	**ELECTIVE - III Paper - XVI 3/2(Bio-Nanotechnology)**		
Course Type	**Elective 3/2**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of C01: The basics knowledge of Nano-Biotechnology C02: Concept of Spectroscopic techniques. C03: Methods in nanotechnology. C04:Nanoparticles and their synthesis. C05: DNA nanotechnology		
Credit Value	**4**		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction and history of Nanotechnology**, Applications of Nanotechnology in Biology, Criteria for suitability of nanostructures for biological applications. Health, environmental and social impact of Nanotechnology, plants and microbes as nanofactotries.
Unit II	**Methods in Nanotechnology I** – Spectroscopic techniques – UV – Visible Spectroscopy, Raman Spectroscopy, X - ray diffraction, Fourier Transform Infra-Red spectroscopy (FTIR), Terahertz spectrometry, Surface Enhanced Raman Spectroscopy (SERS).
Unit III	**Methods in Nanotechnology II** – Microscopic techniques – Confocal microscopy, Electron microscopy, Scanning probe microscopy: Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy (AFM), optical microscopic methods in nanoscience. Fluorescent in situ hybridization (FISH), Fluorescent Biological Labels, Colorimetric assay
Unit -IV	**Nanoparticles and their synthesis**, Nanomaterials: Fullerens, Carbon Nanotubes (CNT), gold monolayer, quantum dots, core shell nanopracticles. Silver nanoparticles, Magnetic nanoparticles, Nanoshells. Diamondoid, Biodegradable polymers and their uses, Colloids in Nanotechnology.
Unit -V	**Nanobiology, Nanosensers**, Nanomedicine. Drug delivery system, Nanomachine, Nanobiosensors, Nano DNA Technology, Optical biosensors, Concept of Nanorobots and Nubots.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. Nano: The Essentials Pradeep
2. Nanobiotechnology Balaji
3. The University Textbook of Nanotechnology Heller, Mehmud, Tumbull
4. Multilayer Thin Films Decher, Schlenoff
5. Bio nanotechnology: Lessons from nature good sell
6. Biomedical nanotechnology Malsch
7. Nanotechnology – A fundamental approach Kumar

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program :	**Class: M.Sc.**	**Semester: IV**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-44**		
Course Title	**ELECTIVE - IV Paper XVII 4/1 (ENGINEERING PRINCIPLES)**		
Course Type	**Elective 4/1**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of C01: The basics knowledge of ENGINEERING PRINCIPLES C02: Concept of fluid flow and mixing. C03: Thermodynamic system. C04: Heat transfer. C05: Mass transfer		
Credit Value	**4**		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction to Engineering** calculations, SI units, Dimensional analysis, presentation and analysis of data, Bernoulli's equations, Friction factor, pressure drop, power requirement for pumping and mixing. Boiling and evaporation:Mechanisms of boiling; film and nucleate boiling, single and multiple effect evaporators, economy and evaporators performance with various feeding patterns viz. forward, backward and parallel.
Unit II	**Fluid flow and mixing:** Classification of fluids, fluids in motion, stream lines, Reynolds number, hydrodynamic boundary layers, momentum transfer, viscosity, non-Newtonian fluids, Rheological properties of fermentation broths, mixing equipment's, flow patterns in agitated tanks, Radial and axial flow impellers, Mechanism of mixing, scale up of mixing systems, power requirement for mixing, ungassed Newtonian fluids, gassed fluids, improving mixing in fermenters, effect of rheological properties on mixing, role of shear in stirred fermenters, interactions between cells and turbulent eddies, operating conditions for turbulent shear damage, bubble shear
Unit III	**Material balances:**Thermodynamic preliminaries, system and process, steady state and equilibrium, law of conservation of mass, types of material balance problem, material balances with recycle and bypass streams, stoichiometry of growth and product formation, growth stoichiometry and elemental balances, electron balances, biomass yield, unsteady state material balance equations. Energy Balances: Basic energy concepts Intensive and extensive properties, enthalpy, general energy balance equations, enthalpy change in non-reactive processes, enthalpy change due to reaction, heat of combustion, heat of reaction at non-standard conditions, thermodynamics of microbial growth, energy balance equation for cell culture, unsteady state energy balance equations.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit IV	**Heat transfer:** Heat transfer equipment's Bioreactors, general equipment for heat transfer, double pipe heat exchanger, shell and tube heat exchanger; mechanisms of heat transfer-conduction, heat transfer between fluids; design equations for heat transfer systems, logarithmic and arithmetic mean temperature differences, calculation of heat transfer coefficients, relationship between heat transfer, cell concentration and stirring.
Unit V	**Mass transfer: Molecular** diffusion, diffusion theory, role of diffusion in bioprocessing, film theory, liquid solid mass transfer, liquid-liquid mass transfer, gas-liquid mass transfer, mass transfer co-relations. Unit operations: Filtration-filter aids, filtration equipment's, centrifugation, cell disruption, the ideal stage concept, adsorption.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources
Text Books, Reference Books, Other Resources
Texts/References: 1.Mechanical Engineering Principles Paperback (Author), Carl Ross 2.Basic Mechanical Engineering Paperback Pravin Kumar (Author) www.freebookcentre.net>....free**Engineering Principles**books download eBook Online

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program :	**Class: M.Sc.**	**Semester: IV**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**BT-44**		
Course Title	**ELECTIVE- IV Paper-XVII 4/2(GENOMICS, PROTEOMICS, IPR & BIOSAFTEY)**		
Course Type	**Elective 4/2**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of C01: DNA sequencing which is a broad area of current proteomics and genomics study. C02: Different tools for genome analysis. Like RFLP, RAPD, PCR. C03: The different proteomic analysis methods, C04: This part of the course is completely job-oriented field such as patent, trademark and copyright designing for the industries		
Credit Value	**4**		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction:**DNA sequencing principles and Sequencing methods; Enzymatic DNA sequencing; Chemical sequencing of DNA; Automated DNA sequencing; RNA sequencing; Chemical Synthesis of oligonucleotides; Recognition of coding and non-coding sequences gene annotation, EST's and SNP's
Unit II	**Tools for genome analysis:** -RFLP, DNA fingerprinting, RAPD, Linkage and Pedigree analysis-physical and genetic mapping, Primer design; PCR: its types and applications, Site Specific Mutagenesis, Gel Mobility Shift assay. **Gene silencing techniques**; Introduction to siRNA; siRNA technology; Micro RNA; Construction of siRNA vectors; Principle and application of gene silencing; Gene knockouts and Gene Therapy; Creation of knockout mice; Disease model; Somatic and germ-line therapy- in vivo and ex-vivo; Suicide gene therapy; Gene replacement; Gene targeting; Transgenics; Comparative genomics – characteristics of genome of human
Unit III	**Proteomics:** Protein analysis (includes measurement of concentration, amino acid composition, N-terminal sequencing); 2-D electrophoresis of proteins; Microscale solution isoelectricfocusing; Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; **Functional genomics and proteomics:** Analysis of microarray data; Protein and peptide microarray-based technology; C-DNA array, SAGE, Intragenic array.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Unit IV	**Introduction to Intellectual Property:** Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Protection of GMOs, IP as a factor in R&D; IPs of relevance to Biotechnology and few Case Studies. Types of patent application: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Patent databases.
Unit V	**Biosafety:** Introduction; Historical Background; Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels: Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines- Government of India; Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. Voet D, Voet JG & Pratt CW, Fundamentals of Biochemistry, 2nd Edition. Wiley 2006
2. Brown TA, Genomes, 3rd Edition. Garland Science 2006
3. Campbell AM &Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings 2007
4. Primrose S &Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006.
5. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998.
6. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007
7. Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd., 2007

References

1. http://www.w3.org/IPR/
2. http://www.wipo.int/portal/index.html.en
3. http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
4. www.patentoffice.nic.in
5. www.iprlawindia.org/ - 31k - Cached - Similar page
6. http://www.cbd.int/biosafety/background.shtml
7. http://www.cdc.gov/OD/ohs/symp5/jyrtext.htm
8. http://web.princeton.edu/sites/ehs/biosafety/biosafetypage/section3.html

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: IV**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**PRBT-41**		
Course Title	**M.Sc. - Semester - IV (BIOTECHNOLOGY) Practical - I (Based on theory paper -XIV&XV) Bioprocess Technology and Animal Biotechnology**		
Course Type	**Core Course**		
Pre-requisite (If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Learning Outcomes: at the end of the paper students will be able to: 1. Basic Technique of Bioprocess Technology and Animal Biotechnology 2.To learn Isolation of microorganism 3.Pursue Career in Bioprocess Technology and Animal Biotechnology		
Credit Value	**3**		
Total Marks	**Max Marks 75**		**Min Passing Marks 26**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B: Content of the Practical Course

List of experiments / Exercise

1. Isolation and screening of industrially important microorganisms.
2. Determination of thermal death point and thermal death time of microorganisms.
3. Production of microbial products in bioreactors.
4. Assay of antibiotics production.
5. Studying the kinetics of enzymatic reaction by microorganisms.
6. Production and purification of various enzymes from microbes.
7. Comparative studies of Ethanol production using different substrates.
8. Microbial production and downstream processing of an enzyme, e.g. amylase.
9. Various immobilization techniques of cells/enzymes, use of alginate for cell immobilization.
10. Production of protease from soil microbes.
11. Preparation of single cell suspension from spleen and thymus.
12. Cell counting and cell viability.
13. Macrophage monolayer from PEC, and measurement of phagocytic activity.
14. Trypsinization of monolayer and sub-culturing.
15. Cryopreservation and thawing.
16. Measurement of doubling time.
17. Role of serum in cell culture.
18. Preparation of metaphase chromosomes from cultured cells.
19. Isolation of DNA and demonstration of apoptosis and DNA laddering.
20. MTT assay for cell viability and growth.
21. Cell fusion with PEG.
22. **Cultivation of Edible mushroom.**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program:	**Class: M.Sc.**	**Semester: IV**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**PRBT-42**		
Course Title	**M.Sc. - Semester - IV (BIOTECHNOLOGY) Practical - II (Based on theory paper -XVI- XVII) Cancer Genetics, Bio-Nano technology, Engineering principles, Genomics, Proteomics, IPR &Biosafety**		
Course Type	**Elective**		
Pre-requisite (If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Learning Outcomes: at the end of the paper students will be able to: 1. Understand Basic Technique of Cancer Genetics, Bio-Nano technology, Engineering principles, Genomics, Proteomics, IPR &Biosafety 2.To learn isolation of DNA and Protein 3.Pursue Career in Cancer Genetics, Bio-Nano technology, Engineering principles, Genomics, Proteomics, IPR &Biosafety		
Credit Value	**3**		
Total Marks	**Max Marks 75**		**Min Passing Marks 26**

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part B : Content of the Practical Course

List of experiments / Exercise

1. Comparative study of Cancerous and Normal cell through slides
2. To study the effect of different carcinogenic agents
3. Demonstration of chromosomal aberration in cancerous cells
4. To study the different stages of cancerous cells through slides
5. Different types of cancers through slides
6. Detection of Polycythemia
7. Detection of Leukemia
8. Estimation of Bio-Marker of Cancer Cell
9. Serial analysis of Gene Expression
10. Formation of different Nano-particles
11. Effect of Nano-particles on Microbial Growth
12. Comparison of Silver Nanoparticles as disinfectant
13. Nanoparticles in water treatment
14. To test the pH, Conductivity, TDS, Turbidity, DO in different nanofluid.
15. PCR amplification gene and analysis by agarose gel electrophoresis.
16. Polymerase Chain reaction, using standard 16srRNA eubacterial primers.
17. RFLP analysis of the PCR product.
18. Plasmid isolation and confirming recombinant by PCR and RE digestion.
19. Southern hybridization of *B. subtilis* genome with probe and non-radioactive detection.
20. Studying physical properties of protein using Swiss PROT.
21. Industrial Visit / Institutional Visit (Report Submission- 10 Marks)

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part A: Introduction			
Program :	**Class: M.Sc.**	**Semester: III**	**Session 2021-22**
Subject: Biotechnology			
Course Code	**OE-BB**		
Course Title	**Open Elective** **Basic Of Bioinformatics**		
Course Type	**OPEN ELECTIVE**		
Pre-requisite(If any)	**M.Sc. Previous. (Biotechnology)**		
Course Learning Outcomes	Course Outcomes: After the completion of course, students will have understanding of CO1: The basics knowledge of Bioinformatics. CO2: Basics concept NCBI. CO3: About types of Protein Structure. CO4: Data base Analysis Tool. CO5: Drug Discovery and design.		
Credit Value	**4**		

Total Marks

CCE (Max)	CCE (Min)	External Assessments Max	External Assessments Min	Total Max	Total Min
25	9	75	26	100	35

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

GOVT. HOLKAR (MODEL, AUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF BIOTECHNOLOGY
Syllabus Session: 2021-22

Part B: Content of the Course	
Total number of Lecture Hours/ Week :4	
Unit	**Topic**
Unit I	**Introduction to Bioinformatics and Biological database:** What is Bioinformatics and its relation with molecular biology Applications of Bioinformatics. Nucleic acid Databases (NCBI), Protein databases (Primary, Secondary and Composite). Specialized Genome databases: (SGD). Structure Databases (CATH, SCOP) File Format (, PDB, Swiss-Prot)
Unit II	**Sequence Alignments:** Introduction to Sequences, Alignments and Dynamic Programming; Local Alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST Algorithm), and multiple sequence alignment (Clustal W algorithm).
Unit III	**Structural Bioinformatics:** Protein Structure: Primary, Secondary, Super Secondary, Domains, Tertiary, Quaternary, Ramachandran plot. Protein Secondary Structure Classification Databases: CATH, SCOP, Protein Secondary Structure prediction methods: GOR, Chou-Fosman., Visualization Tool (Rasmol, Spdbv)., *Protein Tertiary structure prediction methods*:Homology Modeling, Fold Recognition, Abintio Method, Protein folding.
Unit -IV	**Motif and Domain database and Phylogenetic analysis:** Motif database and analysis tools, Domain database and analysis tools. **Phylogeny:** Introduction to Phylogenetic analysis, Concept of Phylogenetic tree.
Unit V:	**System Biology:** Introduction, associated disciplines, interactomics, Metabolic pathway database (KEGG), Drug Discovery and design:Target identification, target validation, lead identification, lead optimization, preclinical pharmacology and toxicology.

Experts Members (Name & Signature)			
S.No.	**Name**	**Designation**	**Signature**
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Part C: Learning Resources

Text Books, Reference Books, Other Resources

Texts/References:

1. A text book of Bioinformatics by sharma&Munjal& Shankar.
2. Bioinformatics by CSV Murthy
3. Basic Bioinformatics by S. lgnacimuthu, S.J.
4. Bioinformatics: Concepts. Skills and Application by S.C. Rastogi.N. Mendiratta&ParagRastogi.
5. Practical Guide for basic Bioinformatics & Biostatistics by P. tiwari& P. Panday
6. Biostatistics By B. Prasad.
7. Statistical Methods By S.P Gupta.
8. Fundamentals of Statistics by S.C. Gupta.

www.freebookcentre.net>....freeBioinformaticbooks download eBook Online

Experts Members (Name & Signature)

S.No.	Name	Designation	Signature
1	Dr. Kiran Billore	Chairman	
2	Dr. A. Nighojkar	VC Member	
3	Dr. Bhavesh Patel	Subject Expert	
4	Dr. R K Garg	Subject Expert	
5	Mr. Nitesh Jasani	Representative from Industry	
6	Dr. Rekha Sharma	Member	
7	Mrs. Farida Johar	Alumni	

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Botany

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

B.Sc.: -

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. First Sem.

Subject : Botany

Paper – I Major

Title of Paper: Applied Botany **Code of the paper: S1-BOT1T**

Part A : Introduction for code-		
1	Pre-requisite (if any)	The students must have passed 12th with Biology/Life Sciences/ Agriculture.
2	Course Objectives	To known the basics of Botany.
	Course Learning Outcomes	By the end of this course the student must should have
		1 Undrestood the significance and role of botany.
		2 Learnt the basic aspects of applied botany.
		3 Gained knowledge about employment opportunities in field of botany
		4 Gained knowledge about start up opportunities in field of botany
		5 Learnt about opportunities of social services.
		6 Gain knowledge about best health practices

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22
Class B.Sc. I Sem. Botany
Paper - I
Major- Applied Botany

UNIT	TOPICS	NO. OF LECTURES
I	1.1 Introduction objectives and importance of Applied botany 1.2 History and evolution of botany 1.3 Relation of plants to man and relation with other services 1.4 Various disciplines of botany and their applications to human welfare	12
II	1.1 Definition and types of pollution and pollutants 1.2 Phytoremediation: Air water Soil noise and thermal pollutants (Any 5 plants with botanical name, family) and their role in pollution control. 1.3 Bioremediation definition and types	12
III	1.1 Ancient agricultural practices 1.2 Modern agriculture practices Poly house. Drip irrigation hydroponics computer based agriculture. Terrace farming. 1.3 Organic farming: Introduction objective and brief technique. 1.4 Horticulture: Definition and role in human welfare 1.5 Forestry : Definition branches and role in human welfare 1.6 Silviculture: Definition and management practices	12
IV	1.1 Role of Botany in Rural development. 1.2 Ethnobotany: Introduction and importance. 1.3 Ethnomedicine: Definition and examples. (Local name, Botanical name family and importance of Neem, Aloe, Clove, Ginger, Tulsi, Turmeric, Giloy, Emblica, Ashwagandha, Arandi) 1.4 Ethno- fibres: Definition and examples (Local name, Botanical name, family and importance of Ankara, Coconut, elephant grass, cotton) 1.5 Ethno –food crops: Definition and examples (Local name, Botanical name, family and importance of Garadu, Singada, Kutaki, Sama, Kodo, Bathua, Sehjan, Jowar, Makka, Bajra, Jau)	12
V	1.1 Plant tissue culture: Definition, Types and Importance 1.2 DNA Recombinant Technique: Introduction, tools and importance 1.3 Role of recombination in present era 1.4 Bioinformatics: Definition, concept and tools 1.5 Introduction of bioinformatics software: Basic idea of BLAST and FASTA Importance of bioinformatics	12

Part C :Learning Resources

1- Levetin E. and Mcmahon K. "Plants and Society" McGraw Hill Education. 2007
2- MaitirR., Rodriguez K. G. and Thakur A. S. "Applied Botany" American Academic Press 2017
3- Negi S.S. "Forest Botany" M/s Bishen Singh Mahendra Pal Singh 2012.
4- Agrahari R. P. " Environmental Ecology, Biodiversity, Climate Change and Disaster Management" Mc Graw Hill Education 2020.
5- Sharma D.K. " Biodiversity Conservation: Current Status and future strategies" Write and print publication. 2017
6- Singh J. "Biodiversity Environment and Sustainability" MD Publication Pvt Ltd/ 2008
7- Gupta P.K. "Molecular Biology and genetic Engineering Rastogi Publications. 2005
8- Sharma V., Munjal A. and Sharkar A. Bioinformatics" Rostogi Publications. 2008

Applied Botany Practical (Paper-1)

Part A: Introduction				
Program: Certificate	**Class B.Sc. 1st Sem.**		Year 2021	Session 2021-22
Subject : Botany				
1	Course Code	**S1-BOT1P**		
2	Course Title	Applied Botany Practical (Paper-1)		
3	Course Type (Core Course/ Elective/Generic Elective/Vocational/….)	Core Course		
4	Pre-requisite (If any)	To study this course a student must have had the subject Botany, Botany, Life Science in class/12th/.		
5	Course Learning Outcome	On completion of this course, learners will be able to: By the ened of this course the students should have knowledge of practical skill related with ethnobotany, tissue culture, application of bioinformatics software and tools of recombinant DNA technology.		
6	**Credit Value**	2		
7	**Total Marks: 100**	Max. Marks: 25+75		Min Passing Marks: 33

Part B Content of the Course

Total No. of Lectures- Tutorials- Practical (In hours per week)
L-T-P:

Unit	Topics	No of Lectures
1	1- Identification of ethnomedicinal plants 2- Preparation of soil health card of any agricultural field. 3- Study of vermicompost and composting of kitchen waste 4- Use of BLAST and FASTA 5- Prepare the list of important air, water and soil pollutants of local areas 6- **Plant Tissue culture technique:** sterilization, inoculation, culture media, acclimatization and hardening, 7- Preparation of list of ethnomedicinal food fibre plant locally available 8- **Tools of recombinant DNA technology:** Restriction, enzymes, plasmid vectors, other enzymes 9- Study of global warming, acid rain and water quality (pH and Conductivity), 10- Study of local plants grown around agricultural field 11- * Practical can be decided on theory basis according to availability. 12- * Case and field study can be designed accordingly.	30

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Levetin E. and Mcmahon K. "Plants and Society" McGraw Hill Education. 2007
2. Maitir., Rodriguez H. G. and Thakur A. S. "Applied Botany" American Academic Press 2017
3. Negi S.S. "Forest Botany" M/s Bishen Singh Mafendra Pal Singh 2012.
4. Agrahari R. P. " Environmental Ecology, Biodiversity, Climate Change and DisasterManagement" Mc Graw Hill Education 2020.
5. Sharma D.K. " Biodiversity Conservation: Current Status and future strategies" Write and print publication. 2017
6. Singh J. "Biodiversity Environment and Sustainability" MD Publication Pvt Ltd/ 2008
7. Gupta P.K. "Molecular Biology and genetic Engineering Rostogi Publications. 2005
8. Sharma V., Munjal A. and Sharkar A. Bioinformatics" Rostogi Publications. 2008

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **End Semester Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: End Semester Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. First Sem.

Subject : Botany

Paper – II Minor

Title of Paper: Basic Botany **Code of the paper: S1-BOT2T**

Part A : Introduction for code--		
1	Pre-requisite (if any)	To Study this course, a student must have had the subject Botany in class/ 12th./ Certificate/diploma.
2	Course Objectives	To known the basics of Botany.
	Course Learning Outcomes	1- This course will help the student to understand the diversity of plants and evolutionary process in plant kingdoms.
		2- It gives an accounts of plant adaptations from aquatic condition to colonize terrestrial habitat
		3- The changes in morphological, anatomical and reproductive structures that propel plant evolution can be investivgated.
		4- The economic importance and significance of plants in nature will be understood.
		5- They will be acquainted with locally prevalent microbial diseases of plants and humans.

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22
Class B.Sc. I Sem.
Paper - II
Minor - Basic Botany

UNIT	TOPICS	NO. OF LECTURES
I	**1.1 History of Botany and Indian Contributions.** 1.2 Morphological characteristics of lower and higher plants (Angiosperms). 1.3 Types of leaves, Inflorescence, Flowers and fruits. 1.4 Structure of plants cell and cell organelles, Prokaryotic and Eukaryotic Cells, Types of cell division. 1.5 Microscope structure and function of Light Microscope (magnification and resolving power). 1.6 Various types of microscopes: Bright field, Phase Contrast, SEM and TEM.	12
II	**1- Algae** 1.1 General characteristics 1.2 Range of thallus organization, reproduction. 1.3 Types of life-cycles in algae 1.4 Role of algae in nature and its economic importance. **2- Bryophytes** 2.1 General characteristics, Ecology. 2.2 Range of thallus organization, morphology, anatomy (internal and external features) and reproduction of any one Bryophyte. 2.3 Economic importance of Bryophytes	12
III	**1- Pteridophytes** 1.1 General characteristics and morphology. 1.2 Stelar organization and reproduction. 1.3 Heterospory and seed habit. 1.4 Economical importance **2- Gymnosperms** 2.1 General Description and their distribution. 2.2 Economical importance of Gymnosperms. **3- Paleobotany** 3.1 Indian contribution in paleobotany. 3.2 Brief knowledge of Fossils and Geological time scale.	12
IV	**1- Fungi** 1.1 General characteristics and cell wall composition. 1.2 Mode of nutrition 1.3 Types of reproduction 1.4 Economic importance 1.5 Parasexuality and Mycorrhiza 2- **Lichens:** Brief Knowledge and their significance.	12
V	**1- Microbes** 1.1 Brief outline of various types of microbes 1.2 Archaebacteria, Eubacteria Cyanobacteria, Mycoplasma, Actinomycetes and Virus. 1.3 Beneficial and harmful roles.	12

Part C :Learning Resources

1- Oladele Ogunseitan, Microbial Diversity: Form and Function in Prokayotes, Wiley Blackwell, 2008.

2- Pelczar, M.J. et al., Microbiology, Tata McGraw-Hill Co, New Delhi, 5th edition, 2001.

3- Presscott, L. Harley, J. and Klein, D., Microbiology, Tata McGraw-Hill Co. New Delhi, 6th edn., 2005.

4- Fritsch F.E., The structure & Reproduction of Algae, Vol. I & Vol. II, Cambridge End Semester Press Cambridge, UK 1945.

5- Smith, G.M., Cryprogamic Botany, Vol. 1 : Algae, Fungi, & Lichens, Mc Graw-Hill Book Co., New York, 1955.

6- IanMorris, An Introduction to the Algae, Hutchinson, London, 1967.

7- Alexopoulos, C.J., Mims, C.W. and Blackwell, M., Introductory Mycology, John Wiley and Sons, 1996

8- Webster, J., Introduction to fungi, Cambridge End Semester Press 2nd edn., 1999.

9- Cavers F., The inter relationships of the Bryophtya, The New Phytologist, Indian reprint, Vol. 10, issue 1-2, p. 1-21, 1911.

10- Parihar, N.S., An Introduction to Embryophyta: Bryophyte, Vol.I, Central Book Depot, Allahabad, 1965.

11- Waston, E.V., British Mosses and Liverworts, Cambridge End Semester Press, U.K. 1968.

12- Eames, A.J., Morphology of Vascular Plants: Lower Groups McGraw Hill N.Y., 1936.

13- Parihar, N.S., An Introducction to Embryophyta: Pteridophte, Vol.II, Central Book Depot, Allahabad, 1965.

14- Sporne, K.R., The Morphology of Pteridophytes: The Structure of Ferns and Allied Plants, Hutchinson End Semester Library, London, 1970.

15- Bierhorst, D.W., Morphology of Vascular Plants, The MacMillan Co., N.Y. and Collier-MacMillan Ltd., London. 1971.

16- Coulter, J.M. and C.J. Charmberlain, Morphology of Gymnosperms, Central Book Depot, Allahabad, 1964.

17- Sporne, K.R., The Morphology of Gymnosperms: The Structure and Evolution of Promitive seed Plants, Hutchinson End Semester Library, London, 1971.

18- Dutta, S.C., An introduction to Gymnosperms, Kalyani Publisher, New Dilhi, 1984.

19- Sharma, O.P and Shivani Dixit, Gymnosperms, Pragati Prakashan, Meerut, 2015.

20- Vasishtha, P.C., Botany for Degree students: Gymnosperms, revised edn., S. chand and comp. Ltd., N. Delhi, 2018.

21- Bhatnagar, S.P. and Alok Moitra, Gymnosperms, New age International (P.) Ltd., New Delhi. 2000.

Basic Botany Practical (Paper-1)

Part A: Introduction				
Program: Certificate		**Class B.Sc. 1st Sem.**	Year 2021	Session 2021-22
Subject : Botany				
1	Course Code	S1-BOT2P		
2	Course Title	Basic Botany Practical (Paper-2)		
3	Course Type (Core Course/ Elective/Generic Elective/Vocational/….)	Core Course		
4	Pre-requisite (If any)	To study this course, a student must have had the subject of Biology/ Life science/Agriculture in class 12th.		
5	Course Learning Outcome	• Students will learn to carry out practical work in the laboratory. • Interpreting Plant morphology and anatomy of various groups of lower and higher plants. • Students will be able to identify the major groups of microorgansms.		
6	**Credit Value**	2 Credits		
7	**Total Marks: 100**	Max. Marks: 25+75	Min Passing Marks: 33	

Part B Content of the Course

Total No. of Lectures- Tutorials- Practical (In hours per week)
L-T-P:

Unit	Topics	No of Lectures
1	1- Study of various types of leaves, inflorescence, flowers and fruits. 2- Understanding various parts of microscope(Simple and compound microscope) 3- Study of plant cells (e.g. Onion etc.) 4- Study of Permanent slides of Mirosis and meiosis 5- Study of Electron Micrographs of cell and organelles from Internet, You- Tube. 6- Identification of Various algae from nearby areas like, *Nostoc, Oscillaloria, Volvax, Spirogyra, Oedoginium, Chara* and specimens and pictographs of marine algae like *Ectocarpus, Sargassum, Polysiphonia*. 7- Study of Identification of some Bryophytes like *Riccia, Marchantia, Anthoceros, Funaria and* Field visit. 8- Study of some fossils (specimens and slides) 9- Study of Some Pteridophytes Like *Lycopodium, Sellaginella, Equisetum, Marselia* and study of any one fern. 10- Section cutting of Pteridophytes and Gymnosperms: Stem, root and leaves 11- Specimen study of Pteridophytes and Gymnosprms Cones 12- Study of Fugal structures and Preparation of temporary mounts of *Mucor, Rhizopus, Asperigillus, Yeast,* 13- Permanent slides of puccinia on host. 14- Study of Various fungal Plant diseases. 15- Observation of symptoms of virus and bacteria on plants. 16- Gram staining techniques.	30

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1- **Bendre Ashok and Ashok Kumar, A Textbook of Practical Botany, vol. 1, Rastogi Pub., Meerut, 1984.**
2- **Pandey B.PModern Practical Botany,.,vol.1,S. Chand and Co. Ltd., N. Delhi 17th edn., 1999.**
3- **Singh M.P., Chaudhary S.B. and sahu H. BA Textbook of practical botany, daya pub. House, N.Delhi 2005.**
4- **Shahezad, Akil Mohd., Practical Botany, Shanti Prakashan, Gwalior, 2016.**
5- **Elezabeth Margaret and Angela GPractical manual of Botany, vol.1, New Age (Pub.) Ltd., Delhi, 2017.**

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **End Semester Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: End Semester Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. First Sem.

Subject : Botany

Paper – II (Open Elective Paper)

Title of Paper: Basic Botany **Code of the paper:S1-BOT3T**

Part A : Introduction for code--		
1	Pre-requisite (if any)	To Study this course, a student must have had the subject Botany in class/ 12th./ Certificate/diploma.
2	Course Objectives	To known the basics of Botany.
	Course Learning Outcomes	1- This course will help the student to understand the diversity of plants and evolutionary process in plant kingdoms.
		2- It gives an accounts of plant adaptations from aquatic condition to colonize terrestrial habitat
		3- The changes in morphological, anatomical and reproductive structures that propel plant evolution can be investivgated.
		4- The economic importance and significance of plants in nature will be understood.
		5- They will be acquainted with locally prevalent microbial diseases of plants and humans.

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class B.Sc. I Sem.

Paper - II

Open Elective Paper - Basic Botany

UNIT	TOPICS	NO. OF LECTURES
I	1.1 Morphological characteristics of lower plants. 1.2 Structure of plants cell and cell organelles, Prokaryotic and Eukaryotic Cells, Types of cell division. 1.3 Microscope structure and function of Light Microscope (magnification and resolving power).	12
II	**1- Algae** 1.1 General characteristics 1.2 Range of thallus organization, reproduction. 1.3 Role of algae in nature and its economic importance. **2- Bryophytes** 2.1 General characteristics. 2.2 Range of thallus organization, morphology, anatomy (internal and external features) and reproduction of any one Bryophyte. 2.3 Economic importance of Bryophytes	12
III	**1- Pteridophytes** 1.1 General characteristics and morphology. 1.2 Stelar organization and reproduction. 1.3 Economical importance **2- Gymnosperms** 2.1 General characters & economic importance of Gymnosperms.	12
IV	**1- Fungi** 1.1 General characteristics. 1.2 Mode of nutrition 1.3 Types of reproduction 1.4 Economic importance 2- **Lichens:** Brief Knowledge and their significance.	12
V	**1- Microbes** 1.1 Archaebacteria, Eubacteria Cyanobacteria, Mycoplasma, Actinomycetes and Virus. 1.2 Beneficial and harmful roles.	12

Part C :Learning Resources

1- Oladele Ogunseitan, Microbial Diversity: Form and Function in Prokayotes, Wiley Blackwell, 2008.

2- Pelczar, M.J. et al., Microbiology, Tata McGraw-Hill Co, New Delhi, 5th edition, 2001.

3- Presscott, L. Harley, J. and Klein, D., Microbiology, Tata McGraw-Hill Co. New Delhi, 6th edn., 2005.

4- Fritsch F.E., The structure & Reproduction of Algae, Vol. I & Vol. II, Cambridge End Semester Press Cambridge, UK 1945.

5- Smith, G.M., Cryprogamic Botany, Vol. 1 : Algae, Fungi, & Lichens, Mc Graw-Hill Book Co., New York, 1955.

6- IanMorris, An Introduction to the Algae, Hutchinson, London, 1967.

7- Alexopoulos, C.J., Mims, C.W. and Blackwell, M., Introductory Mycology, John Wiley and Sons, 1996

8- Webster, J., Introduction to fungi, Cambridge End Semester Press 2nd edn., 1999.

9- Cavers F., The inter relationships of the Bryophtya, The New Phytologist, Indian reprint, Vol. 10, issue 1-2, p. 1-21, 1911.

10- Parihar, N.S., An Introduction to Embryophyta: Bryophyte, Vol.I, Central Book Depot, Allahabad, 1965.

11- Waston, E.V., British Mosses and Liverworts, Cambridge End Semester Press, U.K. 1968.

12- Eames, A.J., Morphology of Vascular Plants: Lower Groups McGraw Hill N.Y., 1936.

13- Parihar, N.S., An Introducction to Embryophyta: Pteridophte, Vol.II, Central Book Depot, Allahabad, 1965.

14- Sporne, K.R., The Morphology of Pteridophytes: The Structure of Ferns and Allied Plants, Hutchinson End Semester Library, London, 1970.

15- Bierhorst, D.W., Morphology of Vascular Plants, The MacMillan Co., N.Y. and Collier-MacMillan Ltd., London. 1971.

16- Coulter, J.M. and C.J. Charmberlain, Morphology of Gymnosperms, Central Book Depot, Allahabad, 1964.

17- Sporne, K.R., The Morphology of Gymnosperms: The Structure and Evolution of Promitive seed Plants, Hutchinson End Semester Library, London, 1971.

18- Dutta, S.C., An introduction to Gymnosperms, Kalyani Publisher, New Dilhi, 1984.

19- Sharma, O.P and Shivani Dixit, Gymnosperms, Pragati Prakashan, Meerut, 2015.

20- Vasishtha, P.C., Botany for Degree students: Gymnosperms, revised edn., S. chand and comp. Ltd., N. Delhi, 2018.

21- Bhatnagar, S.P. and Alok Moitra, Gymnosperms, New age International (P.) Ltd., New Delhi. 2000.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **End Semester Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: End Semester Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. Second Sem.

Subject : Botany

Paper – I Major

Title of Paper: Basic Botany **Code of the paper: S2-BOT1T**

Part A : Introduction for code--		
1	Pre-requisite (if any)	To Study this course, a student must have had the subject Botany in class/ 12th./ Certificate/diploma.
2	Course Objectives	To known the basics of Botany.
	Course Learning Outcomes	1- This course will help the student to understand the diversity of plants and evolutionary process in plant kingdoms.
		2- It gives an accounts of plant adaptations from aquatic condition to colonize terrestrial habitat
		3- The changes in morphological, anatomical and reproductive structures that propel plant evolution can be investivgated.
		4- The economic importance and significance of plants in nature will be understood.
		5- They will be acquainted with locally prevalent microbial diseases of plants and humans.

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22
Class B.Sc. II Sem.
Paper - I
Major - Basic Botany

UNIT	TOPICS	NO. OF LECTURES
I	**1.1 History of Botany and Indian Contributions.** 1.2 Morphological characteristics of lower and higher plants (Angiosperms). 1.3 Types of leaves, Inflorescence, Flowers and fruits. 1.4 Structure of plants cell and cell organelles, Prokaryotic and Eukaryotic Cells, Types of cell division. 1.5 Microscope structure and function of Light Microscope (magnification and resolving power). 1.6 Various types of microscopes: Bright field, Phase Contrast, SEM and TEM.	12
II	**1- Algae** 1.1 General characteristics 1.2 Range of thallus organization, reproduction. 1.3 Types of life-cycles in algae 1.4 Role of algae in nature and its economic importance. **2- Bryophytes** 2.1 General characteristics, Ecology. 2.2 Range of thallus organization, morphology, anatomy (internal and external features) and reproduction of any one Bryophyte. 2.3 Economic importance of Bryophytes	12
III	**1- Pteridophytes** 1.1 General characteristics and morphology. 1.2 Stelar organization and reproduction. 1.3 Heterospory and seed habit. 1.4 Economical importance **2- Gymnosperms** 2.1 General Description and their distribution. 2.2 Economical importance of Gymnosperms. **3- Paleobotany** 3.1 Indian contribution in paleobotany. 3.2 Brief knowledge of Fossils and Geological time scale.	12
IV	**1- Fungi** 1.1 General characteristics and cell wall composition. 1.2 Mode of nutrition 1.3 Types of reproduction 1.4 Economic importance 1.5 Parasexuality and Mycorrhiza 2- **Lichens:** Brief Knowledge and their significance.	12
V	**1- Microbes** 1.1 Brief outline of various types of microbes 1.2 Archaebacteria, Eubacteria Cyanobacteria, Mycoplasma, Actinomycetes and Virus. 1.3 Beneficial and harmful roles.	12

Part C :Learning Resources

1- Oladele Ogunseitan, Microbial Diversity: Form and Function in Prokayotes, Wiley Blackwell, 2008.

2- Pelczar, M.J. et al., Microbiology, Tata McGraw-Hill Co, New Delhi, 5th edition, 2001.

3- Presscott, L. Harley, J. and Klein, D., Microbiology, Tata McGraw-Hill Co. New Delhi, 6th edn., 2005.

4- Fritsch F.E., The structure & Reproduction of Algae, Vol. I & Vol. II, Cambridge End Semester Press Cambridge, UK 1945.

5- Smith, G.M., Cryprogamic Botany, Vol. 1 : Algae, Fungi, & Lichens, Mc Graw-Hill Book Co., New York, 1955.

6- IanMorris, An Introduction to the Algae, Hutchinson, London, 1967.

7- Alexopoulos, C.J., Mims, C.W. and Blackwell, M., Introductory Mycology, John Wiley and Sons, 1996

8- Webster, J., Introduction to fungi, Cambridge End Semester Press 2nd edn., 1999.

9- Cavers F., The inter relationships of the Bryophtya, The New Phytologist, Indian reprint, Vol. 10, issue 1-2, p. 1-21, 1911.

10- Parihar, N.S., An Introduction to Embryophyta: Bryophyte, Vol.I, Central Book Depot, Allahabad, 1965.

11- Waston, E.V., British Mosses and Liverworts, Cambridge End Semester Press, U.K. 1968.

12- Eames, A.J., Morphology of Vascular Plants: Lower Groups McGraw Hill N.Y., 1936.

13- Parihar, N.S., An Introducction to Embryophyta: Pteridophte, Vol.II, Central Book Depot, Allahabad, 1965.

14- Sporne, K.R., The Morphology of Pteridophytes: The Structure of Ferns and Allied Plants, Hutchinson End Semester Library, London, 1970.

15- Bierhorst, D.W., Morphology of Vascular Plants, The MacMillan Co., N.Y. and Collier-MacMillan Ltd., London. 1971.

16- Coulter, J.M. and C.J. Charmberlain, Morphology of Gymnosperms, Central Book Depot, Allahabad, 1964.

17- Sporne, K.R., The Morphology of Gymnosperms: The Structure and Evolution of Promitive seed Plants, Hutchinson End Semester Library, London, 1971.

18- Dutta, S.C., An introduction to Gymnosperms, Kalyani Publisher, New Dilhi, 1984.

19- Sharma, O.P and Shivani Dixit, Gymnosperms, Pragati Prakashan, Meerut, 2015.

20- Vasishtha, P.C., Botany for Degree students: Gymnosperms, revised edn., S. chand and comp. Ltd., N. Delhi, 2018.

21- Bhatnagar, S.P. and Alok Moitra, Gymnosperms, New age International (P.) Ltd., New Delhi. 2000.

Basic Botany Practical (Paper-1)

Part A: Introduction				
Program: Certificate		**Class B.Sc. IInd Sem.**	Year 2021	Session 2021-22
Subject : Botany				
1	Course Code	**S2-BOT1P**		
2	Course Title	Basic Botany Practical (Paper-2)		
3	Course Type (Core Course/ Elective/Generic Elective/Vocational/….)	Core Course		
4	Pre-requisite (If any)	To study this course, a student must have had the subject of Biology/ Life science/Agriculture in class 12th.		
5	Course Learning Outcome	• Students will learn to carry out practical work in the laboratory. • Interpreting Plant morphology and anatomy of various groups of lower and higher plants. • Students will be able to identify the major groups of microorgansms.		
6	**Credit Value**	2 Credits		
7	**Total Marks: 100**	Max. Marks: 25+75	Min Passing Marks: 33	

Part B Content of the Course

Total No. of Lectures- Tutorials- Practical (In hours per week)
L-T-P:

Unit	Topics	No of Lectures
1	1- Study of various types of leaves, inflorescence, flowers and fruits. 2- Understanding various parts of microscope(Simple and compound microscope) 3- Study of plant cells (e.g. Onion etc.) 4- Study of Permanent slides of Mirosis and meiosis 5- Study of Electron Micrographs of cell and organelles from Internet, You- Tube. 6- Identification of Various algae from nearby areas like, *Nostoc, Oscillaloria, Volvax, Spirogyra, Oedoginium, Chara* and specimens and pictographs of marine algae like *Ectocarpus, Sargassum, Polysiphonia*. 7- Study of Identification of some Bryophytes like *Riccia, Marchantia, Anthoceros, Funaria and* Field visit. 8- Study of some fossils (specimens and slides) 9- Study of Some Pteridophytes Like *Lycopodium, Sellaginella, Equisetum, Marselia* and study of any one fern. 10- Section cutting of Pteridophytes and Gymnosperms: Stem, root and leaves 11- Specimen study of Pteridophytes and Gymnosprms Cones 12- Study of Fugal structures and Preparation of temporary mounts of *Mucor, Rhizopus, Asperigillus, Yeast,* 13- Permanent slides of puccinia on host. 14- Study of Various fungal Plant diseases. 15- Observation of symptoms of virus and bacteria on plants. 16- Gram staining techniques.	30

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1- **Bendre Ashok and Ashok Kumar, A Textbook of Practical Botany, vol. 1, Rastogi Pub., Meerut, 1984.**
2- **Pandey B.PModern Practical Botany,.,vol.1,S. Chand and Co. Ltd., N. Delhi 17th edn., 1999.**
3- **Singh M.P., Chaudhary S.B. and sahu H. BA Textbook of practical botany, daya pub. House, N.Delhi 2005.**
4- **Shahezad, Akil Mohd., Practical Botany, Shanti Prakashan, Gwalior, 2016.**
5- **Elezabeth Margaret and Angela GPractical manual of Botany, vol.1, New Age (Pub.) Ltd., Delhi, 2017.**

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **End Semester Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: End Semester Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. Second Sem.

Subject : Botany

Paper – II (Minor)

Title of Paper: Applied Botany **Code of the paper:S2-BOT2T**

Part A : Introduction for code--		
1	Pre-requisite (if any)	The students must have passed 12th with Biology/Life Sciences/ Agriculture.
2	Course Objectives	To known the basics of Botany.
	Course Learning Outcomes	By the end of this course the student must should have
		1 Undrestood the significance and role of botany.
		2 Learnt the basic aspects of applied botany.
		3 Gained knowledge about employment opportunities in field of botany
		4 Gained knowledge about start up opportunities in field of botany
		5 Learnt about opportunities of social services.
		6 Gain knowledge about best health practices

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22
Class B.Sc. II Sem. Botany
Paper - II
Minor- Applied Botany

UNIT	TOPICS	NO. OF LECTURES
I	1.1 Introduction objectives and importance of Applied botany 1.2 History and evolution of botany 1.3 Relation of plants to man and relation with other services 1.4 Various disciplines of botany and their applications to human welfare	12
II	1.1 Definition and types of pollution and pollutants 1.2 Phytoremediation: Air water Soil noise and thermal pollutants (Any 5 plants with botanical name, family) and their role in pollution control. 1.3 Bioremediation definition and types	12
III	1.1 Ancient agricultural practices 1.2 Modern agriculture practices Poly house. Drip irrigation hydroponics computer based agriculture. Terrace farming. 1.3 Organic farming. Introduction objective and brief technique. 1.4 Horticulture: Definition and role in human welfare 1.5 Forestry : Definition branches and role in human welfare 1.6 Silviculture: Definition and management practices	12
IV	1.1 Role of Botany in Rural development. 1.2 Ethnobotany: Introduction and importance. 1.3 Ethnomedicine: Definition and examples. (Local name, Botanical name family and importance of Neem, Aloe, Clove, Ginger, Tulsi, Turmeric, Giloy, Emblica, Ashwagandha, Arandi) 1.4 Ethno- fibres: Definition and examples (Local name, Botanical name, family and importance of Ankara, Coconut, elephant grass, cotton) 1.5 Ethno –food crops: Definition and examples (Local name, Botanical name, family and importance of Garadu, Singada, Kutaki, Sama, Kodo, Bathua, Sehjan, Jowar, Makka, Bajra, Jau)	12
V	1.1 Plant tissue culture: Definition, Types and Importance 1.2 DNA Recombinant Technique: Introduction, tools and importance 1.3 Role of recombination in present era 1.4 Bioimformatics: Definition, concept and tools 1.5 Introduction of bioinformatics software: Basic idea of BLAST and FASTA Importance of bioinformatics	12

Part C :Learning Resources

1- Levetin E. and Mcmahon K. "Plants and Society" McGraw Hill Education. 2007
2- MaitirR., Rodriguez K. G. and Thakur A. S. "Applied Botany" American Academic Press 2017
3- Negi S.S. "Forest Botany" M/s Bishen Singh Mahendra Pal Singh 2012.
4- Agrahari R. P. " Environmental Ecology, Biodiversity, Climate Change and Disaster Management" Mc Graw Hill Education 2020.
5- Sharma D.K. " Biodiversity Conservation: Current Status and future strategies" Write and print publication. 2017
6- Singh J. "Biodiversity Environment and Sustainability" MD Publication Pvt Ltd/ 2008
7- Gupta P.K. "Molecular Biology and genetic Engineering Rastogi Publications. 2005
8- Sharma V., Munjal A. and Sharkar A. Bioinformatics" Rostogi Publications. 2008

Applied Botany Practical (Paper-1)

Part A: Introduction				
Program: Certificate	**Class B.Sc. IInd Sem.**		Year 2021	Session 2021-22
Subject : Botany				
1	Course Code	**S2-BOT2P**		
2	Course Title	Applied Botany Practical (Paper-1)		
3	Course Type (Core Course/ Elective/Generic Elective/Vocational/….)	Core Course		
4	Pre-requisite (If any)	To study this course a student must have had the subject Botany, Botany, Life Science in class/12th/.		
5	Course Learning Outcome	On completion of this course, learners will be able to: By the ened of this course the students should have knowledge of practical skill related with ethnobotany, tissue culture, application of bioinformatics software and tools of recombinant DNA technology.		
6	**Credit Value**	2		
7	**Total Marks: 100**	Max. Marks: 25+75		Min Passing Marks: 33

Part B Content of the Course

Total No. of Lectures- Tutorials- Practical (In hours per week)
L-T-P:

Unit	Topics	No of Lectures
1	1- Identification of ethnomedicinal plants 2- Preparation of soil health card of any agricultural field. 3- Study of vermicompost and composting of kitchen waste 4- Use of BLAST and FASTA 5- Prepare the list of important air, water and soil pollutants of local areas 6- **Plant Tissue culture technique:** sterilization, inoculation, culture media, acclimatization and hardening, 7- Preparation of list of ethnomedicinal food fibre plant locally available 8- **Tools of recombinant DNA technology:** Restriction, enzymes, plasmid vectors, other enzymes 9- Study of global warming, acid rain and water quality (pH and Conductivity), 10- Study of local plants grown around agricultural field 11- * Practical can be decided on theory basis according to availability. 12- * Case and field study can be designed accordingly.	30

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Levetin E. and Mcmahon K. "Plants and Society" McGraw Hill Education. 2007
2. Maitir., Rodriguez H. G. and Thakur A. S. "Applied Botany" American Academic Press 2017
3. Negi S.S. "Forest Botany" M/s Bishen Singh Mafendra Pal Singh 2012.
4. Agrahari R. P. " Environmental Ecology, Biodiversity, Climate Change and DisasterManagement" Mc Graw Hill Education 2020.
5. Sharma D.K. " Biodiversity Conservation: Current Status and future strategies" Write and print publication. 2017
6. Singh J. "Biodiversity Environment and Sustainability" MD Publication Pvt Ltd/ 2008
7. Gupta P.K. "Molecular Biology and genetic Engineering Rostogi Publications. 2005
8. Sharma V., Munjal A. and Sharkar A. Bioinformatics" Rostogi Publications. 2008

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **End Semester Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: End Semester Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. Second Sem.

Subject : Botany

Paper – Open Elective Paper

Title of Paper: Functional Botany **Code of the paper: S2-BOT3T**

Part A : Introduction for code--		
1	Pre-requisite (if any)	The students must have passed 12th with Biology/Life Sciences/ Agriculture.
2	Course Objectives	To known the basics of Botany.
	Course Learning Outcomes	By the end of this course the student must should have
		1 Understood the significance and role of botany.
		2 Learnt the basic aspects of applied botany.
		3 Gained knowledge about employment opportunities in field of botany
		4 Gained knowledge about start up opportunities in field of botany
		5 Learnt about opportunities of social services.
		6 Gain knowledge about best health practices

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22
Class B.Sc. II Sem. Botany
Paper – Open Elective Paper
Applied Botany

UNIT	TOPICS	NO. OF LECTURES
I	1.1 Introduction objectives and importance of Applied botany 1.2 History and evolution of botany	12
II	1.1 Definition and types of pollution and pollutants 1.2 Phytoremediation: Air water Soil noise and thermal pollutants (Any 5 plants with botanical name, family) and their role in pollution control.	12
III	1.1 Organic farming: Introduction objective and brief technique. 1.2 Horticulture: Definition and role in human welfare 1.3 Silviculture: Definition and management practices	12
IV	1.1 Ethnobotany: Introduction and importance. 1.2 Ethnomedicine: Definition and examples. (Local name, Botanical name family and importance of Neem, Aloe, Clove, Ginger, Tulsi, Turmeric, Giloy, Emblica, Ashwagandha, Arandi) 1.3 Ethno –food crops: Definition and examples (Local name, Botanical name, family and importance of Garadu, Singada, Kutaki, Sama, Kodo, Bathua, Sehjan, Jowar, Makka, Bajra, Jau)	12
V	1.1 Plant tissue culture: Introduction objective and brief technique 1.2 DNA Recombinant Technique: Introduction, tools and importance 1.3 Role of recombination in present era	12

Part C :Learning Resources

1- Levetin E. and Mcmahon K. "Plants and Society" McGraw Hill Education. 2007
2- MaitirR., Rodriguez K. G. and Thakur A. S. "Applied Botany" American Academic Press 2017
3- Negi S.S. "Forest Botany" M/s Bishen Singh Mahendra Pal Singh 2012.
4- Agrahari R. P. " Environmental Ecology, Biodiversity, Climate Change and Disaster Management" Mc Graw Hill Education 2020.
5- Sharma D.K. " Biodiversity Conservation: Current Status and future strategies" Write and print publication. 2017
6- Singh J. "Biodiversity Environment and Sustainability" MD Publication Pvt Ltd/ 2008
7- Gupta P.K. "Molecular Biology and genetic Engineering Rastogi Publications. 2005
8- Sharma V., Munjal A. and Sharkar A. Bioinformatics" Rostogi Publications. 2008

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **End Semester Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: End Semester Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. Second Year

Subject : Botany

Paper – I

Title of Paper: Taxonomy and Embryology of Angiosperms
आवृतबीजियों की वर्गीकी एवं भ्रूणिकी **Code of the paper: 204-I**

Part A : Introduction for code-- 204-1		
1	Pre-requisite (if any)	The students must have passed Ist Year with Botany
2	Course Objectives	To known the basic principles of Taxonomy & Embryology of Angiosperms
	Course Learning Outcomes	After the completion of this course students will have understanding of
		1 Students will come to know about classification of plants. How plants were classified in ancient times.
		2 Importance and basis of classification as well as need to classify the plants
		3 Knowledge about flower, how flower plays an important role in the life of plants. Structure and function of floral parts.
		4 What is pollination how it takes place agencies which plays important role in pollination, CO5: Fertilization and formation of fruits seed and its role in giving rise to next generation.
		5 Fertilization and formation of fruits seed and its role in giving rise to next generation.

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class B.Sc. II Year Botany

Paper - I

Taxonomy and Embryology of Angiosperms

Unit-I

Taxonomy: Origin and Evolution of Angiosperms: Principles and rules of Botanical Nomenclature, Museum, Herbarium and Botanical Gardens; Comparative account of various systems of Classification of Angiosperms: Bentham and Hooker, and Modern trends in Taxonomy including Molecular taxonomy. APG IV System.

Unit-II

Taxonomy: Terminology for plant description in semi-technical language: Diagnostic characteristics and Economic Importance of Families- Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Magnoliaceae, Rosaceae, Dipterocarpaceae and Cucurbitaceae.

Unit-III

Taxonomy: diagnostic characteristics & Economic Importance to Families- Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Poaceae, Asclipiadaceae, Verbanaceae, Arecaceae, Musaceae and Orchidoceae.

Unit-IV

Embryology: Concept of flower as a modified shoot. Structure of Anther, Microsporogenesis and Male Gametophyte. Structure of Pistil, Ovules, Megasporogenesis and Development of Female Gametophyte (Embryo Sac) and its types. Pollination- Mechanism and Agencies of Pollination, Pollen Pistil interactions and Self incompatibility.

Unit-V

Embryology: Double Fertilization and Triple Fusion. Development and Types of Endosperm and its morphological nature, Development of Embryo in Monocot and Dicot plants, Polyembryony and Apomixis, Application of Palynology, Experimental Embryology including Pollen storage and test tube fertilization Fruit Development and maturation, Seed Structure and dispersal. Mode of Vegetative Propagation.

Part C :Learning Resources

- Gangulee, H.C., Das, K.S. And Dutta, C. 2007 College Botany Voll. I, New Central Book Agency (P) Ltd. Kolkata, 70000
- Heywood, V.H. & Moore, D.M. (eds) 1984. Current Concepts in Plant Taxonomy. Academic press, London.
- Jones, S.B. Jr. And Luchisnger, A.E. 1986, Plant Taxonomy (III edition) Mc Graw Hill Book Co. New York.
- Maheshwari, P. 1978. Plant Embryology. Pandey, B.P. 2010. A Text book of Botany-Angiosperms, S. Chand & & Company Ltd. Ramnager, new Delhi-110055.
- Radford, A.E. 1986. Fundamentals of Plant Systematics, Harper and Row, New York.
- Shrivastava and Das, Modern text book of botnay vol.III & IV.
- Singh, V., Pande P.C. and Jain, D.K. Structure & Development in Angiosperms. Rastogi Publication, Meerut.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **University Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: University Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. Second Year

Subject : Botany

Paper – II

Title of Paper: Plant Ecology Biodiversity and Phytogeography

Code of the paper: 204-II

Part A : Introduction for code-- 204-II		
1	Pre-requisite (if any)	The students must have passed Ist Year with Botany
2	Course Objectives	To known the basic principles of Plant Ecology Biodiversity and Phytogeography
	Course Learning Outcomes	After the completion of this course students will have understanding of
		1 Student can well understand about Ecosystem and how it works in the environment.
		2 Soil, its structure, properties and soil testing methods can be well understood. It also helps in making carrier of students.
		3 Types of Biodiversity i.e. different types of plants, insects, animal and their nature/behavior can be well understood.
		4 Conservation methods of biodiversity and threats to the wild life can be understood which also important aspect in making carrier..
		5 Phytogeography gives idea about distribution of plants.

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class B.Sc. II Year Botany

Paper - II

Plant Ecology Biodiversity and Phytogeography

Unit-I Ecosystems: Structure and Types, Biotic and Abiotic components, Trophic levels, Food chain, Food web, Ecological pyramids, Energy flow, Concept of Biogeochemical cycles: Gaseous Liquid and Sedimentary cycles: Carbon, Nitrogen, Water, Phosphorous and Sulphur cycles.

Unit-II Ecological Adaptations: Morphological, Anatomical, Physiological responses. Water adaptations (Hydrophytes and Xerophytes). Temperature adaptations (Thermoperiodism and Vernalization). Light adaptations (Heliophytes and Sciophytes). Photoperiodism, Plant succession: causes, trends and processes, Types of succession: Hydrosere and Xerosere.

Unit-III Biodiversity and Population Ecology: Distribution patterns, Density, Natality, Mortality, Growth curves, Ecotypes and Ecades. Community Ecology: Frequency, Density, Abundance, Cover and life forms. Biodiversity: Basic concept, Importance, Biodiversity of India, Hotspots, In situ and Ex situ Conservation. Biosphere reserves, Santuries and National parks of Madhya Pradesh. Endangered and Threatened species, Red data book.

Unit-IV Soil And Pollution: Physical and Chemical properties, Soil formation, Development of soil profile, Soil classification, Soil composition, Soil factors. Pollution: Types and Causes, Global warming, Acid rain, Climate Change and Ozone Layer and Ozone Hole.

Unit-V Phytogeography: Phytogeographical regions of India. Vegetations types of Madhya Pradesh. Natural resources: Definition and classification. Conservation and Management of Natural resources, Land resource management, Water and Wet land resource management.

Part C :Learning Resources

1. Benerjee,. S. 1998. Bio Diversity conservation – Agrobotanica, Bikaner.
2. Kumar, U.K. 2006. Bio diversity principles and conservation, A grobios, Jodhpur.
3. Odum, E.P. 5th ed. 2004 Fundamentals of Ecology, Natraj Publisher, Dehradun.
4. Puri, G.S. 1960. Indian Forest Ecology.
5. Sharma. P.D. 7th ed. 1998. Ecology and Environment, Rastogi Publication, Shivaji Road, Meerut. 250002. India
6. Shukla, R.S. & Chandel, P.S. 2006. A Text Book of Plant Ecology.
7. Kochar, S.L.-Economic Botany.
8. Pandey Neeraj and Dharni Khushdeep- Intelltctual Property right.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **University Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: University Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Practical Scheme
B.Sc. II Year Botany
Session 2021-22

(BASED ON PAPER I & II)

			50 MARKS
1.	Taxonomy	-	10
2.	Embryology – Anther/Ovule/Placentation	-	05
3.	Exercise based on Ecology	-	10
4.	Exercise based on Phytogeography/National Parks	-	05
5.	Spotting (01-05)	-	10
6.	Viva voce	-	05
7.	Sessionals	-	05

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. III Year

Subject : Botany

Paper – I

Title of Paper: Plant Physiology and Biochemistry

Code of the paper: 304-I

Part A : Introduction for code-- 304-I		
1	Pre-requisite (if any)	The students must have passed IInd Year with Botany
2	Course Objectives	To known the basic principles of Plant Physiology and Biochemistry
	Course Learning Outcomes	After the completion of this course students will have understanding of
		1: Students were able to enhance their capability to understand importance of physiological activities in relation to plants.
		2: Understanding of nutrition and requirements of biomolecules in plants and gains knowledge to fulfill these requirements.
		3: Importance of Bio catalyst and hormones in various activities of division and development of plants is conceptualize to students.
		4: The Course will achieve capability of relating theory and practical's together.
		5: The practical's will support the students to understand concepts in theory clearly.

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class B.Sc. III Year Botany

Paper - I

Plant Physiology and Biochemistry

Unit -I

Plant Water relations : Properties of water, Importance of water in plant life diffusion osmosis & Osmotic relation to plant cell. Water absorption, Ascent of Sap. Transpiration: Structure & Physiology of Stomata, Mechanism of Transpiration, Factors affecting the rate of Transpiration.

Unit -II

Plant Nutrition, Biomolecules & Metabolism: Mineral Nutrition, Essential Macro & Micro Nutrients and their role, Absorption of mineral nutrients and Hydroponics, translocation of organic solutes.

Biomolecules: Structure classification and functions of carbohydrates Amino Acids, Proteins and lipids, Nitrogen fixation, Nitrogen and Lipid metabolism.

Unit-III

Photosynthesis: Chloroplast Photosynthetic pigments, Concept of two photosystems, Light reaction, Red drop, Emerson's effect, Dark reaction Calvin cycle, Hatch & Slack cycle, Factor affecting rate of photosynthesis & Photorespiration.

Unit- IV

Respiration: Mitochondria, aerobic and anaerobic respiration, fermentation, respiratory coenfficient, mechanism of respiration – Glycolysis Kreb's cycle, Pentose phosphate pathway, Electron transport system, Factors affection rate of respiration, Redox Potential and theories of ATP synthesis.

Unit- V

Enzymology & Plant Hormones Classification nomenclature and characteristics of enzymes, Concept of Holoenzyme, apoenzyme, Co- enzyme and co- factors, Mode & mechanism of enzyme action, Factors affection enzyme activity.

Plant Harmons : Discovery, Structure mode of action and role of anxins, Gibberellins, Cytokinin, Abscissic Acid and Ethylene.

Part C :Learning Resources

1. David, L.N. and Michael, M.C. 2000. Leheniger's Principle of Biochemistry, Macmillan worth Pub. New York, U.S.A.
2. Gengulee, H.C. Das, Datta, C. and sen, S. 2007. College Botany Voll. I, New Central Book Agency (P) Ltd. Kolkata. 700009
3. Hopkins, W.G. 1995. Introduction of Plant Physiology Pub. John Wiley and sons, New York.
4. Taiz & Zeiger, E, 1998. Plant Physiology. Sinauer associates, Inc. Pub. Massachudetts, U.S.A.
5. Salisbury & Ross – Plant Physiology.
6. Devlin - Plant Physiology .
7. Verma, S.K. & Verma, M.A. 1995. Text Book of Plant Physiology & Biotechnology. S. Chand & Company.
8. Verma, V. 1995. Plant Physiology, Emkey Pub.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **University Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: University Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : B.Sc. III Year

Subject : Botany

Paper – II

Title of Paper: Cell Biology Genetics and Biotechnology

कोशिकी जैविकी, अनुवांशिकी एवं जैव प्रौद्योगिकी

Code of the paper: 304-II

Part A : Introduction for code-- 304-2		
1	Pre-requisite (if any)	The students must have passed IInd Year with Botany
2	Course Objectives	To known the basic principles of Cell Biology Genetics and Biotechnology
	Course Learning Outcomes	After the completion of this course students will have understanding of
		1: Deep conceptualization of cell and cell organelles is made easy to understand by students.
		2: Importance of genetic Inheritance, cellular division and development is easily understood by the students which make them confident to conceptualize evolution adaptation and development
		3: Recent knowledge of technologies related to improvement of genetic species gives students confidence to play role in field of agriculture & Biotechnology.
		4: To discharge related technologies to the students in order to give them confidence regarding the course.
		5: To achieve better teacher student relationship by making students understand the subject very well.

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class B.Sc. III Year Botany

Paper - II

Cell Biology Genetics and Biotechnology

कोशिकी जैविकी, अनुवांशिकी एवं जैव प्रौद्योगिकी

UNIT-I

The cell envelops and organelles: Techniques of cell biology, prokaryotic and Eukaryotic cell structure and plasma membrane, lipid bilayer structure, function of the cell wall. Structure and function of cell organelles: Nucleus, Chloroplast, Mitochondria, Golgi bodies, ER, Peroxisome and Vacuole. Cell signaling and cell receptors, signal transduction.

UNIT-II

Chromosomal organization: structure and function of chromosome, centromere and telomere. Nucleosome model, special types of chromosomes, Mitosis and Meiosis. Variation in chromosome Structure: Deletion, Duplication, Translocation and Inversion, Variation in chromosome number, Euploidy, Aneuploidy, DNA: The genetic material, DNA Structure and Replication.

UNIT-III

Genetic Inheritance: Mentalism: Law of Dominance, laws of segregation and independent assortment, Linkage analysis, Interaction of genes. Cytoplasmic inheritance, Mutations: spontaneous and induced: Transposable elements, DNA damage and repair.

UNIT-IV

Gene: Development of Genetics, Structure of Gene, Gene verses allele genetics code, transfer of genetic information , Transcription , translation , protein synthesis ,t RNA and ribosome . Regulation of gene expression in prokaryotes and eukaryotes. Organic evolution - Role of RNA in origin and evolution.

UNIT-V

Plant Breeding: Introduction, Methods Selection and Hybridization (pedigree, backcross, mass selection and bulk method)

Biotechnology: Definition, basic aspects of plant tissue culture, cellular totipotency, differentiation and morphogenesis Impotent achievements of biotechnology in agriculture.

Genetic Engineering: Tools and techniques of recombinant DNA technology: Cloning Vectors; biology of agrobacterium vectors for gene delivery and Marker genes. DNA fingerprinting genomic and cDNA library. Gene mapping and Chromosome walking.

Biostatistics: Introduction and application

Part C :Learning Resources

1. Alberts B.D. Lewis, J. Raff, M. Rubers, K. Nad Watson I.D. 1999 molecular Biology of Cell Garland pub.Co. Inc. New York, U.S.A.
2. P.K. Gupta 1999 a text Book of Cell and Molecular Biology Rastogi Pub. Meerut India.
3. Kleinsmith L.J. and Molecular Biology (2nd edition) Harper Collins College Pub. New York USA.
4. P.K. Gupta Geneties Rastogi Pub. Meerut.
5. Sinha & Sinha Cytogenties & Plant Breeding Vikas Pub.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE)** **University Exam (UE):**		**100** **25** **75**
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	**15+10=25**
External Assesment: University Exam Setion: 75 Time: 02:00 Hours	Section(A): Three Very Short Questions (50 Words Each)	3X3=9
	Section(B): Four Short Questions (200 Words Each)	4X9=36
	Section(C): Two Long Questions (500 Words Each)	2X15=30
	Total	**75**

Practical Scheme
B.Sc. III Year Botany
Session 2021-22

(BASED ON PAPER I & II)

50 MARKS

1.	Exercise based on Physiology	-	10
2.	Biochemical Test	-	05
3.	Exercise based on Cytology	-	10
4.	Exercise based on Genatic Problem	-	05
5.	Spotting (01-05)	-	10
6.	Viva Voce	-	05
7.	Sessionals	-	05

M.Sc.: -

Government Holkar **(Model, Autonomous) Science College, Indore (M.P.)**

Department of Botany

Class : M.Sc. I Sem.

Subject : Botany

Paper –I

Title of Paper: Biology & Diversity of Viruses, Bacteria and Fungi

Code of the paper: BO11

Part A : Introduction for code-- BO11		
1	Pre-requisite (if any)	The students must have passed B.Sc. with Botany
2	Course Objectives	The paper is aimed to introducing the students for Biology & Diversity of Viruses, Bacteria and Fungi
	Course Learning Outcomes	1-Introduction to microbial world.
		2-To recognize the morphology, reproduction and life cycle patterns of Bacteria, Fungi and Cyanobacteria.
		3-Give understanding of infection cycle of microbes and fungi and their control measures.
		4-Collection of fungi, Bacteria, and Cyanobacteria from different localities, their diversification and familiarize with various ecological niche.
		5- Use of fungi in food and tool in industrial production.

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. I Sem. Botany

Paper - I

Biology & Diversity of Viruses, Bacteria and Fungi

UNIT-I	Viruses: - Characteristics and ultra-structure of virions; isolation and purification of viruses; chemical nature of viruses; replication and transmission of viruses; economic importance of viruses.
UNIT-II	Porkaryotes:-/Archaebacteria and Eubacteria: - General account of archaebacteria, Eubacteria: general characters, ultra structure, nutrition, classification, reproduction and economic importance. General account of Actinomycetes. Mycoplasma:- Salient features, cell structure, reproduction, transmission, plant and animal diseases and their control measures. Cyanobacteria: salient features, ultra structure, reproduction and biological importance.
UNIT-III	Mycology: - General characters, substrate relationship of fungi, cell ultra structure, thallus- organization, mode of nutrition (saprophytic, parasitic, and symbiotic) and reproduction. Economic importance of fungi.
UNIT-IV	Mycology:- Recent trends in classification, (Alexopoulous, Ainswarth), Heterothallism. General account of Mastigomycotina(Saprolegnia, Phytophthora, Pythium,Peronospora,Albugo) and Zygomycotina(Mucor,Rhizopus,Pilobolous).
UNIT-V	Mycology: Diagnostic features and general account of Ascomycotina (Pennicillium, Neurospora and Peziza, Protomyces Basidiomycotina (Puccinia, Ustilago), and Deuteromycotina (Alternaria, Fusarium, Cercospora). Para-sexuality. Diseases in plants and Humans. Mycorrhizal association, symbiosis and Fungi as biocontrol agent.

Part C :-Learning Resources

1	Alexopoulus, C.J. Mims, C. W. and Blackwel, M; 1996: Introductory coO' Mycology,Jbon Wjley & Sons Inc.
2	Clifton, A; 1958: Introduction to Bacteria, Mcgraw- Hills Book Co.New Delhi.
3	Madigan, M T. Martinko, J. M and Parker Jack; I 997: Brock Biology Of
4	Madigan, M T. Martinko, J. M and Parker Jack; I 997: Brock Biology Of Microorganisms, (8th edition) Prentice Hall, N,J. U.S.A
5	Mehrotra, RS. and Aneja, RS.; 1998: An Introduction to Mycology. New Age Intermediate Press.
6	Rangaswamy, G. and Mahadevan, A; 1999: Diseases of Crop Plants in Indja (4th edjtjon).PrentjceHaJl ofInilia Ltd. New Delhi.
7	Webster, J.; 1985: Introduction to Fungi Cambridge University Press.
8	Dubey, R C. & Maheshwari, D. K.; 2005: A Text Book of Microbiology, S. Chand Publisher, New Delhi

Part D :-Assessment and Evaluation		
Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Department of Botany

Class : M.Sc. I Sem.

Subject : Botany

Paper –II

Title of Paper: Biology & Diversity of Algae & Bryophytes

Code of the paper: BO12

Part A : Introduction for code-- BO12		
1	Pre-requisite (if any)	The students must have passed B.Sc. with Botany
2	Course Objectives	The paper is aimed to introducing the students for Biology & Diversity of Algae & Bryophytes
	Course Learning Outcomes	1- The students can learn the General characters of algae and Bryophyta , the diverse habitat and it nature of thallus ,
		2- Criteria of classification of algae, Economic importance of various Algae.
		3- The life cycle of Chlorophyta, Xanthophyta, Phaeophyta
		4- Rhodophyta can be understood by study of importance genera of these classes of Algae.
		5- Similarity the general characters, Classification, types of reproduction and alternation of generation of important members of bryophytes can be understood by study its life cycle.

Part B :Content of the Course

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. I Sem. Botany

Paper – II Biology & Diversity of Algae & Bryophytes

UNIT-I	Algae: - General characters, diversified habitats, thallus organization. Criteria of classification (pigments, reserve foods, flagella). Economic importance; algal bloom and biofertilizer).
UNIT-II	Algae: - Salient features, classification, reproduction and economic importance of Chlorophyta (Ulotrix, Spirogyra, Oedogonoium, Pithophora, Cladophora, Coleochaete Hydrodyction and Ulva),Charophyta(Chara and Nitella) and Xanthophyta (Vaucheria and Botrychium).
UNIT-III	Algae: - Salient features, classification, reproduction and economic importance of Phaeophyta(Ectocarpus,Laminaria,Fucus and Sargassum) and Rhodophyta (Batrachospermum, Polysiphonia). General account of Bacillariophyta (Pinularia).
UNIT-IV	Bryophyta: General characters, classification, vegetative propagation and sexual reproduction of bryophytes.Life cycle and alternation of generation in bryophytes. Economic importance of bryophytes. General account of Sphaerocarpales (Sphaerocarpus); Marchantiales(Riccia,Marchantia) and Jungermeniales(Pellia, Porella).
UNIT-V	Bryophyta: General account of Anthocerotales (Anthoceros and Notothyllus, Funariales (Funaria), Sphagnales(Sphagnum), Andraeales(Andraea) and Polytrichales (Polytrichum).

Part C :-Learning Resources

1	Smith G. M.~ Cryptogamic Botany VoL I(2nd edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
2	Kumar H. D. 1988: Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.
3	Parihar~ N.S. 1991: Bryophyta. Central Book Depot. Allahabad.
4	Brower~ 1926: Primitive Land Plants~ Cambridge At the University Press.
5	Kashyap~ 1972 Liver worts of Western Himalayas and Punjab. Research co Publication.
6	Smith, G. M.~ Cryptogamic Botany VoL I (2nd edition)~ TataMc Graw -Hill Publishing Company~ Bombay -New Delhi.
7	Puri P. 1980~ Bryophyta -Morphology, Growth & Differentiation. Atmaram & Sons, Delhi.
8	Chopra & Kumar~ 1988: Biology of Bryophyta; Wiley Eastern Ltd.
9	Ram Udar; 1970: An Introduction to Bryophyta; Shashidhar Malviya Prakashan
10	Watson; 1968: Structure and life of Bryophyta; Hutchinson & Co. Ltd.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	75

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. I Sem.

Subject : Botany

Paper –III

Title of Paper: Biology & Diversity of Pteridophytes & Gymnosperms

Code of the paper: BO13

Part A : Introduction for code-- BO13		
1	Pre-requisite (if any)	The students must have passed B.Sc. with Botany
2	Course Objectives	The paper is aimed to introducing the students for Biology & Diversity of Pteridophytes & Gymnosperms
	Course Learning Outcomes	1- General characters, Classification and life history of Pteridophytes.
		2- General account of different Pteridophytes.
		3- General account classification and life history and economic importance of Gymnosperms.
		4- General account of order Pentoxylales, Ginkgoales etc.
		5- Morphology structure and reproduction Gnetales.

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. I Sem. Botany

Paper III

Biology & Diversity of Pteridophytes & Gymnosperms

UNIT-I	Pteridophyta: General characters and life history of pteridophytes. Classification of Pteridophyta. Evolution of stele. Heterospory and origin of seed habit. Basic idea about paleobotany Fossilization and Types of Fossils.
UNIT-II	Pteridophyta: General account of Psilopsida-(Rhynia,Psilotum); Morphology, anatomy, reproduction and life history of 1- Lycopsida (Lycopodium,Sellaginella): 2-Sphenosida(Equisetum):3- Pteropsida (Pteridium, Adiantum)
UNIT-III	Gymnosperms:General Characters and life history of gymnosperms. Classification of gymnosperms (Pant and Raizada; Bierhort). Economic importance of gymnosperms. General account of Pteridospermales.
UNIT-IV	Gymnosperms: (1) General account of Cycadeoidales (Williamsonia) (2) Pentoxylales (Pentoxylon) (3) General account of Cordaitales(Cordaites, Mesoxylon) (4) General account of Cycadales(Cycas) (5) General account of Ginkgoales(Ginkgo)
UNIT-V	Gymnosperms: (1) Morphology, structure and reproduction of Coniferales(Pinus,Thuja) (2) Morphology, structure and reproduction of Ephedrales(Ephedra) (3) Morphology, structure and reproduction of Welwitschiales(Welwitchia) (4) Morphology,structure and reproduction of Gnetales(Gnetum).

Part C :-Learning Resources

1	Bhatnagar, S.P. and Moitra, A; 1996: Gymnosperms. New Age International Pvt. Ltd., New Delhi.
2	Singh H.; 1978: Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.
3	Sporne K R; 1991: The Morphology of Gymnosperms; Hutchinson Univ. Library; London.
4	Foster A S. & Gifford E. M; Comparative morphology of vascular Plants; Vakils, Feffer, & Simons Private Ltd. Bombay.
5	Chamberlain; Gymnosperms -Structure & Evolution; CBS Publishers & Distributors Delhi.
6	Shukla A C. & Mishra S. P.; Essentials of Paleobotany; Vikas Publishing House Pvt. Ltd. Delhi-Bombay-:6angalore-Calcutta-Kanpur.
7	Campbell; 1939: The evolution of land plants; Stanford University.
8	Sporne, K.R. 1991. The Morphology of Pteridophytes.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar **(Model, Autonomous) Science College, Indore (M.P.)**

Department of Botany

Class : M.Sc. I Sem.

Subject : Botany

Paper –IV

Title of Paper: Plant Ecology

Code of the paper: BO14

Part A : Introduction for code-- BO14		
1	Pre-requisite (if any)	The students must have passed B.Sc. with Botany
2	Course Objectives	The paper is aimed to introducing the students for Plant Ecology
	Course Learning Outcomes	1- Understand the concept of ecosystem.
		2- Learn about cycling of minerals in ecosystem.
		3- Know about ecological succession.
		4- Learn about concept of community.
		5- Learn about population ecology.

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. I Sem. Botany

Paper IV

Plant Ecology

UNIT-I	Ecology and Ecosystem: Definition; Tropic organization and structure; Food chains & webs; Energy flow pathways; Ecological efficiencies, consumption, assimilation and production; Primary production; Methods of measurement of primary production, Limiting factors.
UNIT-II	Ecosystem: Fate of matter in ecosystems: Recycling pathway; Relationship between energy flow and recycling pathways; Nutrient exchange and cycling; Biogeochemical cycles, (C, N, P and S); Physical, chemical and biological characteristics of soil, Soil Carbon Sequestration.
UNIT-III	Ecosystem: Ecosystem development and stability: Temporal changes cyclic and non cyclic; Succession processes & types; Mechanism of succession facilitation; Tolerance and inhibition models; Concept of climax community. Ecological perturbation (Natural and Anthropogenic); Ecosystem restoration.
UNIT-IV	Ecosystem: Community organization: Concepts of community and continuum; Analysis of community (analytical and synthetic characters); Community coefficients. Indices of diversity; inter-specific association; negative and positive inter action concept of ecological niche; Concepts of biodiversity; evolution and differentiation of species. allopathric & sympatric speciation; Ecads and Ecotypes
UNIT-V	Population Ecology: Population & Environment; Density & distribution; Natality; Mortality; Survivorship curves, Age structure & pyramids; Fecundity schedules, Life tables; Population growth. Exponential and logistic curves; Intra specific competition and self regulation; r-and k-strategies.

Part C :-Learning Resources	
1	Smith. R.L. 1996. Ecology and Field Biology. Harper Collins. New York.
2	Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
3	Begon. M.. Harper, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science. Cambridge.
4	Ludwig. J. and Reynolds. J.F. 1988. Statistical Ecology. John Wiley & Sons.
5	Odum. E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.
6	Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
7	Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California
8	Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
9	Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. t::ambridge University Press, Cambridge, U.K.
10	Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.

Part D :-Assessment and Evaluation		
Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	75

Govt. Holkar Science College, Indore (M.P.)

M.Sc. Botany Syllabus

Choice - Based Credit System (CBCS)

CORE SUBJECT: BOTANY – [Post Graduate]

Year 2021-22

DEGREE: M.Sc. Botany

I SEMESTER PRACTICAL - 1

Practical Based on Theory Paper 1 & 2

Time – 4 Hrs **Max. Marks - 75**

1.	Microbiology exercise.	-	10
2.	Study of Mycological Material.	-	10
3.	Study of Algae Material	-	10
4.	Study of Bryophyte.	-	15
4.	Spot (1-5)	-	15
5.	Viva - Voce	-	05
6.	Record & Sessional.	-	10
	Total	-	75

Govt. Holkar Science College, Indore (M.P.)

M.Sc. Botany Syllabus

Choice - Based Credit System (CBCS)

CORE SUBJECT: BOTANY – [Post Graduate]

Year 2021-22

DEGREE: M.Sc. Botany

I SEMESTER PRACTICAL - 2

Practical Based on Theory Paper 3 & 4

Time – 4 Hrs **Max. Marks - 75**

1.	Study of Pteridophyte material.	-	15
2.	Detailed Study of Gymnosperm Material.	-	15
3.	Major ecological exercise.	-	10
4.	Minor ecological exercise.	-	05
5.	Spotting. (1-5)	-	15
6.	Viva.	-	05
7.	Record & Sessional.	-	10
	Total	-	75

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. II Sem.

Subject : Botany

Paper –I

Title of Paper: Plant Development & Reproduction

Code of the paper: BO21

Part A : Introduction for code-- BO21		
1	Pre-requisite (if any)	The students must have passed M.Sc. I Sem with Botany
2	Course Objectives	The paper is aimed to introducing the students for Plant Development & Reproduction
	Course Learning Outcomes	1- To study plant development, meristems, nodal anatomy.
		2- Study of primary and secondary anomalies.
		3- ABC model of flower development, Microsporogenesis.
		4- To study megasporogenesis and types of embroy sac.
		5- To study double fertilization, endosperm, embryo development.

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. II Sem. Botany

Paper - I

Plant Development & Reproduction

UNIT-I	Plant Development: Unique features of plant development; Organization of root and shoot apical me Plant Development meristems. Leaf- leaf growth and differentiation. Root-stem organization; Nodal anatomy.
UNIT-II	Plant Development: Cell fates and lineages; Tissue differentiation specially xylem and phloem, Secretary Ducts and laticifiers; Secondary growth; Primary and secondary anomalies. Wood development in relation to environmental factors.
UNIT-III	Reproduction: Vegetative propagations and sexual reproduction. Flower is a modified shoot ; Flower development (A,B,C models) and genetics of floral-organ differentiation; Homeotic mutants in Arabidopsis and Antirrhinum; Androecium; Structure of anther; Microsporogenesis; Role of tapetum; Pollen development; Male sterility.
UNIT-IV	Reproduction: Structure of Pistil; Ovule development; Megasporogenesis and megagametogenesis; Monosporic, bisporic and tetrasporic embryo sacs; Pollination; Pollen tube greet and guidance; Pollen stigma interaction; Parthenocarpy
UNIT-V	Reproduction: Sporophytic and gametophytic-self-incompatibility; Double fertilization and triple fusion; Endosperm development; Embryogenesis, Development of monocot & dicot embryo; Polyembryony; Apomixes. Dynamics of fruit growth. Fruit maturation

Part C :-Learning Resources

1	Bhojwani,S.S.and Bhatnagar,S.P.2000. The Embryology of Angiosperms(4th revised and enlarged edition). Vikas Publishing House,New Delhi.
2	Burgess.J.1985.An introduction to Plant Cell Development.Cambridge University Press,Cambridge.
3	Fageri,K.and Van der Pijl,L1979. The Principles of Pollination Ecology .Pergamon Press,Oxford.
4	Fahn, A 1 982.Plant Anatomy.(3rd edition).Pergamon Press,Oxford.
5	F osket, D .E.1994 .Plant Growth and Development. A Molecular Approach.Academic Press,San Diego.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. II Sem.

Subject : Botany

Paper –II

Title of Paper: Morphology & Taxonomy of Angiosperms

Code of the paper: BO22

Part A : Introduction for code-- BO22		
1	Pre-requisite (if any)	The students must have passed M.Sc. I Sem with Botany
2	Course Objectives	The paper is aimed to introducing the students for Morphology & Taxonomy of Angiosperms
	Course Learning Outcomes	1- They will fully understand the concepts of floral morphology.
		2- They will understand modern trends in Taxonomy
		3- They will be capable to identify diagnostic characters of major orders and families of Angiosperms.
		4- The students will be able to prepare artificial key for plants
		5- They will learn teamwork which can be used plant conservation.

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. II Sem. Botany

Paper - II

Morphology & Taxonomy of Angiosperms

UNIT-I	Morphology: Morphology of stamens, Morphology of carpel, carpel evolution, Morphology of inferior ovary; Placentaion -types and their origin.
UNIT-II	Taxonomy: The species concept; Taxonomic hierarchy, Binomial nomenclature & ICBN; Modern trends in taxonomy; Morphology, Anatomy, Palynology, Embryology, Cytology,and Phytochemistry in relation to taxonomy.
UNIT-III	Taxonomy: Systems of angiospermic classifications - Phenetic versus Phylogenetic systems: Classifications proposed by 1- Benthem and Hooker 2- Takhtazan 3- Dahlgren; Merits & demerits of above classifications; Taxonomic tools- herbarium and floras.
UNIT-IV	Taxonomy: Floral structure and phylogeny of – a- Ranales b- Caryophyllales c- Rosales d- Euphorbiales
UNIT-V	Taxonomy: Floral structure and phylogeny of – a- Asterales b- Lamiales c- Orchidales d- Greminales

Part C :-Learning Resources

1	Heywood & Moore, D.M; 1984: CWTent concept in Plant Taxonomy Academic Press.
2	Banson, L.B.; 1957: Plant Classification, Health & Co. Boston.
3	Davis, P.R & Heywood, V.H 1973: Principles of Angiosperms and Taxonomy, Robert E.
4	Kreiger Pub. Co. New York, USA
5	Eames, AI.; 1961: Morphology of Angiosperms, Mc-Graw Hill, New York.
6	Jeffery, C.; 1968: An Introduction to Plant Taxonomy J. & H. Churchill Limited.
7	Lawrence, G .H.M.; 1951: Taxonomy of Vascular Plants Macmillan, New York.
8	Naik V. N.; 1984: Taxonomy of Angiosperms. Tata Mc-Graw Hill Pub. Co. Ltd. New Delhi.
9	Porter, L.L.; 1959: Taxonomy of Flowering Plants. San Francisco. Radfor~ AE. Dickinson,
10	W.C. MasseyJ.R and. Ben. C.R: 1974: VQ~llar Plant SYstematics, Harper & Row, New York
11	Core E.L.; Plant Taxonomy.
12	Heywood V.H.: Plant Taxonomy
13	Nath R. : Plant Taxonomy.
14	Clive A. Stace : Taxonomy.
15	Houpt. A.W. Plant Morphology
16	Bold H.C. Plant Morphology
17	Biol H.C. Plant Morphology

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	75

Govt. Holkar Science College, Indore (M.P.)

M.Sc. Botany Syllabus

Choice - Based Credit System (CBCS)

CORE SUBJECT: BOTANY – [Post Graduate]

Year 2021-22

DEGREE: M.Sc. Botany

II SEMESTER PRACTICAL - 3

Practical Based on Theory Paper 1 & 2

Time – 4 Hrs **Max. Marks - 75**

1.	Major exercise based on Anatomy.	-	15
2.	Major exercise based on Taxonomy.	-	15
3.	Minor exercise based on Taxonomy.	-	10
4.	Minor exercise based on Embryology/Placentation	-	05
5.	Spot 1 to 5	-	15
6.	Viva-Voce	-	05
7.	Sessional/Record	-	10
	Total	-	75

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. II Sem.

Subject : Botany

Paper –III Utilization & Conservation of Plant Resources

Title of Paper:

Code of the paper: BO23

Part A : Introduction for code-- BO23		
1	Pre-requisite (if any)	The students must have passed M.Sc. I Sem with Botany
2	Course Objectives	The paper is aimed to introducing the students for Utilization & Conservation of Plant Resources
	Course Learning Outcomes	1- Students will get information about Natural Resources, their availability and use and also about types of forest in the world.
		2- They can well understand the economic important of forest plants regarding their medicinal important and importance of non wood forest products like Gum plant, Fodder plant etc.
		3- Different conservation practices for forest and natural resource conservation and its information will understood.
		4- Students can make their carrier in forest and plant product and other related field like aquatic habitat.
		5- The importance of Air, Water and Soil Pollution. Kinds, Resource, and effect of their pollution on ecosystems, Climate changes sources, Greenhouse gases, Global warming, and Ozone layer dip lection can be understood.

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. II Sem. Botany

Paper - III

Utilization & Conservation of Plant Resources

UNIT-I	Major Biomes of the world- Tropical, Temperate(Boreal and Seasonal forests, rain) & Seasonal Forests; Grasslands, Deserts; Aquatic Ecosystems(wetlands, Lake ,Pond, River, Stream, Estuarine), Marine-habitats.
UNIT-II	Organization of Resources- utilization of Resources from forest, grassland and aquatic habitat ; Food forage, Fodder, Timber & Non-wood forest products; Threats to quality & quantity of resources due to over exploitation.
UNIT-III	Conservation of resources: Classifications of resources; Principles of conservation; In-situ conservation, sanctuaries, National parks, Biosphere reserves for wildlife conservation; Habitat conservation practices of conservation for forests, ranges, soil and water; Ex-situ conservation- Botanical gardens, field gene banks, seed banks, Cryobank, Microbial repositories and Medicinal plant repositories.
UNIT-IV	Pollution & Climate Change: Air, Water and Soil pollution, Kinds, Sources, Quality parameters, Effects on structure & function of ecosystems; Management of pollution; Bioremediation; Climate changes sources, Trends & role of greenhouse gases, Effect of global warming on climate, Ecosystem processes & Biodiversity; Ozone layer & Ozone hole.
UNIT-V	Resource monitoring: Remote sensing concepts & Tools, Satellite remote sensing basics sensors, Visual & digital interpretation, EMR bands and their applications; Indian remote sensing programme; thematic mapping of resources Application of remote sensing in Ecology & Forestry.GIS

Part C :-Learning Resources

1	Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.
2	Treshow. M. 1985. Air Pollution and Plant Life. Wiley Interscience.
3	Heywood, V.H. and Watson. R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.
4	Mason, C.F. 1991. Biology of Freshwater Pollution. Longman. '
5	Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press.
6	Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.
7	Kothari, A 1997. Understanding Biodiversity: Life'Sustainability and Equity. Orient Longman.
8	Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994. Tree Directory of Chandigarh.Lovedale Educational, New Delhi.
9	Nair, M.N.B. et. al (Eds) 1998. Sustainable Management of Non-wood Forest Products.
10	Faculty of Forestry, Universiti Putra Malaysia. 434004 PM Serdong, Selangor, Malaysia.
11	Paroda, R.S. and Arora, R.K. 1991. Plant Genetic Resources Conservation and Management. IPGRI (Publication) S0uth Asia Office, C/o NBPGR, Pusa Campus, New Delhi.
12	Pjmentel, D. and Hall, C.W. (eds) 1989. Food.and Natural Resources. Academic Press, London-New York. .

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	75

Government Holkar **(Model, Autonomous) Science College, Indore (M.P.)**

Department of Botany

Class : M.Sc. II Sem.

Subject : Botany

Paper –IV Cell Biology

Title of Paper:

Code of the paper: BO24

Part A : Introduction for code-- BO24		
1	Pre-requisite (if any)	The students must have passed M.Sc. I Sem with Botany
2	Course Objectives	The paper is aimed to introducing the students for Cell Biology
	Course Learning Outcomes	1- Understand the structure of plant cell.
		2- Learn about various models and functioning of plasma membrane.
		3- Know about various cell organelles of plant cell'
		4- Understand chromosome structure and cell cycle.
		5- Know about breeding behavior in plants.

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. II Sem. Botany

Paper - IV

Cell Biology

UNIT-I	Structural organization of the plant cell; specialized plant cell types. Biogenesis, structure and functions of cell wall. Cytoskeleton: organization and role ofmicrotubules and microfilaments. Chemical composition of cell wall.
UNIT-II	Plasma membrane: structure, models and functions; sites for ATPases; ion carriers,channels and pumps; receptors. Structure of plasmodesmata, role in movement of molecules; comparison with gap junctions. vacuoles: tonoplast membrane,
UNIT-III	Cholorplast: structure, genome organization, gene expression, nucleo-chloroplastic interactions; mitochondira: structure, genome organization, biogenesis. Plant ATPases, trasporters, as storage organelle. Other cell organelles: golgi apparatus, lysosomes, endoplasmic reticulum.
UNIT-IV	Nucleus: structure. Cell cycle: control mechanisms; role of cyclins and cyclindependent kinases; mechanisms of programmed cell death. Chromosome structure and packaging of DNA; euchromatin and heterochromatin; karyotype analysis and evolution; banding patterns; specialized types of chromosomes.
UNIT-V	Origin, meiosis and breeding behaviour of duplication, deficiency, inversion and translocation heterzygotes; origin, occurrence, production and meiosis of haploids,aneuploids and euploids; Origin and production of autopolyploids. Allopolyploids; types, genome constitution and analysis.

Part C :-Learning Resources

1	Lewin, B. 2000, Genes VIL Oxford University Press, New York.
2	Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing:Inc., New York.
3	Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA
4	Rost, T. et: al. 1998.Plant Biology, Wadsworth Publishing Co., California, U.S.A
5	Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton,Florida U.S.A
6	Buchanan, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants.
7	Plants. American Society of Plant Physiologists, Maryland, USA
8	De, D.N. 2000: Plant Cell Vacuoles: An Introduction. CSIRO Publication, ColliJ18W~Australia.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	75

Govt. Holkar Science College, Indore (M.P.)

M.Sc. Botany Syllabus

Choice - Based Credit System (CBCS)

CORE SUBJECT: BOTANY – [Post Graduate]

Year 2021-22

DEGREE: M.Sc. Botany

II SEMESTER PRACTICAL - 4

Practical Based on Theory Paper 3 & 4

Time – 4 Hrs **Max. Marks - 75**

1.	Exercise based on cell biology.	-	15
2.	Exercise based on Cytogenetics.	-	15
3.	Morphology, anatomy and Economic Important of any (Food/Forage/Fibre oil Yielding)	-	10
4.	Report of Field Survey Prescribed in Syllabus.	-	05
5.	Spotting 1 to 5	-	15
6.	Viva-Voce	-	05
7.	Sessional and Record	-	10
	Total -		75

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. III Sem.

Subject : Botany

Paper –I

Title of Paper: Plant Physiology

Code of the paper: BO31

Part A : Introduction for code-- BO31		
1	Pre-requisite (if any)	The students must have passed M.Sc. II Sem with Botany
2	Course Objectives	The paper is aimed to introducing the students for To learn various physiological activities of plant like osmosis, transpiration, phytohormones, photoperiodism and vernalization.
	Course Learning Outcomes	1- Plant Physiology is a paper in M.Sc. classes to know the Physiological
		2- Phloem transport, loading and unloading. Proteins, phospholipids signaling
		3- Study of Plant growth regulator
		4- Study of Photoperiodism and Vernalization
		5- Students should learn stress physiology

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. III Sem. Botany

Paper –I

Plant Physiology

UNIT-I	Osmotic relation of plant cells-osmosis and diffusion, Osmotic pressure, Wall pressure , turgor pressure, DPD, water potential, Absorption of water, Ascent of sapTranspiration, Mechanism of water transport through xylem.
UNIT-II	Phloem transport, loading and unloading. Passive and active solute transport. Signal transduction over view, receptors, Proteins, phospholipids signaling, role of cyclic nucleotides Calcium calmodulin cascade
UNIT-III	Plant growth regulator and elicitors; physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines jasmonic acid and salicylic acid. Harmone receptors.
UNIT-IV	Flowering process- Photoperiodism and its significance. Endogenous clock and its regulation. Floral induction and development Phytochrome and cytocrome, their photochemical and biochemical properties Vernalization
UNIT-V	Stress physiology Plant responses to biotic and abiotic stress, Water deficit and drought resistance. Salinity stress and resistance, Concept of freezing, heat and oxidative stresses.

Part C :-Learning Resources

1	Radioisotope methodology, autoradiography, instrumentation (GM counter and scintillation counter) and principles involved
2	Priniciples of colorimetry,spectrophotometry, and florimetry/calorimetry.
3	Determine rate of transpiration by Ganong's potometer
4	Determine rate of respiration in germinating/young buds by Ganong's respirometer

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. III Sem.

Subject : Botany

Paper –II

Title of Paper: Plant Biochemistry and Metabolism

Code of the paper: BO32

Part A : Introduction for code-- BO32		
1	Pre-requisite (if any)	The students must have passed M.Sc. II Sem with Botany
2	Course Objectives	The paper is aimed to introducing the students for To study enzymology, photosynthesis, respiration and nitrogen,sulphur , nitrogen fixation
	Course Learning Outcomes	1- To Study different bio chemical and metabolic function of plants
		2- To learn about photosynthesis, photorespiration and its significance
		3- To learn about over view of respiration
		4- To learn about Lipid and Sulphate Metabolism Structure and function of lipids
		5- Study of Nitrogen Metabolism

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. III Sem. Botany

Paper –II

Plant Biochemistry and Metabolism

UNIT-I	Fundamental Enzymology Characters and classification of Enzymes.; Factors affecting enzymetic activities. Allosteric mechanism, Regulatory and active site, isoenzymes. Mechanism of enzyme action Michalis Menton equation and its significance. Inhibition of enzymes- competitive ,noncompetitive and mixed inhibition.
UNIT-II	Photochemistry and photosynthesis. General concept, evolution of photosynthetic apparatus, Photosynthetic pigments and photosystem, Photo-oxidation of water, mechanism of electron and proton transport. Carbon assimilation- calvin cycle, photorespiration and its significance, C4 cycle. Factors affecting photosynthesis.
UNIT-III	Respiration- general Concept. Overview of plant respiration, Glycolysis, TCA cycle Electron transport and ATP synthesis, Oxidative Pentose phosphate Pathway. Glyoxalate cycle, alternative oxidase system, Structure and function of ATP.
UNIT-IV	Lipid and Sulphate Metabolism Structure and function of lipids. Fatty acid biosynthesis and oxidation Ketone bodies. Sulphate uptake, transport and assimilation.
UNIT-V	Nitrogen Metabolism Nitrogen metabolism over view Nitrogen fixation mechanism Nodule formation Ammonium assimilation

Part C :-Learning Resources

1	Effect of time and enzyme concentration on the rate of reaction of enzyme C e.g. acid phosphate, nitrate reductase.
2	Effect of substrate concentration on activity of any enzyme C(catalase, amylase).
3	Demonstration of the substrate inducibility of the enzyme nitrate reductase..
4	Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.
5	Separation of isoenzyme of esterase, peroxidases by native polyacrelamide gel electrophoresis.6- 6-6. To demonstrate photophosphorylation in intact chloroplast, resolve the phosphoproteins by SDS-PAGE and perform autoradiography desalting of proteins by gel filtration chromatography embaying Sephadex G-25.
6	Extraction of seed proteins depending upon the solubility.
7	Desalting of proteins by gel filtration chromatography employing Sephadex G-25.
8	Preparation of standard curve of protein and estimation of protein contents in extracts of plant material by Lowry's Bradford's method.
9	Fraction of proteins using gel filtration chromatography by Sephadex G-100 or Sephadex G-200.

Part D :-Assessment and Evaluation

Saggested cntinmous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Govt. Holkar Science College, Indore (M.P.)

M.Sc. Botany Syllabus

Choice - Based Credit System (CBCS)

CORE SUBJECT: BOTANY – [Post Graduate]

Year 2021-22

DEGREE: M.Sc. Botany

III SEMESTER PRACTICAL - 5

(Practical Based on Theory Paper 1 & 2)

Time – 4 Hrs **Max. Marks - 75**

1.	Major exercise based on Paper 1.	-	15
2.	Major exercise based on Paper 2.	-	15
3.	Minor exercise based on Paper 1.	-	10
4.	Minor exercise based on Paper 2	-	05
5.	Spot 1 to 5	-	15
6.	Viva-Voce	-	05
7.	Sessional/Record	-	10
		Total -	75

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. III Sem.

Subject : Botany

Paper –III-A Elective -1

Title of Paper: Cytology and Genetics

Code of the paper: BO33-I

Part A : Introduction for code– BO33-I		
1	Pre-requisite (if any)	The students must have passed M.Sc. II Sem. with Botany
2	Course Objectives	The paper is aimed to introducing the students for Study of plant cell and cell organalles with study of chromosome, mutation and laws of genetics.
	Course Learning Outcomes	1- Understand the structure of plant cell
		2- Learn about various models and functioning of plasma membrane.
		3- Know about various cell organelles of plant cell
		4- Understand chromosome structure and cell cycle
		5- To Study Mendel's laws of inheritance

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. III Sem. Botany

Paper –III-A

Cytology and Genetics

UNIT-I	**Cell wall:** Structure; function; growth and cell differentiation. Plasma membrane: Membrane architecture (fluid mosaic model); sites for ATPases; membrane transport - ion carriers.. **Plasmodesmata:** Structure, role in movement of molecules and macromolecules; Cellular organelles: Ultra-structure and function of golgi complex, lysosomes, peroxisomes, endoplasmic reticulum, mitochondria, chloroplast and plant vacuoles. **Cell shape and motility:** The cytoskeleton; organization and role of microtubules and microfilaments; motor movements, implications in flagellar & other movements, cell division. Nucleus: Ultrastructure, nuclear pores, nucleolus, DNA structure A, B and Z forms, replication in prokaryotic and eukaryotic cells, DNA replication proteins, damage and repair.
UNIT-II	Chromatin organization: Chromosome structure and packaging of DNA; molecular organization of centromere and telomere, rRNA genes, euchromatin and heterochromatin; Karyotype analysis and evolution, banding patterns; specialized types of chromosomes: polytene, lampbrush, B-chromosome, sex chromosome; molecular basis of chromosome pairing, C- value paradox, Cot curve and its significance.
UNIT-III	Structural and numerical changes in chromosomes; origin, breeding behavior of 1duplications, deficiency, inversion and translocation heterozygotes; effect of aneuploidy on plants; transmission of trisomics and monosomics and their use in chromosome mapping; complex translocation heterozygotes, translocation tester sets; Robertsonian translocation.
UNIT-IV	Mutations: Spontaneous and induced; physical and chemical mutagens; molecular basis; transposable genetic elements; site directed mutagenesis; role of mutations in crop improvement; induction of polyploidy Epigenetics: Introduction; paramutations in maize; Epigenetics and Lamarckism; Epigenome and epigenomics.
UNIT-V	Mendel's laws of inheritance; chromosome theory of inheritance; deviations from Mendel's findings; ; , suppressors and pleiotrpic genes; multiple alleles and isoalleles (example Corn, Drosophila and Nicotiana); multigene families, Cytoplasmic inheritance and interaction of genes. sex determination.

Part C :-Learning Resources

1	Gupta P K 2007 Genetics: Classical to Modern. Rastogi Publications, Meerut.
2	Hexter W and Yost Jr. H T 1977 The Science of Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
3	Hartl D L and Jones E W 1998 Genetics: Principles and Analysis (4thed.). Jones and Barflett Publishers, USA.
4	Khush G S 1973 Cytogentics of Aneuploids.Academic press, New York.
5	Snustad D P and Simmons M J 2000 Principles of Genetics (2nded.) John Wiley and Son Inc., USA.

Part D :-Assessment and Evaluation

Saggested cntinmous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. III Sem.

Subject : Botany

Paper –III-B Elective -1

Title of Paper: Economic Botany

Code of the paper: BO33-II

Part A : Introduction for code-- BO33-II		
1	Pre-requisite (if any)	The students must have passed M.Sc. II Sem. with Botany
2	Course Objectives	The paper is aimed to introducing the students for To study economic importance of plants in agriculture, Global warming, Soil fertility.
	Course Learning Outcomes	1- Study of Global warming and climate change
		2- To learn about medicinal plant of India and their uses
		3- To Study plants of economic importance - Vegetables, oil yielding plants, wild edible plants, food crops, spices and condiments, Forage- fodder plants
		4- Study of Plant products and production
		5- To study organic farming and bio-fertilizers

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. III Sem. Botany

Paper –III-B

Economic Botany

UNIT-I	Plants, energy and global warming (15) • Introduction to plants, plant resources and their importance l to human race and survival (5) • Plants as key solution for major global problems viz. Energy, pollution control, agricultural productivity, global warming, climate change, soil fertility and conservation etc. (10)
UNIT-II	Plants and Industries (15) • Medicinal plants of India, Importance and uses.(3) • Plants as Ayurvedic, Allopathy and Unani medicines (3) • Cottage Industries • Fermentation, Ethyl Alcohol Fermentation (2) • Citric acid Fermentation (2) • Mushroom Cultivation (4)
UNIT-III	Plants and plant products (15) • Vegetables, oil yielding plants, wild edible plants, food crops, spices and condiments, Forage- fodder plants (5) • Fibre yielding plants, textile fibres, cordage fibres, fibres for stuffing (3) • Important timber yielding plants and non-wood forest products (2)
UNIT-IV	Plant products and production (15) • Resin, dye, tannin and gum yielding plants and their applications(2) • Grasses, their economic importance (3), Organic farming (3), Mushroom cultivation (3), Vine production(2), and Beer production(2)
UNIT-V	Soil Biology and Organic farming • Soil: Definition and Composition, mode of origin of soil, formation of soil, factors affecting soil formation. • Soil profile, soil types soil components. • Soil organisms, soil micro organisms, rhizosphere and rhizoplane micro-organisms. • Organic farming, and bio-fertilizers.

Part C :-Learning Resources

1	A manual of ethnobotany Ed., S. K. Jain, Eciatific publications Jodhpur
2	Advances in Oilseeds Production and Technology, G. V. Ramanamurthy. ICAR New Delhi (1985)
3	Agricultural Botany. N. T. Gill and K. C. Vear. GaralDuekworth and Co. Ltd. London (1969)
4	Agrofrestry India Perspeetive. L.K. Jha and P. K. Sengupta. Ashish Publishing House., New Delhi
5	Applied Ethnobotany – E.Varghesee S-VD
6	Crop Protection Principles and Practices, S.R. Chapmen and L.P. Carter. Publ. W. H. Freeman and Company Son Fran (1976)
7	Economic Botany, Hill A. Mcgrow Hill Book Company (1962)
8	Energy Plant Species. Their use and impact on environment and development. N. El. Bassam. Publ. James and James (Science Publishers) U. K. (2005)
9	Field crops of India by A.K. Aiyer. Banglore Printing and Publishing Company Bangalore (1966)
10	Forest Resources – Crises and Management Natraj Publishers, Dehradun. Vandana Shiva, V. M. Meherhomji and N.D. Joryal (1992)
11	Forestry and the People (1994) L. K. Jha and P. K. SenSharma .Ashish Pub. House, New Delhi.
12	Forestry Research and Education in India. P.D. Dogra and R C. Dhiman (edt.) 1994. ADiamond Jubilee Publication by INSA, New Delhi.
13	Handbook of Agriculture, ICAR New Delhi (1969)
14	New Crops for Food and Industry. Ed. G. E. Wickens. N. Hag, P.Day, Chapmen and Hall Publi. London Ogorzaly, McGraw Hill Intenational Edition (1986)

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. III Sem.

Subject : Botany

Paper –IV-A Elective -2

Title of Paper: Molecular Biology

Code of the paper: BO34-I

Part A : Introduction for code-- BO34-I		
1	Pre-requisite (if any)	The students must have passed M.Sc. II Sem. with Botany
2	Course Objectives	The paper is aimed to introducing the students for To learn about structure and types of DNA, genes, molecular and immunology techniques.
	Course Learning Outcomes	1- Study of different types of DNA, RNA
		2- To learn about fine structure of genes
		3- Study of Protein synthesis
		4- To Study different Molecular techniques
		5- To Study Immuno techniques ELISA, FISH, GISH

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. III Sem. Botany

Paper –IV-A

Molecular Biology

UNIT-I	DNA structure, A, B and Z forms DNA replication in prokaryotes and eukaryotes Satellite and repetitive DNA Plant promoters Structure of t-RNA, m-RNA and r-RNA. DNA damage and repair
UNIT-II	Fine structure of gene., split gene, overlapping gene Cis trans test, Gene expression in prokaryotes and eukaryotes and their regulation. Gene interaction.
UNIT-III	Mechanisms of transcription, translation, initiation, elongation and termination in prokaryotes and eukaryotes, transcription factors., m-RNA splicing. Protein sorting and protein targeting, physical mapping – restriction mapping, Sequenced tagged site (STS) mapping, Chromosome walking.
UNIT-IV	Molecular techniques- basic concept, principles, technique and application Gel electrophoresis. In situ hybridization, Southern blotting technique, Northern blotting technique, Western blotting technique. Dot blot technique
UNIT-V	Immuno techniques- precipitin test, agglutination, complement fixation test, radio immune assay, immunosorbent assay, ELISA. Florescent antibody technique-Flow cytometry Florescent in situ hybridization (FISH) Genomic in situ hybridation (GISH)

Part C :-Learning Resources

1	Alberts. B. Bray,, D. Lewis, J. Raff: M. Roberts, K. and Watson. J.D. 1989 Molecular Biology of the cell (2nd edition). Garland Publishing Inc.m New York. USA.
2	Karp. G. 1999 Cells and molecular Biology: Concepts and Experiments John Wiley & Sons, Inc. USA.
3	Malacinski. G.M. and Freifelder, D. 1998. Essentials of Molecular Biology (3M editon). Jones and Barlett Publishers, Inc. London.
4	Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing of the Cell Garland Publishing : Inc. New York.
5	Alberts. B. Bray,, D. Lewis, J. Raff: M. Roberts, K. and Watson. J.D. 1999 Molecular Biology of the cell (2nd edition). Garland Publishing Inc.m New York. USA.
6	Genetics by BD Singh Kalyani Publication

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. III Sem.

Subject : Botany

Paper –IV-B Elective -2

Title of Paper: Advance-Taxonomy, Embryology and Anatomy of Angiosperm

Code of the paper: BO34-II

Part A : Introduction for code-- BO34-II		
1	Pre-requisite (if any)	The students must have passed M.Sc. II Sem. with Botany
2	Course Objectives	The paper is aimed to introducing the students for Advance-Taxonomy, Embryology and Anatomy of Angiosperms
	Course Learning Outcomes	1- To learn Modern systems of classification in the light of New Concepts of classification
		2- To study of evolution of Angiosperms Origin of Flower
		3- To study Tissues and Tissues systems
		4- To study Embryology and its prospects
		5- To study polyembryony embryo culture Seed and seed germination

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. III Sem. Botany

Paper –IV-B

Advance-Taxonomy, Embryology and Anatomy of Angiosperm

UNIT-I	Taxonomy History of plants taxonomy: Modern systems of classification in the light of New Concepts of classification (Hutchinson's and Cronquist's classifications).The principles of taxonomy: Rules of Nomenclature (ICBN). Tools of Taxonomy: Preservation, documentation (Flora and Monographs), Botanical gardens and Herbaria
UNIT-II	Fossil history, phylogeny and evolution of Angiosperms. Phylogeny and floral evolution in Amentiferae, Tubifloerae, Helobiales and Glumales. Families of heterotrophic angiosperms (Parasitic, saprophytic and Insectivorous) Orobanchaceae, Balanophoraceae, Loranthaceae, Convolvulaceae, Refflesiaceae, Santalaceae, and Nepenthaceae. Origin of Flower: New concept.
UNIT-III	Anatomy: Techniques used in the study of anatomy and histology.Primary and secondary meristems, Tissues and Tissues systems. Seedling anatomy and their evolutionary singnificance. Stucture and classification of Stomata. Wood anatomy- porous and nonporous timber. The cambium and its derivatives. The Cork Cambium and its derivatives: Morphology and economic aspects of cork.
UNIT-IV	Embryology History and present status of plant embryology. Embryology and its prospects. Development of male reproductive structure in Angiosperms. Development of female reproductive structure in Angiosperms. Post fertilization changes in the embryo of monocot and dicot plants, nutritive tissue, and apomixes. Xenia and meta- xenia.
UNIT-V	Induced polyembryony, artificial induction of adventitive embryos. Control of fertilization, embryo culture, culture of ovaries and ovules, induced parthenogenesis Seed and seed germination, dynamics of seed growth. Biochemical changes during seed germination Induced parthenocarpy. Merits and demerits of Artificial and Terminator seeds.

Part C :-Learning Resources

1	Benson : Plant taxonomy
2	Benson : Plant classification
3	Bhojwani and Bhatnagar : Embryology.
4	Datta S.C. : Systemic Botany
5	Eams & Medenial : Plant Anatomy
6	Hutchinson : Phylogeny and classification of flowering Plants
7	Maheshwari : Introduction to Embryology of Angiosperm
8	Maheshwari : Recent advances in the embryology of angiosperms.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Govt. Holkar Science College, Indore (M.P.)

M.Sc. Botany Syllabus

Choice - Based Credit System (CBCS)

CORE SUBJECT: BOTANY – [Post Graduate]

Year 2021-22

DEGREE: M.Sc. Botany

III SEMESTER PRACTICAL - 6

(Practical Based on Theory Paper 3 &4)

Time – 4 Hrs **Max. Marks - 75**

1.	Major exercise based on Paper 3.	-	15
2.	Major exercise based on Paper 4.	-	15
3.	Minor exercise based on Paper 3.	-	10
4.	Minor exercise based on Paper 4	-	05
5.	Spot 1 to 5	-	15
6.	Viva-Voce	-	05
7.	Sessional/Record	-	10
		Total -	75

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. III Sem.

Subject : Botany

Paper –V Open Elective Paper

Title of Paper: Environmental Biology

Code of the paper: OE-EB

Part A : Introduction for code– OE-EB		
1	Pre-requisite (if any)	The students must have passed M.Sc. II Sem. (other than Botany)
2	Course Objectives	The paper is aimed to introducing the students for To learn about environmental Biology, ecosystem, Biogeochemical cycle, population, plants Biodiversity and different types of pollution, causes and control mechanism.
	Course Learning Outcomes	To study concept and scope of environmental biology
		To learn about Biogeochemical cycles.
		Concept of population: population growth forms
		To learn about Biodiversity
		To learn about different types of pollution and details

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. III Sem. Botany

Paper – V Open Elective Paper

Environmental Biology

UNIT-I	Concept and scope of environmental biology; environmental ethics, Ecosystem: concept, structure, functions and types of ecosystem; Food chains and Food web; Ecological pyramids.
UNIT-II	Biogeochemical cycles: concept; gaseous and sedimentary cycles (C, N, S, H2O Cycles); Soil: classification of soils, soil formation, Physical, biological, and chemical characters of soil.
UNIT-III	Concept of population: population growth forms; basic concept of growth rate, Inter-specific and intra-specific interaction; Commensalisms, Mutualism, Predation, Parasitism, Competition, Ecological niche.
UNIT-IV	Concept of Biodiversity: definition and importance; species diversity, generic diversity, Hot spots of biodiversity; Threats to biodiversity, biodiversity conservation. In-situ and ex-situ conservation; Botanical garden and Zoological Park.
UNIT-V	Concept of Pollution: definition, sources effect and Control of:- (i) Air pollution; (ii) Noise pollution; (iii) Water pollution; (iv) Soil pollution; (v) Thermal pollution. e-Waste; Green house gases; Global warming; Ozone depletion; Role of individual in pollution control.

Part C :-Learning Resources

1	Smith. R.L. 1996. Ecology and Field Biology. Harper Collins. New York.
2	Odum. E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.
3	Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
4	Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
5	Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. t::ambridge University Press, Cambridge, U.K.
6	Systemic Botany and Ecology, J.N. MItra.
7	Environment Studies, Dr. Anis Sidhiki, Dr. Rajiv Sharma.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. IV Sem.

Subject : Botany

Paper –I

Title of Paper: Plant Cell, Tissue & Organ Culture

Code of the paper: BO41

Part A : Introduction for code-- BO41		
1	Pre-requisite (if any)	The students must have passed M.Sc. III Sem with Botany
2	Course Objectives	The paper is aimed to introducing the students for Plant Cell, Tissue and Organ Culture
	Course Learning Outcomes	1- Plant tissue culture Introduction and scope.
		2- To study somatic embryogenesis
		3- To study protoplast culture and Somatic hybridization.
		4- To learn about Somoclonal variation and role of tissue culture
		5- To learn about Application of plant tissue culture

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. IV Sem.

Subject : Botany

Paper –II

Title of Paper: Biotechnology & Genetic Engineering

Code of the paper: BO42

Part A : Introduction for code-- BO42		
1	Pre-requisite (if any)	The students must have passed M.Sc. III Sem with Botany
2	Course Objectives	The paper is aimed to introducing the students for Biotechnology and Genetic Engineering
	Course Learning Outcomes	To learn about biotechnology and its tools and techniques.
		Genetic transfer, DNA finger printing and PCR.
		Transgenic crops and ethical issues related to it.
		Use of Biotechnology in use and development of economically important microbes.
		To know about basic concepts of Bioinformatics.

Part C :-Learning Resources

1. Alberts B.D. Lewis, J. Raff, M. Rubers, K. Nad Watson I.D. 1999 molecular Biology of Cell Garland pub.Co. Inc. New York, U.S.A.
2. P.K. Gupta 1999 a text Book of Cell and Molecular Biology Rastogi Pub. Meerut India.
3. Kleinsmith L.J. and Molecular Biology (2nd edition) Harper Collins College Pub. New York USA.
4. P.K. Gupta Genetics Rastogi Pub. Meerut.
5. Sinha & Sinha Cytogenics & Plant Breeding Vikas Pub.

Part D :-Assessment and Evaluation		
Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Govt. Holkar Science College, Indore (M.P.)

M.Sc. Botany Syllabus

Choice - Based Credit System (CBCS)

CORE SUBJECT: BOTANY – [Post Graduate]

Year 2021-22

DEGREE: M.Sc. Botany

IV SEMESTER PRACTICAL – 1

(Practical Based on Theory Paper 1 & 2)

Time – 4 Hrs **Max. Marks - 75**

1.	Major exercise based on Paper 1.	-	15
2.	Major exercise based on Paper 2.	-	15
3.	Minor exercise based on Paper 1.	-	10
4.	Minor exercise based on Paper 2	-	05
5.	Spot 1 to 5	-	15
6.	Viva-Voce	-	05
7.	Sessional/Record	-	10
	Total	-	75

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. IV Sem. Botany

Paper – III-A Elective 3

Plant Pathology

UNIT-I	(1) Nature and concept of plant disease, impact of plant disease pathological terms and definitions. (2) History and progress of plant pathology. (3) Agents of infectious disease: Fungi Bacteria Mycoplasma and Viruses. (4) Classification of plant disease. (5) Symptoms of plant disease (6) Methods of studying plant disease
UNIT-II	(1)Phenomenon of infection prepenetration, penetration and development of pathogen inside the host. (2) Role of enzyme, Toxins and hormones in pathogenesis. (3) Defense mechanisms in plants: Structural defense, Biochemical defence. (4) Effect of infection on physiology of the host plant.
UNIT-III	(1) Genetics of Virulence in pathogen and of resistance in host plant, physiological specialization and its significance. (2) Effect of environment on pathogenesis. (3) Survival of plant pathogens. (4) Dispersal of plant pathogens.
UNIT-IV	(1) General principles of disease control. (2) Chemical methods for plant disease control. (3) Biological control. (4) Breeding for disease resistance
UNIT-V	(1) Important disease of main crops of M.P. such as Wheat Barley, Jowar, Bajra, Potato, Pulses, Sugarcane, Oil-Seeds (Ground nut, Til and Lin seed).Vegetables, Fruits (Papaya, Mango, Guava, Lemon and Banana) and Cotton.

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. IV Sem. Botany

Paper – III-B Elective 3

Plants & Society

UNIT-I	History of plants and development of society, Role of plants in tracing human history, green revolution:- benefits and adverse consequences. Innovations for meeting world food demands. Early domestication centers of major cultivated plants, Plants in Mythology, folklores Role of Ethnobotony in relation to development of society.
UNIT-II	Plants & Human Health, Usage of plants in different systems of medicine allopathic, Homeopathic Aurvedic, Herbal Medicine, and concept of Herbal Cosmetic. Plants as health hazards. Food spoilage. Viral, Bacterial and fungal diseases of human beings.
UNIT-III	Plants in Enterprenural Areas-A: Techniques of cultivation and marketing of few Chlorophytum, Guggul, Commiphera wightii, Rauwolfia serpentina. Plants and other uses : Agriculture & Horticulture.
UNIT-IV	Plants in Enterprenural Areas - B: Use of plants in earning livelihood - Such as Bamboos, Rattans, Raw Materials of papermakings, Gums tannins, dyes, resins and fruits. Techniques of cultivation and marketing of - Aromatic Plants - Lemon grass, plasma Rosa, Floriculture - rose and gladioli.
UNIT-V	Plants in Enterprenural Areas - C: Techniques of cultivation and marketing of - Mushroom Cultivation, Nursery management, Vermiculture & Vermicompost. Mass cultivation of few plants using tissue culture techniques. Bonsii Techniques.

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. IV Sem.

Subject : Botany

Paper –IV- A Elective 4

Title of Paper: Industrial Microbiology

Code of the paper: BO44-I

Part A : Introduction for code-- BO44-I		
1	Pre-requisite (if any)	The students must have passed M.Sc. III with Botany
2	Course Objectives	The paper is aimed to introducing the students for Industrial Microbiology
	Course Learning Outcomes	1- Basic techniques in microbiology - Microscopy, staining techniques, Culture, Nutrition and growth of microorganisms
		2- Food Microbiology: Food spoilage, Food preservation methods, Microbiological production of food such as fermented products
		3- Fermentation Industry: Selection of micro-organisms, Techniques and quality control, Production of antibiotics, steroids, Human proteins, Vaccines and vitamins
		4- Microbial Growth-Environmental influences, Physical control, Chemical control & Antibiotic controls
		5- Water quality in industry: Bacteriological safety of potable water, water quality analysis, importance of BOD.

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. IV Sem. Botany

Paper – IV- A Elective 4

Industrial Microbiology

UNIT-I	Basic techniques in microbiology - Microscopy, staining techniques, Culture, Nutrition and growth of microorganisms. Replication and structure of viruses & other a cellular microorganisms, prokaryotic microorganisms, classification and diversity of Bacteria, Eukaryotic microorganisms.
UNIT-II	Food Microbiology: Food spoilage, Food preservation methods, Microbiological production of food such as fermented products, alcoholic beverages, vinegar. Fermented vegetables. Single cell protein production in industry, fermented dairy products and uses.
UNIT-III	Fermentation Industry: Selection of micro-organisms, Techniques and quality control, Production of antibiotics, steroids, Human proteins, Vaccines and vitamins. Survey of microorganisms of industrial uses. Production of organic acids, amino acids, Enzymes, Solvents and fuels.
UNIT-IV	Recovery of minerals by using microbes, Oil recovery, Biodeterioration. Mushroom culture, Biotech products including human insulin, Microbial Growth-Environmental influences, Physical control, Chemical control & Antibiotic controls.
UNIT-V	Water quality in industry: Bacteriological safety of potable water, water quality analysis, importance of BOD. Biodegradation of wastes and pollutants, Primary, Secondary and Tertiary Sewage treatments. Water quality in industry: Bacteriological safety of potable water, water quality analysis, importance of BOD. Biodegradation of wastes and pollutants, Primary, Secondary and Tertiary Sewage treatments.

Part C :-Learning Resources

1	Introduction to Industrial Microbiology by NL Morgan.
2	Industrial Microbiology by Patel.
3	Industrial Microbiology by Casida.
4	Industrial Microbiology by Dubey and Maheshwari

Part D :-Assessment and Evaluation		
Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. IV Sem.

Subject : Botany

Paper –

Title of Paper: Applied Botany

Code of the paper: BOAB

Part A : Introduction for code-- BOAB		
1	Pre-requisite (if any)	The students must have passed M.Sc.III Sem. with Botany
2	Course Objectives	The paper is aimed to introducing the students for Applied Botany
	Course Learning Outcomes	1- Students will get information about entrepreneurship and Govt.
		2- Policies and various schemes and subsidies which helps in making carrier.
		3- Cultivation and marketing of floriculture and nursery development.
		4- Student will understood knowledge and information about organic farming, vermiculture, green manure and biofertilizer which help them in their future life.
		5- Student can make carrier in medicinal plants growing and business of auryedic.

UNIT-V	Medicinal plants and their use for welfare of human beings. The use of plant parts for medicinal purpose. Azadirachta indica (Neem), Ocimum sanctum (Tulsi), Phyllanthus emblica (Awala), Zingiber officinale (Adrak), Withania somnifera (Ashwagandha), Tinospora cordifolia (Giloy), Raulvolfia serpentina (Sarphgandha), Curcuma longa (Haldi) Glycyrrhiza glabra (Mulathi), Syzygium aromaticum (laung), Chlorophytum borivilianum (Safed musli) and Aloe vera (Guarpatha).

Part C :-Learning Resources

1	"How to Win Friends and Influence people" by Dale Carnegic.
2	"The 7 Habits of Highly Effective People" by Stephen Covey.
3	"Think and Grow Rich" by Napolieon Hill.

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. IV Sem. Botany

Paper – I

Plant Cell, Tissue & Organ Culture

UNIT-I	Plant tissue culture-General introduction and Scope. Concept of Totipotency and importance of totipotency in plant science. Concept of cytodifferetiation and organogenesis. General technique of plant tissue culture. Callus and suspension.
UNIT-II	Somatic embryogenesis. Organ culture-Meristem, anther and embyo culture-Principle, technique and significance.
UNIT-III	Protoplast culture- Principle, technique of isolation of protoplast and its significance. Viability testing of protoplast Protoplast fusion- methods and importance Hybrid selection and regeneration. Somatic hybridization.
UNIT-IV	Somoclonal variation and role of tissue culture in Agriculture. Production of disease resistant plants, virus free plants. Stress resistant plants, Herbicide resistant plants.
UNIT-V	Application of plant tissue culture-clonal propagation Artificial seeds Production of secondary metabolites/natural products. Cryopresevation and Germ plasm storage

Part C :-Learning Resources

1	Introduction to plant tissue culture - M.K. Razdan
2	Introduction to plant –Biotechnology – H.S. Chawla. Oxford and IBH pub. Co. Pvt. Ltd, New Delhi.
3	Elements of Biotechnology - P.K. Gupta
4	Text Book of Biotechnology – H.K. Das
5	Biotechnology – Ashok Ganguli
6	A Text Book of Biotechnology – R.C. Dubey – S. Chand & Company LTD.
7	Plant – Biotechnology – The general manipulation of plant -Adrian Slater, Nigel Scot & Mark Fowler
8	Methods in Biotechnology & Bioengineering – D.V. Kohli., S.P. Vyas – CBS Publisher & Distributers CBS

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. IV Sem. Botany

Paper –BO42

Biotechnology & Genetic Engineering

UNIT-I	Biotechnology- basic concept, principle and scope. Recombinant DNA technology. Tools (Vectors and enzymes) and techniques cDNA and genomic Libraries.
UNIT-II	Agrobacterium mediated gene transfer. Transposon tagging direct gene transfer techniques DNA finger printing. Polymerase chain reaction.
UNIT-III	Strategies for development of transgenic plants Transgenic plants –Ecological risk and ethical concern. Intellectual property rights
UNIT-IV	Genetic improvement of industrial microbes, Nitrogen fixers. Fermentation technology- Basic concept, characteristic of ideal ferment or, Types of ferment or. Up stream and down stream processing Genomics-Basic concept, types and strategies for genome analysis.
UNIT-V	Protein profiling technology and its application. Bioinformatics-Basic concept and its application in biological science. Genomic projects-basic concept. High through put sequencing (bioinformatics) Microarrays.

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. IV Sem.

Subject : Botany

Paper –III-A Elective 3

Title of Paper: Plant Pathology

Code of the paper: BO43-I

Part A : Introduction for code-- BO43-I		
1	Pre-requisite (if any)	The students must have passed M.Sc. III with Botany
2	Course Objectives	The paper is aimed to introducing the students for Plant Pathology
	Course Learning Outcomes	To study the various disease causing organisms on plants of economic importance and their control.
		The phenomenon of infection, to study virulence and defense in hosts, concepts of disease control.
		Study of some important plant diseases.
		Breeding for disease resistance
		Effect of environment on pathogenesis.

Part C :-Learning Resources

1	Alexopoulus, C.J. Mims, C. W. and Blackwel, M; 1996: Introductory coO' Mycology,Jbon Wjley & Sons Inc.
2	Clifton, A; 1958: Introduction to Bacteria, Mcgraw- Hills Book Co.New Delhi.
3	Madigan, M T. Martinko, J. M and Parker Jack; I 997: Brock Biology Of Microorganisms, (8th edition) Prentice Hall, N.J. U.S.A
4	Mandahar, C. L.; 1978: Introduction to Plant Viruses. Chand & Co.Ltd. Delhi.
5	Mehrotra, RS. and Aneja, RS.; 1998: An Introduction to Mycology. New Age Intermediate Press.
6	Rangaswamy, G. and Mahadevan, A; 1999: Diseases of Crop Plants in Indja (4th edjtjon).PrentjceHaJl offnilia Ltd. New Delbj.
7	Webster, J.; 1985: Introduction to Fungi Cambridge University Press.
8	Dubey, R C. & Maheshwari, D. K.; 2005: A Text Book of Microbiology, S. Chand Publisher, New Delhi

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. IV Sem.

Subject : Botany

Paper –III-B Elective 3

Title of Paper: Plants & Society

Code of the paper: BO43-II

Part A : Introduction for code-- BO14		
1	Pre-requisite (if any)	The students must have passed M.Sc. III Sem. with Botany
2	Course Objectives	The paper is aimed to introducing the students for Plants & Society
	Course Learning Outcomes	1- The most important paper of M.Sc. classes for students is "Plant and Society" whole syllabus is designed for entrepreneurship development of students.
		2- All the possible uses of plants for livelihood of humans are included in this course.
		3- Students can go in the field of Pharma, cosmetic and paper including after studying this syllabus.
		4- They can also develop their own tissue culture lab, Bonsai garden, mushroom activation unit.
		5- Production of medicinal plants, Floriculture and Nursery Management are another fields of earning money.

Part C :-Learning Resources

1	Ethnobotany, Volume 1 Dr. Suresh Kumar (Author)
2	Ethnobotany Application of Medicinal Plants Edited By José L. Martinez Amner Muñoz-Acevedo Mahendra Rai
3	Medicinal plants by N Subramanyam

Part D :-Assessment and Evaluation		
Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Government Holkar (Model, Autonomous) Science College, Indore (M.P.)

Department of Botany

Class : M.Sc. IV Sem.

Subject : Botany

Paper –IV-B Elective 4

Title of Paper: Pollution Ecology

Code of the paper: BO44-II

Part A : Introduction for code-- BO14		
1	Pre-requisite (if any)	The students must have passed M.Sc.III Sem. with Botany
2	Course Objectives	The paper is aimed to introducing the students for Pollution Ecology
	Course Learning Outcomes	1- The general concept of world environment and need to improve quality of environment by understanding of various environmental problems.
		2- The aim is to understand the environmental problems of India with special reference to Madhya Pradesh.
		3- The sources of Air, Soil, Water Pollution and steps to reduce the pollution of environment.
		4- Nuclear pollution Pollution, to understand environmental laws
		5- Role of to have pollution control boards NGO'S and awareness about environmental problems and means to control their.

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. IV Sem. Botany

Paper – IV-B Elective 4

Pollution Ecology

UNIT-I	Pollution: Status and Concerns Classification of contaminants and pollutants. Brief account of major environmental disasters of the past. Indicator concept-biological indicators of pollution.
UNIT-II	Air pollution Sources and causes of air pollution. Effects of air pollution on flora and fauna, materials and structures, soil atmosphere, water bodies and on human health. Transport and dispersion of pollutants.
UNIT-III	Water Pollution Sources and causes of water pollution Status of water pollution in India and M.P. Water harvesting and recharging of water resources-concerns and remedies.
UNIT-IV	Soil pollution and other pollution types Causes and sources of soil pollution. Pesticidal and heavy metal pollution-sources, causes and effects Nuclear, thermal and noise pollution-sources, causes and effects
UNIT-V	Pollution: Monitoring and Control Monitoring systems and analytical methods for air, water and soil pollution. Control and abatement measures for air, water and soil pollution. Brief account of legislation and environmental protection acts in India.

Part C :-Learning Resources

1	Environmental Ecology by Bill Freedman.
2	Environmental Pollution and Control by P. Aarne Vesllind
3	Environmental Pollution by B.D. Sharma
4	Air Pollution and Control by N. Sharma
5	Environmental Management G.N. Pandey
6	Modern Concepts of Ecology by H D Kumar

Part D :-Assessment and Evaluation

Saggested cntinnous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE) University Exam (UE):	 100 25 75	
Intenal Assesment Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/ Presentation	25 15X5=75
External Assesment: University Exam Setion: 75 Time: 03:00 Hours	Five Long Questions	**75**

Govt. Holkar Science College, Indore (M.P.)

M.Sc. Botany Syllabus

Choice - Based Credit System (CBCS)

CORE SUBJECT: BOTANY – [Post Graduate]

Year 2021-22

DEGREE: M.Sc. Botany

IV SEMESTER PRACTICAL – Elective

(Based on PG 403A - Plant Pathology & 404A- Industrial Microbiology)/
(Based on PG 403B- Plants & Society & 404B- Pollution Ecology)

Time – 4 Hrs **Max. Marks - 75**

1.	Major exercise based on Paper 1.	-	15
2.	Major exercise based on Paper 2.	-	15
3.	Minor exercise based on Paper 1.	-	10
4.	Minor exercise based on Paper 2	-	05
5.	Spot 1 to 5	-	15
6.	Viva-Voce	-	05
7.	Sessional/Record	-	10
	Total	-	75

Govt. Holkar (Model Autonomous)Science College, Indore (M.P.)

Department of Botany

Year 2021-22

Class M.Sc. IV Sem. Botany

Paper –

Applied Botany

UNIT-I	Entrepreneurship - meaning, nature, importance, Traits of Entrepreneurs, Preparing for business plan legal requirements for establishing of a new unit procedure for registering business, market assessment, survey of local market, product designing branding, Research and development. DIC and various government policies for the development of entrepreneurship. Government schemes, subsidies, role of lead banks.
UNIT-II	Protected Cultivation 1- Open cultivation: Merits and demerits. 2- Protected cultivation useful for floriculture, vegetables, nursery development and fruit crops. 3- Construction & Design of polyhouse/ green house: site selection orientation, size, cost, height, ventilation, temp, humidity maintenance. 4- Technical standards for poly house, net house. 5- Cultivation & marketing of some flowers & vegetables in polyhouse. 1- Floriculture: Rose and Gladiolus. 2- Vegetables: Tomato, Capsicum Spp. 3- Nursery management in polyhouse. 6- Shade /Net house : structure, design, specification and importance.
UNIT-III	Organic Farming 1- Concept & definition, socio economic impact, organic farming and national economy. 2- Relevance of organic farming to India and global agriculture with future prospects. 3- Farming systems and crop rotation. 4- Management of available water for organic farming. 5- Earthworms, vermicompost, green manures & biofertilizers. 6- liquid organic manures, panchgavya, jeevamrut & beejamrut.
UNIT-IV	Water management 1- Introduction 2- Techniques of water management. 3- Water management strategies. 4- Water management in India. 5- Water management projects. 6- Rain water harvesting.

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Chemistry

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

B.Sc. I Semester Chemistry Syllabus
CBCS Annual Pattern
From Academic Year 2021-2022
Paper I (Major)

Part A Introduction			
Program-CERTIFICATE	**Class-B.Sc.**	**Semester-I**	**Session: 2021-2022**
Subject - Chemistry			
Course Code	**S1–CHEM1T**		
Course Title	**Fundamentals of Chemistry (Paper I) (Major)**		
Course Type	Core Course		
Pre-requisite (if any)	To study this course our students must have had the subject Chemistry in class +2 or equivalent.		
Course Learning Outcomes (CLO)	By the end of this course students will learn the following aspects of Chemistry: 1. Ancient Indian chemical techniques. 2. Various theories and principles applied to reveal atomic structure. 3. Significance of quantum numbers. 4. Concepts of periodic Properties of elements. 5. Theories related to chemical bonding. 6. Acid-base concept, pH, buffer. 7. Factors responsible for reactivity of organic molecules. 8. Basics and mechanism of chemical kinetics. 9. Properties of electrolytes.		
Credit Value	4		
Total Marks	Maximum Marks: CCE - 40, Theory Exam (TE) - 60	Minimum Passing Marks:35	

Part B – Content of the course
Total No. of Lecture-Tutorials-Practical (In hours per week): L-T-P:60-0-30

Unit	Topic	No. of lectures
1	**(a)**Chemical techniques in ancient India: General Introduction **(b)**Contribution of ancient Indian scientists in chemistry e.g. metallurgy, dyes, pigments, cosmetics, Ayurveda, Charak Sanhita. **Atomic Structure:** (i)Review of Bohr's theory and its limitations. Atomic spectrum of Hydrogen. Dual nature of particles and wave, de Broglie's equation, Heisenberg's Uncertainty principle and its significance. (ii)Quantum numbers and their significance. Rules for filling electrons in various orbitals, Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations, Variation of orbital energy with atomic number. Electronic configuration of the stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations. ***Keywords/Tags**: Metallurgy, Dyes, Cosmetics, Charak Sanhita Hydrogen spectrum, Hund's rule, Aufbau principle.*	**2+4**
2	**Elementary idea of the following properties of the elements with reference to s & p-block elements in periodic table.** • Effective nuclear number (EAN), shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. • Atomic radii (van der Waals) • Ionic and crystal radii. • Covalent radii (octahedral and tetrahedral) Detailed discussion of the following properties of the elements, with reference to s & p-blocks. • Ionization energy- Successive ionization energy and factors affecting ionization energy. Applications of ionization energy. • Electronegativity- Pauling's/ Mulliken's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization.	**6+4**

	***Keywords/Tags**: EAN, Atomic Radii, Ionic Radii, Crystal Radii, Ionization Energy.* **Acid-Base concept** Arrhenius cocepts, Bronsted-Lowry's concepts, conjugate acids and bases, relative strength of acids, Lewis concept. pH, buffer solutions. Acid-base neutralisation curves, Handerson equation. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Indicator, choice of indicators. ***Keywords/Tags**: Acid-Base Concept, Bronsted-Lowry's Concept, Conjugate Acid and Bases, pH, Buffer Solution, Indicator.*	
3	**Chemical Bonding** i. Ionic Bonding: General characteristics of ionic bonding. Ionic bonding &Energy: lattice & solvation energies and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Madelung constant, Born-Haber cycle and its applications. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules. ii. Covalent bonding: Lewis structure. Valence Bond theory (Heitler-London approach). Hybridization- Concept, types (SP, SP^2, SP^3, dSP^2, d^2SP^3) with suitable examples of inorganic and organic molecules Ionic character in covalent compounds- dipole moment and percentage ionic character. *Valence shell electron pair repulsion theory (VSEPR) theory:* Assumptions, need of theory, application of theory to explain geometries or shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples	**20**

	of linear, trigonal planar, square planar. tetrahedral, trigonal bipyramidal and octahedral arrangements such as: NH_3, H_2O, SF_4, CIF_3, Pcl_5, SF_6, CIF_5, XeF_4. **Molecular orbital (MO) concept of bonding** The approximations of the theory, Linear combination of atomic orbitals (LCAO) (elementary pictorial approach) Rules for the LCAO method. bonding and antibonding MOs. Characteristics for s-s, s-p and p-p combinations of atomic orbitals. nonbonding combination of orbitals. MO diagrams of homonuclear diatomic molecules: H_2, Li_2, Be_2, B_2, C_2, N_2, O_2, F_2, and their ions. Molecular orbitals of heteronuclear diatomic molecules: CO, NO, CN, HF. **Bond parameters:** Definition and factors affecting - bond orders, bond lengths, bond angles. ***Keywords/Tags:*** *Ionic Bonding Covalent Bonding. Hybridization. VSEPR Theory, LCAO, MO Diagrams, Bond Parameters*	
4	**(a) Fundamentals of Organic Chemistry** Structure, shape and reactivity of organic molecules: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Reactive Intermediates: Carbocations, Carbanions and free radicals. Nucleophiles and electrophiles. **(b) Stereochemistry of Organic compounds:** Concept of isomerism. **Geometrical isomerism:** Determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. **Optical isomerism:** Elements of symmetry, molecular chirality, enantiomers& their properties, stereogeniccentre, optical activity of enantiomers. Concept of chirality (up to two carbon atoms): chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythroisomers, meso isomer,	**12**

	resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Conformations and Conformational analysis Conformations of ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations. ***Keywords/Tags:*** *Electronic Displacements, Nucleophiles, Electrophiles, Isomerism, Molecular Chirality, Enantiomers, Sequence Rules, Conformations.*	
5	**Chemical Kinetics:** Rate of reaction, Definition and difference of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for half-life period. Methods to determine the order of reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. **Ionic Equilibria:** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Solubility and solubility product of sparingly soluble salts-applications of solubility product. ***Keywords/Tags:*** *Order of Reaction. Molecularity of Reaction, Arrhenius Equation, Activation Energy. Electrolytes, Salt Hydrolysis, Solubility Product.*	**12**

Part- C- Learning Resources
Text Book, Reference Books, other resources
Text Books: 1. Lee, J.D., Concise Inorganic Chemistry, ELBS, 1991. 2. Khera, H.C. Gurtu, J.N. Singh, J. Chemistry for B.Sc. I year, Pragati prakashan. 3. Bariyar A & Goyal, S., B.Sc. Chemistry combined. (In hindi) Krishna Educational publisher's year: 2019.

4. Puri, B.R., Pathania M.S., Sharma, L.R., Principles of physical chemistry. Vishal Publishing Co. 2020.
5. Gurtu, J, N., Gurtu A., Advanced physical Chemistry, Pragati prakashan, Meerut ISBN: 9789386633347, 9386633345, Edition: IV, 2017.
6. Day, M.C. and Selbin, J. Theortical Inorganic Chemistry, ACS publications 1962.
7. Bahl, A & Bahl, B.S. Advanced organic chemistry, S. Chand, 2010.
8. Kalsi, P.S., Stereochemistry conformation and mechanism, New age international, 2005.
9. Finar, I.L., organic chemistry (Vol. I and II), E.L.B.S.
10. Morrison, R.T. & Boyd, R.N., Organic Chemistry, Pearson, 2010.
11. Clayden, J.< Greeves, N., Warren, S. Wothers, P., Organic Chemistry, Oxord University Press, 2nd Edition, 2012.
12. Atkins' Physical Chemistry, 10th Edition, oxford University Press, 2014.

Reference Books:

1. Prakash, S., Founders of Sciences in Ancient India, published by the Research Institute of Ancient Scientific Studies, New Delhi, 1965 (OCoLC) 594302452.
2. Acharya Prafulla Chandra Ray- A Collection of Writing, Volume III A: A history of Hindu Chemistry (Volume-I). Editor: prof. Anil Bhattacharyya, Publisher: Unviersity of Calcutta. Online information: http://www/calunic.ac.in/news/APCR%20pulication/acharya-prafulla.html.
3. Chemistry in India, in Traditions and Practices of India, Textbooks for Class XI, Module 2, Central Board of Secondary Education.
4. Subbarayappa, B.V., Chemistry and Chemical Techniques in India, Centre for Studies in Civilizations, 2004, ISBN 818758601X.
5. Huheey, J.E., Kieter, E.A., Keiter, R.L. & Medhi, O.K., Inorganic Chemistry: Prinicples of structure and Ractivity, Person Education india, 2006.
6. Douglas, B.E., Mc Daniel, D.H. & Alexander, J.J, concepts and Models in Inorganic Chemistry, John Wiley & Sons, 1994.
7. Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. organic Chemistry, John Wiley & Sons, 12th Edition 2016.
8. McMurry, J.E. Fundamentals of organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
9. Sykes, P., A. Guidebook to Mechanism in organic chemistry, Orient Longman, New Delhi (1988).
10. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill(2007).

Suggested equivalent online courses:

(all URLs accessed in May 2021)

- MOOC: https://alison.com/course/fundamentals-of-chemistry
- NPTEL: https://nptel.ac.in/courses/104/106/104106119/ ; https://nptel.ac.in/courses/104/101/104101121/
- MIT: https://ocw.mit.edu/courses/chemistry/5-12-organic-chemistry-i-spring-2005/syllabus/

Web sources

(all URLs accessed in May 2021)

https://www.sydney.edu.au/science/chemistry/~george/1108/ShapesOfMolecules.pdf

https://artsandculture.google.com/exhibit/rasashala-ancient-indian-alchemical-lab-national-council-of-science-museums/KwJCaP1RF0y-KQ?hl=en

http://sanskrit.uohyd.ac.in/events-new/Ancient-Indian-chemistry.pdf

https://insa.nic.in/writereaddata/UpLoadedFiles/IJHS/Vol01_1_1_PRay.pdf

https://asi.nic.in/Ancient_India/Ancient_India_Volume_9/article_8.pdf

https://ddceutkal.ac.in/Syllabus/MA_history/paper_23.pdf

https://vvm.org.in/study_material/ENG%20-%20Indian%20Contributions%20to%20Science.pdf

https://www.pgurus.com/chemistry-in-ancient-india/

https://en.wikipedia.org/wiki/History_of_chemistry

Part D- Assessment and Evaluation	
Suggested Continuous Evaluation Methods: Continuous Internal Evaluation Shall be based on Allotted Assignment and class tests. The marks shall be as follows:	Marks
Assessment and presentation of Assignment	**06**
Class Test- I (Objective Questions)	**06**
Class Test- II (Descriptive Questions)	**06**
Class Test- I (Objective Questions)	**06**
Class Test- II (Descriptive Questions)	**06**
Overall performance throughout the year (includes attendance, behaviour, discipline, participation in different activities).	**10**
Total	**40**
Elaboration : Assessment Theory	
External Assessment	

Theory Paper	Section A	3 very short question (50 word each)	
	Section B	4 short question (200 words each)	
	Section C	4 long question (500 words each)	
	Total		**60**
Grand Total			**100**

बी.एस–सी. प्रथम सेमेस्टर
सैद्धांतिक प्रश्नपत्र के पाठ्यक्रम

भाग अ – परिचय			
कार्यक्रम : प्रमाण पत्र	कक्षा : बी.एस–सी.	सेमेस्टर – प्रथम	सत्र : 2021 – 2022
विषय : रसायन विज्ञान			
1	पाठ्यक्रम कोड	**S1 – CHEM1T**	
2	पाठ्यक्रम का शीर्षक	रसायन विज्ञान के आधारभूत सिद्धांत (प्रश्नपत्र I) मेजर	
3	पाठ्यक्रम का प्रकार : कोर कोर्स / इलेक्टिव / जेनेरिक इलेक्टिव / वोकेशनल /	कोर कोर्स	
4	पूर्वापेक्षा (Prerequisite) (यदि कोई हो)	इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों के पास कक्षा +2 या समकक्ष में रसायन विज्ञान विषय होना चाहिए	
5	पाठ्यक्रम अध्ययन की परिलब्धियों (कोर्स लर्निंग आउटकम) (CLO)	इस पाठ्यक्रम के उपरांत विद्यार्थी रसायनशास्त्र विषय के निम्न आयामों का ज्ञान प्राप्त कर लेंगे। 1. प्राचीन भारतीय रासायनिक तकनकी। 2. परमाणु संरचना को प्रकट करने के लिए लागू विभिन्न सिद्धांत एवं अवधारणाएं। 3. क्वांटम संख्याओं को महत्व। 4. तत्वों के आवधिक गुणों की अवधारणा। 5. रासायनिक बंधन से संबंधित सिद्धांत। 6. अम्ल–क्षार अवधारणा, pH, बफर। 7. कार्बनिक अणुओं की क्रिया ीलता के लिए उत्तरदायी कारक। 8. रासायनिक बलगतिकी की आधारभूत अवधारणाएं एवं क्रियाविधि। 9. विद्युत अपघट्य (इलेक्ट्रोलाइटस) के गुण।	

6	क्रेडिट मान	4	
7	कुल अंक	अधिकतम अंक : 40 + 60	न्यूनतम उत्तीर्ण अंक : 35

भाग ब - पाठ्यक्रम विषयवस्तु		
व्याख्यान की कुल संख्या-ट्यूटोरियल- प्रायोगिक(प्रति सप्ताह घंटे में) :**L-T-P:**		
इकाई	विषय	व्याख्यान की संख्या
1	(ए) प्राचीन भारत में रासायनिक तकनीक: सामान्य परिचय। (बी) रसायन विज्ञान में प्राचीन भारतीय वैज्ञानिकों का योगदान उदाहरणार्थ धातुविज्ञान, रंग, रंगद्रव्य, सौंदर्यप्रसाधन, आयुर्वेद (सी) परमाण्विक संरचनाः (i) बोहर के सिद्धांत एवं उसकी सीमाओं की समीक्षा। हाइड्रोजन परमाणु का स्पेक्ट्रम कण एवं तरंग की द्वैतीप्रकृति, डी ब्रोगली समीकरण, हाइजेनबर्ग का अनिश्चितता सिद्धांत एवं इसका महत्व। (ii) क्वांटम संख्याएँ एवं उनका महत्व। विभिन्न कक्षकों में इलेक्ट्रॉनों को भरने के नियम, पाउली का अपवर्जन सिद्धांत, इंड का अधिकतम बहुलता का नियम, औफबाऊ का सिद्धांत एवं इसकी सीमाएं, परमाणु क्रमांक के साथ कक्षीय ऊर्जा का परिवर्तन । परमाणुओं के इलेक्ट्रॉनिक विन्यास। आधे भरे एवं पूरी तरह से भरे हुए कक्षकों की स्थिरता, विनिमय ऊर्जा की अवधारणा। परमाणु कक्षकों की सापेक्ष ऊर्जा, असामान्य इलेक्ट्रॉनिक विन्यास। *सार बिंदु (की वर्ड) / टैग: धातु विज्ञान, सौदर्य प्रसाधन, चरक संहिता, हाइड्रोजन परमाणु का स्पेक्ट्रम पाउली का अपवर्जन सिद्धांत, हुड का नियम, औफबाऊ सिद्धांत*	**2+6**
2	आवर्त सारणी में s & p समुदाय (ब्लॉक) तत्वों के संदर्भ में तत्वों के निम्नलिखित गुणों की प्रारंभिक अवधारणा । • प्रभावी परमाणु क्रमांक (EAN), परिरक्षण या स्क्रीनिंग प्रभाव, स्लेटर नियम, आवर्त सारणी में प्रभावी परमाणु आवेश का परिवर्तन।	**6+4**

	• परमाण्विक त्रिज्या (वण्डरवाल्स) • आयनिक एवं क्रिस्टल त्रिज्या • सहसंयोजक त्रिज्या अष्टफलकीय (ऑक्टाहेड्रल) एवं चतुष्फलकीय (टेट्राहेड्रल) s & p-समुदाय (ब्लॉक) के संदर्भ में तत्वों के निम्नलिखित गुणों की विस्तृत चर्चाः •आयनीकरणऊर्जा-क्रमिक आयनीकरण ऊर्जा एवं आयनीकरण ऊर्जा को प्रभावित करने वाले कारक। आयनीकरण ऊर्जा के अनुप्रयोग। •ऋणविद्युतता (इलेक्ट्रोनगेटिविटी)- पॉलिंग / मुल्लिकेन की ऋणविद्युतता स्केल ऋणविद्युतता पर आबंध संख्या (बॉन्ड ऑर्डर), आंशिक आवेश, संकरण (हाइब्रिडाइजेशन) के परिवर्तन का प्रभाव। *सार बिंदु (की वर्ड) / टैग: EAN, परमाण्विक त्रिज्या, आयनिक त्रिज्या, क्रिस्टल त्रिज्या, आयनीकरण ऊर्जा* अम्ल-क्षार अवधारणा अर्हीनियस अवधारणा, ब्रॉस्टेड-लोरी की अवधारणा, संयुग्मी अम्ल व क्षार, अम्लों की सापेक्ष शक्ति, लुईस अवधारणा pH, बफर विलयन अम्ल-क्षार उदासीनीकरण वक्र, हेंडरसन समीकरण। कार्बनिक अम्लों एवं क्षारों की शक्ति: pK मानों को प्रभावित करने वाले कारकों के परिप्रेक्ष्य में तुलनात्मक अध्ययन सूचक, सूचकों का चयन। *सार बिंदु (की वर्ड) / टैग: अम्ल-क्षार अवधारणा, ब्रॉस्टेड-लोरी की अवधारणा, संयुग्मी अम्ल व क्षार, pH, बफर विलियन, सूचक।*	
3	रासायनिक आबंधन i. आयनिक बंध: आयनिक बंध की सामान्य अभिलक्षण । आयनिक बंध एवं ऊर्जा-जालक व विनायक ऊर्जा एवं उनका	**20**

	आयनिक यौगिकों की स्थिरता एवं घुलनशीलता के संदर्भ में महत्व जालक ऊर्जा की गणना के लिए बोर्न-लैंडे समीकरण का कथन मैडेलुंग स्थिरांक, बोर्न-हैवर चक्र एवं इसके अनुप्रयोग आयनिक यौगिकों में सहसंयोजक चरित्र, ध्रुवीकरण शक्ति एवं ध्रुवीकरण फजान के नियम । ii. सह संयोजक बंधः लुईस संरचना, सहसंयोजक आबंध सिद्धांत (हिटलर-लंदन दृष्टिकोण)। संकरण अवधारणा व प्रकार (SP, SP^2, SP^3, dSP^2, d^2SP^3) कार्बनिक एवं अकार्बनिक अणुओं के उपयुक्त उदाहरणों के साथ। सहसंयोजक यौगिकों में आयनिक लक्षण दिध्रुव आघूर्ण एवं प्रतिशत आयनिक लक्षण। संयोजकता कक्षक इलेक्ट्रॉन युग्म प्रतिकर्षण सिद्धांत (VSEPR) सिद्धांतः अभिग्रहीत, सिद्धांत की आवश्यकता। VSEPR व संकरण के आधार पर कुछ अकार्बनिक अणुओं एवं आयनी की ज्यामितिया आकार की व्याख्या करने के लिए सिद्धांत का अनुप्रयोग उपयुक्त उदाहरणों सहित रैखिक, समतलत्रिकोणीय, वर्ग समतलीय, समचतुफलकीय (टेट्राहेड्रल) त्रिभुजीय द्विपिरामिड (ट्राइगोनल बाइपिरामाइडल), अष्टफलकीय (ऑक्टाहेड्रल) व्यवस्थाएं जैसे: NH_3, H_2O, SF_4, CIF_3, Pcl_5, SF_6, CIF_5, XeF_4. आश्विक कक्षक (MO) आबंधन की अवधारणा सिद्धांत के सन्निकटन, परमाणु कक्षकों का रैखिक संयोजन (LCAO) (प्राथमिक चित्रात्मक दृष्टिकोण) LCAO विधि के लिए नियम, बंधी व प्रतिआबंधी MOs परमाणु कक्षकों के ss, sp व pp संयोजन के अभिलक्षण, अनाबंधी संयोजन की विशेषताएं। समनाभिकीय द्विपरमाण्विक अणुओं के आण्विक कक्षक आरेख: H_2, Li_2, Be_2, B_2, C_2, N_2, O_2, F व उनके आयन। विषमनाभिकीय द्विपरमाण्विक अणुओं के आण्विक कक्षक आरेख CO, NO, CN, HF. बंध प्राचल: बंध कोटि बंध लंबाई, बंध कोण-परिभाषा एवं प्रभावित करने वाले कारक।	

	सार बिंदु (की वर्ड) / टैग: आयनिक बंध, सहसयोजक बंध, संकरण, VSEPR सिद्धांत, LCAO, MO आरेख, बंध प्राचल	
4	(a) कार्बनिक रसायन के आधारभूत सिद्धांत कार्बनिक अणुओं की संरचना, आकृति व क्रियाशीलता: भौतिक प्रभाव, इलेक्ट्रॉनिक विस्थापन प्रेरणिक प्रभाव, इलेक्ट्रोमेरिक प्रभाव, अनुनाद एवं अतिसंयुग्मन। बंध विदलनः समांश व विषमांश बंध विदलन। क्रियाशील मध्यवर्ती: कार्बधनायन, कार्यक्रणायन एवं मुक्त मूलक नाभिकस्नेही व इलेक्ट्रान स्नेही । (b) कार्बनिक यौगिकों का त्रिविम रसायन: समावयवता की अवधारणा ज्यामितीय समावयवता: ज्यामितीय समावयवों के विन्यास का निर्धारण नामकरण की ई व जेड (E & Z) प्रणाली, ऑक्सीम्स एवं एलिसाइक्लिक यौगिकों में ज्यामितीय समावयवता । प्रकाशिक समावयवता: सममिति के तत्व, आण्विक किरैलता, प्रतिविम्बी समावयवी (इनैंशियोमर) व उनके गुण, स्टीरियोजेनिक केन्द्र, प्रतिविम्बी समावयवियों की प्रकाशिक सक्रियता। किरैलता की अवधारणा (दो कार्बन परमाणुओं तक): दो स्टीरियोजेनिक केंद्रों के साथ किरैल एवं अकिरैल अणु, अप्रतिबिम्बी समावयवी (डायस्टेरियोमर्स), थ्रेओ एवं एरिथ्रो समावयवी, मेसो समावयवी प्रतिबिम्बी समावयवियों का वियोजन / पृथक्करण, प्रतिलोमन, अप्रतिलोमन / प्रतिधारण एवं रेसिमीकरण सापेक्ष एवं निरपेक्ष विन्यास, अनुक्रम नियम, नामकरण की डी व एल (D & L) एवं आर व एस (R & S) प्रणाली संरूपण एवं संरुपी विश्लेषण ईथेन, ब्यूटेन एवं साइक्लो हेक्सेन के संरूपण।	**12**

	वेजसूत्र, न्यूमैन, सॉहॉर्स एवं फिशर प्रक्षेपण सूत्रों का परस्पर रूपांतरण । *सार बिंदु (की वर्ड) / टैग: इलेक्ट्रॉनिक विस्थापन, नाभिक स्नेही, इलेक्ट्रॉन स्नेही, समावयवता, आण्विक किरैलता, प्रतिविम्बी समावयवी, अनुक्रम नियम, सरूपण*	
5	रासायनिक बल गतिकी: अभिक्रिया की दर, अभिक्रिया की कोटि एवं आणविकता की परिभाषा एवं अंतर, शून्य कोटि, प्रथम कोटि, द्वितीय, तृतीय कोटि की अभिक्रियाओं के लिए दर / वेग स्थिरांक की व्युत्पत्ति एवंउदाहरण अर्द्ध आयुकाल के लिए व्युत्पत्ति अभिक्रिया की कोटि निर्धारण की विधियाँ, अभिक्रिया की दर पर तापमान का प्रभाव, अर्हीनियस समीकरण, सक्रियण ऊर्जा की अवधारणा। आयनिक साम्य: प्रबल, मध्यम एवं दुर्बल विद्युत अपघट्य, आयनीकरण की कोटि, आयनीकरण की कोटि को प्रभावित करने वाले कारक, आयनीकरण स्थिरांक एवं जल का आयनिक उत्पाद। सम आयन प्रभाव। लवण जल अपघटन, जल अपघटन स्थिरांक की गणना, जल अपघटन की कोटि एवं विभिन्न लवणों के लिए पीएच। विरल रूप से घुलनशील लवणों की विलेयता एवं विलेयता उत्पाद, विलेयता उत्पाद के अनुप्रयोग। अभिक्रिया की कोटि अभिक्रिया की आणविकता, अर्हीनियस समीकरण, सक्रियण ऊर्जा विद्युत अपघट्य, लवण जल-अपघटन, विलेयता उत्पाद । *सार बिंदु (की वर्ड) टैग: अभिक्रिया कोटि, आणविकता, अर्हीनियस समीकरण, सक्रियण ऊर्जा विद्युत अपघट्य, लवण जल-अपघटन, विलेयता उत्पाद ।*	**12**

भाग स- अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें /ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

1. ली, जे.डी., कंसाईज इनऑर्गेनिक केमिस्ट्री, ईएलबीएस, 1991.
2. खेड़ा, एच.सी., गुर्टू, जे.एन., सिंह, जे., केमिस्ट्री फॉर बीएससी फर्स्ट ईयर, प्रगति प्रकाशन.
3. बरियार, ए. एवं गोयल, एस., बी.एससी. केमिस्ट्री कंबाइंड, (हिंदी में) कृष्णा एजुकेशनल पब्लिशर्स वर्ष: 2019.
4. पुरी, बी.आर., पठानिया, एम.एस., शर्मा, एल.आर., प्रिंसिपल्स ऑफ़ फिजिकल केमिस्ट्री, विशाल पब्लिशिंग कंपनी 2020.
5. गुर्टू, जे.एन., गुर्टू ए., एडवांस्ड फिजिकल केमिस्ट्री, प्रगति प्रकाशन, मेरठ, आईएसबीएन: 9789386633347, 9386633345, 2017, संस्करण: IV.
6. डे, एम.सी. एवं सेलबिन, जे., थ्योरेटिकल इनऑर्गेनिक केमिस्ट्री, एसीएस प्रकाशन 1962.
7. बहल, ए. एवं बहल, बी.एस., एडवांस्ड ऑर्गेनिक केमिस्ट्री, एस. चांद, 2010.
8. कलसी, पी.एस., स्टीरियोकेमिस्ट्री कॉनफॉर्मेशन एंड मैकेनिज्म, न्यू एज इंटरनेशनल, 2005.
9. फिनार, आई.एल., ऑर्गेनिक केमिस्ट्री (वॉल्यूम I और II), ईएलबीएस
10. मॉरिसन, आर.टी. एंड बॉयड, आर.एन., ऑर्गेनिक केमिस्ट्री, पियरसन, 2010।
11. क्लेडेन, जे., ग्रीव्स, एन., वॉरेन, एस., वोदर्स, पी., ऑर्गेनिक केमिस्ट्री, ऑक्सफोर्ड यूनिवर्सिटी प्रेस, 2nd एडिशन, 2012.
12. एटकिंस फिजिकल केमिस्ट्री, X एडिशन, ऑक्सफोर्ड यूनिवर्सिटी प्रेस, 2014.

सन्दर्भ पुस्तकें:

1. प्रकाश, एस., फाउंडर ऑफ साइंस इन एनशिएंट इंडिया, द रिसर्च इंस्टिट्यूट ऑफ एनशिएंट साइंटिफिक स्टडीज, नई दिल्ली द्वारा प्रकाशित, 1965.
2. आचार्य प्रफुल्ल चंद्र रे - ए कलेक्शन ऑफ राइटिंग्स, वॉल्यूम III A: ए हिस्ट्री ऑफ हिंदू केमिस्ट्री (वॉल्यूम- I), संपादक: प्रो। अनिल भट्टाचार्य, प्रकाशक: कलकत्ता, ऑनलाइन विवरण - https://www.caluniv.ac.in/news/APCR%20Publication/acharya-prafulla.html
3. भारत में रसायन विज्ञान, भारत की परंपराओं और प्रथाओं में, ग्यारहवीं कक्षा के लिए पाठ्यपुस्तक, मॉड्यूल 2, केंद्रीय माध्यमिक शिक्षा बोर्ड.
4. सुब्बारायप्पा, वी.वी., भारत में रसायन विज्ञान और रासायनिक तकनीक, सभ्यताओं में अध्ययन केंद्र, 2004. ISBN 818758601X.
5. हुही, जे.ई., कीटर, ई.ए., कीटर, आर.एल. और मेथ्री, ओ.के., इनऑर्गेनिक केमिस्ट्री: प्रिन्सिपल्स ऑफ स्ट्रक्चर एंड रिएक्टिविटी, पियर्सन एजुकेशन इंडिया, 2006.
6. डगलस, बी.ई., मैकडैनियल, डी.एच. एंड अलेक्जेंडर, जे.जे., कॉन्सेप्ट्स एंड मॉडल्स इन इनऑर्गेनिक केमिस्ट्री, जॉन विले एंड संस, 1994.
7. ग्राहम सोलोमन, टी. डब्लू, फ्रॉयल, सी. बी., नाइडर, ऐस. ए., ऑर्गेनिक केमिस्ट्री, जॉन विले एंड संस, 12 वां संस्करण, 2016.
8. मैकमुरी, जे.ई. फंडामेंटल्स ऑफ ऑर्गेनिक केमिस्ट्री, 7वां एड। मेंगेज लर्निंग इंडिया संस्करण, 2013.
9. साइक्स, पी., ए गाइडबुक टू मैकेनिज्म इन ऑर्गेनिक केमिस्ट्री, ओरिएंट लॉन्गमैन, नई दिल्ली (1988).
10. बैरो, जी.एम., फिजिकल केमिस्ट्री, टाटा मैकग्रा-हिल 2007.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक **(all URLs accessed in May 2021)**

https://www.sydney.edu.au/science/chemistry/~george/1108/ShapesOfMolecules.pdf

https://artsandculture.google.com/exhibit/rasashala-ancient-indian-alchemical-lab-national-

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

- MOOC: https://alison.com/course/fundamentals-of-chemistry
- NPTEL:https://nptel.ac.in/courses/104/106/104106119/https://nptel.ac.in/courses/104/101/104101121/
- MIT: https://ocw.mit.edu/courses/chemistry/5-12-organic-chemistry-i-spring-2005/syllabus/

भाग द – अनुशंसित मूल्यांकन विधियां :			
अनुशंसित सतत मूल्यांकन विधियां : अधिकतम अंक : 100 सतत व्यापक मूल्यांकन सीसीई अंक : 40 सैद्धांतिक परीक्षा अंक : 60			
	आंतरिक मूल्यांकनः सतत व्यापक मूल्यांकन सीसीई	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण	25 15 कुल अंकः 40
	आकलन : सैद्धांतिक परीक्षा : समय – 02:00 घंटे	अनुभाग (अ) : तीन अति लघु प्रश्न (प्रत्येक 50 शब्द) अनुभाग (ब) : तीन अति लघु प्रश्न (प्रत्येक 200 शब्द) अनुभाग (स) : दो दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	कुल अंक : 60
	कोई टिप्पणी /सुझाव :		

B.Sc. I Semester Chemistry Syllabus
CBCS Annual Pattern
From Academic Year 2021-2022
Paper II (Minor)

Part A Introduction			
Program-CERTIFICATE	**Class-B.Sc.**	**Semester-I**	**Session: 2021-2022**
Subject - Chemistry			
Course Code	**S1 –CHEM2T**		
Course Title	**Analytical Chemistry (Paper II) (Minor)**		
Course Type	Core Course		
Pre-requisite (if any)	To study this course our students must have had the subject Chemistry in class +2 or equivalent.		
Course Learning Outcomes (CLO)	By the end of this course students will learn the following aspects of Chemistry: 1. Basic concepts of Mathematics for Chemists. 2. Fundamentals of analytical chemistry and steps involved in analysis. 3. Basic knowledge of Computer for chemists. 4. Basic Concepts of Chemical equilibrium. 5. Principal of Chromatography and chromatographic techniques. 6. Various techniques of Spectroscopic Analysis.		
Credit Value	4		
Total Marks	Maximum Marks: CCE - 40, Theory Exam (TE) - 60	Minimum Passing Marks:35	

Part B – Content of the course		
Total No. of Lecture-Tutorials-Practical (In hours per week): L-T-P:90-0-30		
Unit	**Topic**	**No. of lectures**
1	**Mathematics for Chemists** Straight line equation, Logarithmic relations, curve sketching, linear graphs & calculation of slopes. Differentiation, differentiation of functions like K_X, e^x, x^n, sinx, logx, maxima & minima, partial differentiation. Integration of some useful relevant functions. ***Keywords/Tags:*** *Linear graphs, Logarithmic Relation, Differentiation, Integration* **Computer for Chemists** Introduction to computer, Introduction to operating systems like -DOS, Windows, Linux and Ubuntu. **Use of computer programs** Running of standard programs & packages such as MS-word, MS-excel, PowerPoint, Execution of linear regression x-y Plot. Use of softwares for drawing structures and molecular formulae. ***Keywords/Tags:*** *Operating Systems, MS-word, MS-excel, PowerPoint.*	**10**
2	**Basic Analytical Chemistry:** Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures. Statistical terms: mean, mean deviation, median. standard deviation, Numerical Problems.	**10**

	Calculations used in Analytical Chemistry **Some Important units of measurements-** SI Units, distinction between mass and weight, mole, milli mole and Numerical Problems. **Solution and their concentrations-** Concept of Molarity, molality and normality. Expressing the concentration in parts per million (ppm), parts per billion (ppb), Numerical Problems. **Chemical Stoichiometry-** Empirical and Molecular Formulas, Stoichiometric Calculations, Numerical Problems. ***Keywords/Tags:*** *Accuracy, Precision, SI units. Units of Concentration, Chemical stoichiometry.*	
3	**Chemical Equilibrium:** Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van't Hoff reaction isotherm. Le-Chatelier's principle and its applications. ***Keywords/Tags:*** *Chemical Equilibrium, Equilibrium constant, Free Energy, Chemical Potential*	**10**
4	**Chromatography** Introduction, Principle and Classification. Mechanism of separation: adsorption, partition & ion-exchange. Development of chromatograms: frontal. elution and displacement methods. Paper Chromatography (ascending, descending and circular), Thin Layer Chromatography (TLC) and Column Chromatography (CC), Gas Chromatography (GC) and High Pressure Liquid Chromatography (HPLC), types of column and column selection, applications, limitations. **Principle and Applications of:** • Flash chromatography, • Ion-exchange chromatography and • Chiral chromatography. ***Keywords/Tags*** *Chromatogram, Ion Exchange, Column Selection Adsorption.*	**10**
5	**Spectral techniques of analysis** **Basics of absorption spectroscopy:** Electromagnetic radiation. Spectral range. Absorbance. Absorptivity, Molar Absorptivity, Fundamental Laws of Absorption. Lambert-Beer Law and its limitations. Constitution & working of photometer, spectrometer, colorimeter.	**10**

	Ultraviolet (UV) absorption spectroscopy- Presentation and analysis of UV spectra. Types of electronic transitions, Effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, Hyperchromic and hypochromic shifts. UV spectra of conjugated polyenes and enones. **Infra-red (IR) absorption spectroscopy-** Molecular vibrations. Hooke's law, selection rules, intensity and position of IR bands, Measurement of IR spectrum, finger print region. characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds. ***Keywords/Tags:*** *Hypsochromic, Hypochromic, Absorption, Spectrum*	

Part C -Learning resources

Text Books, Reference Books, Other Resources

Text Books

1. Gaur, S., Computer for Chemists. Neel Kamal Prakashan. 2017
2. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009
3. Kaur H, Analytical Chemistry, PragatiPrakashan (2008)
4. Gupta, Alka L.,Analytical Chemistry, PragatiPrakashan (2020)
5. Bahl, A. &Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
6. Kaur H, Instrumental Methods of Chemical Analysis, PragatiPrakashan, 2018
7. Sharma B.K., Chromatography, Krishna Prakashan, 2019.
8. Sharma Y.R., Elementary Organic Spectroscopy, S Chand, 2013
9. Singh, DR, Saxena, G., Singh, B., Inorganic Chemicals, Shivlal Aggarwal & Company, Agra
10. Srivastava, S. S., Gehlot, A. S., Chemistry, Ratan Prakashan Temple, Indore
11. Soni, PL, Organic Chemistry, Sultan Chand and Sons, Delhi

12. Singh, R.K. P., Modern Chemistry, Sahitya Bhavan, Agra
13. Agnihotri, PK, Sahu, D
14. P., Pillai, A., Sahu, M., Yugbodh Chemistry, Yugbodh Publications, Raipur

Reference Books:

1. Mitra Surbhi, Handbook of Computer Science & IT, Arihant, 2018
2. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007)
3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill (2007)
5. Atkins' Physical Chemistry, 10th Edition, Oxford University Press, 2014
6. Gurtu J.N, Gurtu A., Advanced Physical Chemistry, PragatiPrakashan, Meerut. ISBN: 9789386633347, 9386633345; Edition: IV, 2017
7. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.
8. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
9. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
10. Banwell, Molecular Spectroscopy, 2017.
11. Silverstien Robert, Spectrometric Identification of Organic Compounds, Wiley, 2014
12. Dyer J.R., Applications of Absorption Spectroscopy of Organic Compounds, 2009.

Suggested equivalent online courses:

MOOC : https://www.edx.org/course/basic-analytical-chemistry

NPTEL: https://nptel.ac.in/courses/104/105/104105084/

Web sources

1. http://www.freebookcentre.net/Chemistry/Analytical-Chemistry-Books.html
2. https://www.springer.com/journal/216

Part D- Assessment and Evaluation	
Suggested Continuous Evaluation Methods: Continuous Internal Evaluation Shall be based on Allotted Assignment and class tests. The marks shall be as follows:	Marks
Assessment and presentation of Assignment	**06**
Class Test- I (Objective Questions)	**06**
Class Test- II (Descriptive Questions)	**06**
Class Test- I (Objective Questions)	**06**
Class Test- II (Descriptive Questions)	**06**
Overall performance throughout the year (includes attendance, behaviour, discipline, participation in different activities).	**10**

Total	**40**
Elaboration : Assessment Theory	
External Assessment	
Theory Paper	**60**
Grand Total	**100**

बी.एस–सी. प्रथम सेमेस्टर
सैद्धांतिक प्रश्नपत्र के पाठ्यक्रम

भाग अ – परिचय				
कार्यक्रम : प्रमाण पत्र	कक्षा : बी.एस–सी.	सेमेस्टर – प्रथम	सत्र : 2021 – 2022	
विषय : रसायन विज्ञान				
1	पाठ्यक्रम कोड	**S1 – CHEM2T**		
2	पाठ्यक्रम का शीर्षक	विशेषणात्मक रसायन विज्ञान (प्रश्नपत्र 2) माईनर		
3	पाठ्यक्रम का प्रकार : कोर कोर्स / इलेक्टिव / जेनेरिक इलेक्टिव / वोकेशनल /	कोर कोर्स		
4	पूर्वापेक्षा (Prerequisite) (यदि कोई हो)	इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों के पास कक्षा +2 या समकक्ष में रसायन विज्ञान विषय होना चाहिए		
5	पाठ्यक्रम अध्ययन की परिलब्धियाँ (कोर्स लर्निंग आउटकम) (CLO)	इस पाठ्यक्रम के उपरांत विद्यार्थी रसायनशास्त्र विषय के निम्न आयामों का ज्ञान प्राप्त कर लेंगे। 1. रसायनज्ञों के लिए गणित की आधारभूत अवधारणाऐं। 2. विश्लेषणात्मक रसायनविज्ञान के आधारभूत और विश्लेषण में शामिल तरीके 3. रसायनज्ञों के लिए कंप्युटर का आधारभूत ज्ञान 4. रसायनिक साम्य की आधारभूत अवधारणाऐं। 5. वर्णलेखिकी (क्रोमेटोग्राफी) और वर्णलेखन (क्रोमेटोग्राफीक) तकनीकी के सिद्धांत 6. स्पेक्ट्रोस्कोपिक विश्लेषण की विभिन्न तकनीक।		
6	केडिट मान	4		
7	कुल अंक	अधिकतम अंक : 40 + 60	न्यूनतम उत्तीर्ण अंक : 35	

भाग ब - पाठ्यक्रम विषयवस्तु		
व्याख्यान की कुल संख्या-ट्यूटोरियल- प्रायोगिक (प्रति सप्ताह घंटे में) : **L-T-P:**		
इकाई	विषय	व्याख्यान की संख्या
1	रसायनज्ञों के लिए गणित सरल रेखा समीकरण, लघुगणकीय सम्बन्ध, वक्र आलेखन, रेखीय ग्राफ व ढाल का परिकलन अवकलन, K_x, e^x, x^n, sinx, logx, फलनों के अवकलन, उच्चिष्ठ व् निम्निष्ट, आंशिक अवकलन कुछ उपयोगी व् सार्थक फलनों के समाकलन. *सार बिंदु (की वर्ड) /टैग: रेखीय ग्राफ, अवकलन, समाकलन.* रसायनज्ञों के लिए कंप्यूटर कंप्यूटर का परिचय, डॉस, विंडोज, लिनक्स और उबंटू जैसे ऑपरेटिंग सिस्टम का परिचय कंप्यूटर प्रोग्राम का उपयोग एमएस वर्ड, एम एस-एक्सेल, पॉवर पॉइंट जैसे मानक प्रोग्राम और पैकेज को चलाना। रेखीय | प्रतिगमन x-y प्लॉट का निष्पादन। संरचनाओं और आणविक सूत्रों के चित्रांकन हेतु सॉफ्टवेयर का उपयोग। *सार बिंदु (की वर्ड) /टैग: ऑपरेटिंग सिस्टम, एमएस-वर्ड, एमएस-एक्सेल, पावरपॉइंट*	**10**
2	आधारभूत विश्लेषणात्मक रसायन: विश्लेषणात्मक रसायन का परिचय और इसकी अंतर्विषयक प्रकृति प्रतिदर्शी (sampling) की अवधारणा विश्लेषणात्मक मापन में यथार्थता (accuracy), परिशुद्धता (precision) और त्रुटि के स्त्रोतों का महत्व । प्रायोगिक डेटा और परिणामों की प्रस्तुति, सार्थक अंकों के दृष्टिकोण से सांख्यिकीय	**10**

	शब्दावली- माध्य माध्यविचलन, माध्यिका, मानकविचलन, संख्यात्मकप्रश्न विश्लेषणात्मक रसायन में प्रयुक्त गणनाएं माप की कुछ महत्वपूर्ण इकाइयाँ- SI इकाइयाँ, द्रव्यमान व भार के बीच अंतर, मोल, मिलीमोल व संख्यात्मक प्रश्न । विलयन और उनकी सांद्रता- मोलरता, मोललता और नॉर्मलता की अवधारणा । भाग प्रति मिलियन (ppm), भाग प्रति बिलियन (ppb) में सांद्रता को व्यक्त करना संख्यात्मक प्रश्न । रासायनिक रससमीकरणमिति- आनुभविक और आणविक सूत्र, रससमीकरणमिति (Stoichiometric) गणना। संख्यात्मक प्रश्न । *सार बिंदु (की वर्ड)/टैग: यथार्थता परिशुद्धता SI इकाइयों, सांद्रता की इकाइयाँ, रासायनिक रससमीकरणमिति*	
3	रासायनिक साम्य: साम्य स्थिरांक एवं मुक्त ऊर्जा, रासायनिक विभव की अवधारणा, रासायनिक साम्य के नियम की ऊष्मागतिक व्युत्तपत्ति, रासायनिक साम्य की ताप पर निर्भरता, वाण्टहॉफ अभिक्रिया समआयतनिक, वाण्टहॉफ अभिक्रिया समतापी, ले-चेटेलियर का सिद्धांत और उसके अनुप्रयोग। *सार बिंदु (की वर्ड)/टैग: रासायनिक साम्य, साम्य स्थिरांक स्थिर, मुक्त ऊर्जा, रासायनिक विभव*	**10**
4	वर्णलेखिकी (क्रोमैटोग्राफी) परिचय, सिद्धांत और वर्गीकरण पृथक्करण की क्रियाविधिः अधिशोषण, वितरण, आयन-विनिमय। क्रोमैटोग्राम का विकास: अग्र-भाग, निक्षालन और विस्थापन की विधियां । कागज़ वर्णलेखिकी (आरोही, अवरोही और गोलाकार), पतली परत वर्ण लेखिकी (TLC) एवं कॉलम वर्णलेखिकी (CC), गैस वर्णलेखिकी (GC) और उच्चदबाव तरल- वर्णलेखिकी (HPLC), कॉलम के प्रकार एवं कॉलम चयन, अनुप्रयोग, सीमाएं सिद्धांत और अनुप्रयोगः	**10**

	• फ्लैश क्रोमैटोग्राफी • आयन-विनिमय क्रोमैटोग्राफी • चिरल क्रोमैटोग्राफी *सार बिंदु (की वर्ड) /टैग: क्रोमैटोग्राम, आयन-विनिमय, कॉलम चयन, अधिशोषण*	
5	**विश्लेषण की वर्णक्रमीय तकनीक** अवशोषण स्पेक्ट्रोस्कोपी का आधारभूत परिचयः विद्युतचुम्बकीय विकिरण, स्पेक्ट्रल परास। अवशोषण, अवशोषकता, आणविक अवशोषकता, अवशोषण के आधारभूत नियम, लैम्बर्ट बीयर नियम व इस की सीमाएं।। फोटोमीटर, स्पेक्ट्रोमीटर, वर्णमापी की संरचना एवं कार्यप्रणाली। **पराबैंगनी** (UV) अवशोषण **स्पेक्ट्रोस्कोपी**- UV स्पेक्ट्रा की प्रस्तुति और विश्लेषण, इलेक्ट्रॉनिक संक्रमण के प्रकार, संयुग्मन का प्रभाव। क्रोमोफोर और ऑक्सोक्रोम की अवधारणा वर्णोत्कर्षी (वैथोक्रोमिक), वर्णापकर्षी (हिप्सोक्रोमिक). वर्णातिशयी (हाइपरकोमिक) और वर्णापशयी (हाइपोक्रोमिक) विस्थापन (शिफ्ट)। संयुग्मित पोलीन्स और एनोन का पराबैंगनी वर्णक्रम (UV स्पेक्ट्रा) । अवरक्त (इन्फ्रा-रेड) अवशोषण स्पेक्ट्रोस्कोपी- आणविक कंपन, हुक का नियम, वरण नियम, अवरक्त बैंड की तीव्रता और स्थिति, अवरक्त | स्पेक्ट्रम का मापन, फिंगर प्रिंट क्षेत्र विभिन्न क्रियात्मक समूहों का अभिलाक्षणिक अवशोषण और सरल कार्बनिक यौगिकों के अवरक्त स्पेक्ट्रा की व्याख्या। *सार बिंदु (की वर्ड) टैग: वर्णातिशयी (हाइपरक्रोमिक) वर्णापशयी (हाइपोक्रोमिक),अवशोषण, स्पेक्ट्रम*	**10**

भाग स – अनुशंसित अध्ययन संसाधन

पाठय पुस्तकें , संदर्भ, पुस्तके, अन्य संसाधन

अनुशंसित सहायक पुस्तकें /ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

1. गौर, एस., कंप्यूटर फॉर केमिस्ट, नील कमल प्रकाशन, 2017

2. खोपकर, एस.एम. विश्लेषणात्मक रसायन विज्ञान की मूल अवधारणाएँ। न्यू एज, इंटरनेशनल पब्लिशर, 2009

3. कौर एच, विश्लेषणात्मक रसायन विज्ञान, प्रगति प्रकाशन (2008)

4. गुप्ता, अलका एल., एनालिटिकल केमिस्ट्री, प्रगति प्रकाशन (2020)

5. बहल, ए. और बहल, बी.एस. उन्नत कार्बनिक रसायन विज्ञान, एस चंद, 2010।

6. कौर एच, रासायनिक विश्लेषण के बाद्य तरीके, प्रगति प्रकाशन, 2018

7. शर्मा बी.के., क्रोमैटोग्राफी, कृष्ण प्रकाशन, 2019।

8. शर्मा वाई.आर., प्राथमिक कार्बनिक स्पेक्ट्रोस्कोपी, एस चंद, 2013,

हिंदी की प्रकाशित पुस्तकें

9. सिंह, डी. आर., सक्सेना, जी.,सिंह, वी., अकार्बनिक रसायन, शिवलाल अग्रवाल एंड कंपनी, आगरा

10. श्रीवास्तव, एस. एस.,गहलोत, ए. एस., रसायन विज्ञान, रतन प्रकाशन मंदिर, इंदौर

11. सोनी, पी. एल., कार्बनिक रसायन, सुल्तान चंद एंड संस, दिल्ली

12. सिंह, आर. पी., आधुनिक रसायन, साहित्य भवन ,आगरा

13. अग्निहोत्री, पी.के.,साहू, डी

14. पी., पिल्लई, ए.,साहू, एम., युगबोध रसायन, युगबोध प्रकाशन ,रायपुर

सन्दर्भपुस्तकें:

1. मित्रा सुरभि, हैंडबुक ऑफ कंप्यूटर साइंस एंड आईटी, अरिहंत, 2018

2. हैरिस, डी.सी. मात्रात्मक रासायनिक विश्लेषण। छठा संस्करण, फ्रीमैन (2007)

भाग द – अनुशंसित मूल्यांकन विधियां :

अनुशंसित सतत मूल्यांकन विधियां :
अधिकतम अंक : 100
सतत व्यापक मूल्यांकन सीसीई अंक : 40 सैद्धांतिक परीक्षा अंक : 60

आंतरिक मूल्यांकनः सतत व्यापक मूल्यांकन सीसीई	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण	25 15 कुल अंकः 40
आकलन : सैद्धांतिक परीक्षा : समय – 02:00 घंटे	अनुभाग (अ) : तीन अति लघु प्रश्न (प्रत्येक 50 शब्द) अनुभाग (ब) : तीन अति लघु प्रश्न (प्रत्येक 200 शब्द) अनुभाग (स) : दो दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	कुल अंक : 60
कोई टिप्पणी / सुझावः		

B.Sc. I Semester
Syllabus of Theory Paper

Part A Introduction			
Program: Certificate	Class: B.Sc.	Semester - I	Session:2021-22
Subject : Chemistry			
1	Course Code	**S1-CHEM1G**	
2	Course Title	Chemistry in Everyday Life	
3	Course Type(Core Course/Elective/Generic Elective/Vocational/ ……)	Elective	
4	Pre-requisite (if any)	To study this course, a student must have had the subject **science/arts/commerce** in class +2 or equivalent…… …… **This course can be opted as an elective by the students of following subject: Open for all**	
5	Course Learning outcomes (CLO)	By the end of this course students are expected to- 1. Learn about the chemistry of ancient India. Ancient construction materials and discoveries. 2. Gain information about acids, bases and salts involved in our day to day life. 3. Have an idea of food adulteration, its harmful effects and methods to detect adulteration and the important constituents of our food.	

		4. Student will be familiar with the chemical nomenclature of the commonly used materials in daily life including toiletries, kitchen and beverages. 5. Have an Elementary idea of disinfectants, pesticides and cleaners.	
6	Credit Value	4	
7	Total Marks	Max.Marks: 40+60	Min.Passing Marks : 35

Part B – Content of the Course

Total No. of Lectures- Tutorials-Practical (in hours per week):

Unit	Topics	No. of Lectures
I	**Ancient Chemistry** – Chemistry in Ancient India • Alchemy- construction material in ancient times like pottery, Bricks, Cement, Minerals. • Discovery and Uses of Glass, cosmetics & perfumes, paper & ink. • Metal extraction in ancient time, fiber cloth and dying chemistry in ancient times. **Basic introduction of chemistry:** Elements (up to atomic number 36), atoms, molecules and compounds. **Keywords/Tags:** ancient chemistry, Alchemy, Glass, Metal extraction, Atoms, molecules.	12
II	**Acids, Bases and Salts in Daily Life** – Definition of acids, bases and neutral substances, pH scale. Sources and uses of – • Acids- hydrochloric acid, acetic acid(vinegar), ascorbic acid, carbonic acid, sulfuric acid, tartaric acid, citric acid. • Bases- sodium hydroxide, magnesium hydroxide, calcium hydroxide, ammonia. • Salts- sodium fluoride, sodium chloride, sodium carbonate, sodium bicarbonate, copper sulphate, Alums, calcium carbonate, ammonium chloride. Keywords/Tags : Acids, Bases, Salts, Neutral Substances, pH	12
III	**Major Components of our Food-** Basic idea of vitamins, fats, carbohydrates, proteins and fibers, their function and sources. **Functions and importance:** Vitamin B complex, antioxidants, micronutrients like iron, zinc, calcium **Food Adulteration**- definition, types, harmful effects • Common adulterants and their detection in- milk, ghee,	12

	mustard oil, sugar, salt, tea, chili powder, black pepper, turmeric powder, honey. • Harmful effects of food additives- saccharin, monosodium glutamate(Ajinomoto), Sulphur dioxide, preservatives **Keywords/Tags:** Vitamins, Minerals, Antioxidants, Adulteration, Additives	
IV	**Basic Knowledge of important constituent of materials used in everyday life- (Names and their effects only)-** • Toothpaste, different types of soaps, detergents and cosmetics, nail polish remover. • Table salt, rock salt, sugar. • Baking soda, caustic soda, baking powder. • Coffee and tea, chemicals involved in processing of bakery products. • Onion, garlic, spices like turmeric, chilly • Oil and fats. • Soda drinks, alcohol and tabacco. **Keywords/Tags:** Toothpaste, Soaps, Salt, Spices, Alcohol.	12
V	**Elementary idea of disinfectants, pesticides and cleaners-** • Alcohol based hand sanitizers, sodium hypo chlorite, naphthalene, Antiseptic solutions. • Pesticides and insecticides like DDT, mosquito repellent, boric acid. • Toilet cleaners, Domestic phenyls, Floor cleaner **Keywords/Tag:** Disinfectants, Pesticides, Cleaners, Mosquito Repellent, Phenyls.	12

Part C – Learning Resources

Text Book, Reference Books, Other Resources

Suggested Readings:

1. Cox H.E.: ANALYSIS OF FOODS 13.
2. Cox H.E. AND PEARSON CHEMICAK ANALYSIS OF FOODS.
3. SHAKUNTALA MANY N. AND SWAMY S. FOODS: FACTS AND PRINCIPLES. 4th ED. NEW AGE INTERNATIONAL (1998)
4. JAIN AND JAIN ENGINEERING CHEMISTRY, DHANPATRAI PUBLISHING COMPANY
5. Garforth, F. (1986). Chemistry through the looking glass. In P.E. Childs (ed.)
6. Limerick, Everyday Chemistry (pp.4-45). Thomond College.
7. Bailin, S. (2002). Critical thinking and science education. Science & Education, 11,361-375.

8. Childs. P.E. (1986). What is everyday chemistry? In P.E. Childs (ed.), Everyday chemistry. Limerick: Thomond College.
9. Chemical Education 60, 1031
10. Hatfield: ASE (1985). Education through science
11. Ray Prafulla Chandra History of Chemistry in Ancient and Medieval India: Incorporating the History of Hindu Chemistry 1 January 2004 Chowkhambha Sanskrit series office

MOOCs, NPTEL, SWAYAM, HE E-Contents-
https://tamilandvedas.com/2019/11/04/rare-chemistry-alchemy-medicine-books-of-ancient-india-post-no-7178/
https://nptel.ac.in/content/storage2/courses/103107082/module1/lecture1/lecture1.pdf
https://nptel.ac.in/courses/104/103/104103071/
https://ncert.nic.in/textbook/pdf/gesc105.pdf
https://onlinecourses.swayam2.ac.in/ugc19_bt16/preview

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 40 Marks Theory Exam (TE) 60 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 40	Class Test Assignment/Presentation	25 15 Total = 40
External Assessment: Theory Exam Section: 60 Time : 02.00 Hours	**Section(A):** Three Very Short Questions (50 Words Each) **Section(B):** four Short Questions (200 Words Each) **Section(C):** Two Long Questions (500 Words Each)	 Total = 60

Any remarks/suggestions:

बी.एस–सी. प्रथम सेमेस्टर
सैद्धांतिक प्रश्नपत्र के पाठ्यक्रम

भाग अ – परिचय			
कार्यक्रम : प्रमाण पत्र	कक्षा : बी.एस–सी.	सेमेस्टर – प्रथम	सत्र : 2021 – 2022
विषय : रसायन विज्ञान			
1	पाठ्यक्रम कोड	S1 – CHEM1G	
2	पाठ्यक्रम का भीर्षक	दैनिक जीवन में रसायन विज्ञान	
3	पाठ्यक्रम का प्रकार : कोर कोर्स /इलेक्टिव/जेनेरिक इलेक्टिव/ वोकेशनल/	इलेक्टिव	
4	पूर्वापेक्षा (Prerequisite)(यदि कोई हो)	इस कोर्स का अध्ययन करने के लिए,छात्र ने विषय विज्ञान/कला/वाणिज्य अध्ययन कक्षा 12वी में किया हो। इस पाठयक्रम को निम्नलिखित विषयों के छात्रों द्वारा एक वैकल्पिक विषय के रूप में चुना जा सकता सभी के लिए उपलब्ध (Open For all)	
5	पाठ्यक्रम अध्ययन की परिलब्धियॉ (कोर्स लर्निंग आउटकम) (CLO)	इस पाठ्यक्रम के उपरांत विद्यार्थी रसायनशास्त्र विषय के निम्न आयामों का ज्ञान प्राप्त कर लेंगे। 1. प्राचीन भारत के रसायन विज्ञान, प्राचीन निर्माण सामग्री और खोजों के बारे में 2. हमारे दैनिक जीवन में शामिल अम्ल, क्षार और लवण के बारे में। 3. खाद्य पदार्थ में मिलावट की, उसके हानिकारक प्रभावों की, मिलावट को पहचानने की विधियों की और भोज्य पदार्थ के महत्वपूर्ण अवयव 4. दैनिक जीवन में प्रसाधन सामग्री, रसोई और पेय पदार्थों सहित आमतौर पर उपयोग की जाने वाली	

		सामग्रियों के रासायनिक नामकरण 5. कीटाणुनाशक, कीटनाशकों और ईंधन के बारे में प्राथमिक जानकारी	
6	क्रेडिट मान	4	
7	कुल अंक	अधिकतम अंक : 40 + 60	न्यूनतम उत्तीर्ण अंक : 35

भाग स- अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें /ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

1. कॉक्स एचई: फूड्स का विश्लेषण 13.
2. कॉक्स एचई और पियर्सन फूड्स का रासायनिक विश्लेषण।
3. शकुंतला मैनी एन. और स्वामी एस. फूड्स: तथ्य और सिद्धांत। चौथा संस्करण। न्यू ए इंटरनेशनल (1998)
4. जैन और जैन, इंजीनियरिंग रसायन विज्ञान, धनपतराय प्रकाशन कंपनी
5. गारफोर्थ , एफ। (1986)। लुकिंग ग्लास के माध्यम से रसायन विज्ञान। पीई चाइल्ड्स (एड।) l.
6. लिमरिक , एवरीडे सी हेमिस्ट्री (पीपी.4-45)। थॉमॉड कॉलेज।
7. बेलिन , एस। (2002)। महत्वपूर्ण सोच और विज्ञान शिक्षा। विज्ञान और शिक्षा, 11, 361-375.
8. चाइल्ड्स, पीई (1986)। रोजमर्रा की रसायन शास्त्र क्या है? पीई चिल्ड्स (एड।), एवरीडे केमिस्ट्री में। लिमरिक: थॉमॉड कॉलेज।
9. रासायनिक शिक्षा का जर्नल 60 , 1031
10. हैटफील्ड: एएसई (1985)। विज्ञान के माध्यम से शिक्षा।
11. रे प्रफुल्ल चंद्र प्राचीन और मध्यकालीन भारत में रसायन विज्ञान के इतिहास: हिन्दू रसायन विज्ञान का इतिहास I जनवरी 2004 चौखंबा संस्कृत श्रृंखला कार्यालय
12.

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम: MOOCs, NPTEL, स्वयं, ई-सामग्री

https://tamilandvedas.com/2019/11/04/rare-chemistry-alchemy-medicine-books-of-ancient-india-post-no-7178/

https://nptel.ac.in/content/storage2/courses/103107082/module1/lecture1/lecture1.pdf

https://nptel.ac.in/courses/104/103/104103071/

https://ncert.nic.in/textbook/pdf/gesc105.pdf

https://onlinecourses.swayam2.ac.in/ugc19_bt16/preview

भाग द – अनुशंसित मूल्यांकन विधियां :

अनुशंसित सतत मूल्यांकन विधियां :
अधिकतम अंक : 100
सतत व्यापक मूल्यांकन (CCE) अंक : 40 सैद्धांतिक परीक्षा (TE) अंक : 60

आंतरिक मूल्यांकन : सतत व्यापक मूल्यांकन(CCE) :40	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण(प्रेजेंटेशन)	25 15 कुल अंक : 40
आकलन : सैद्धांतिक परीक्षा:60 समय–02.00 घंटे	अनुभाग(अ): तीन अति लघु प्रश्न (प्रत्येक 50 शब्द) अनुभाग(ब): चार लघु प्रश्न (प्रत्येक 200 शब्द) अनुभाग(स): दो दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	कुल अंक : 60

कोई टिप्पणी / सुझाव :

B.Sc. I Semester

PRACTICAL				
Program- CERTIFICATE		**Class- B.Sc.**	**Semester - I**	**Session: 2021-2022**
Subject - Chemistry				
1	Course Code	S1 –CHEM1P		
	Course Title	**Qualitative & Quantitative Chemical Analysis (Paper II)**		
2	Course Type	Core Course		
3	Course Learning Outcomes (CLO)	By the end of this course students will learn the following aspects of Laboratory exercises in Chemistry: 1. Importance of chemical safety and lab safety while performing experiments in laboratory 2. Qualitative inorganic analysis 3. Elemental analysis of organic compounds (non-instrumental) 4. Qualitative identification of functional group of organic compounds 5. Techniques of pH measurements 6. Preparation of buffer solutions		
4	Credit Value	2		
	Total Marks	Maximum Marks: Theory Exam (TE)- 60 CCE-40	Minimum Passing Marks:35	

	Part B – Content of the course	Marks
1	**Experiments to be performed in laboratory**	**50**
	Qualitative inorganic analysis **20 Marks** Identification of simple inorganic mixture (5 radicals) with two/three acidic and two/three basic radicals (including typical combinations), special emphasis on learning theoretical concepts of strong, moderate and weak electrolytes, ionic product, common ion effect. Solubility and solubility product. **Qualitative organic analysis** **7+8 Marks** 1. Detection of hetero-elements (N,S, Cl, Br, I) in organic compounds 2. Functional group tests for alcohol, aldehyde, carboxylic acid, carbohydrate, phenols, nitro, amine and amide. **Qualitative analysis of acid, alkali and buffer solutions** **15 Marks** **Ionic Equilibria** 1. Measurement of pH of different solutions if acids and alkalis using pH- meter (May use aerated drinks, fruit juices, shampoos and soaps) *Note – use dilute solutions of soaps and shampoos to prevent damage to the glass electrode.* 2. Measurement of the pH of buffer solutions and comparison of the values with theoretical values. 3. Preparation of buffer solutions and determination of their pH and buffer capacity: (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide	

Part- C- Learning Resources
Text Book, Reference Books, other resources

Text Books:

1. Goswami A.K., Mehta, A., Khanam Rehana, O.R.S., UGC Practical Chemistry VOL. I, Pragati Prakashan, 2015
2. Goyal, S., B.Sc. Chemistry Practical, Krishna Publication, 2017.
3. Vogel, A.I., A Textbook of Quantitative Inorganic Analysis, ELBS.
4. Svehla, G., Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
5. Mendham, J., Vogel's Quantitative Chemical Analysis, Pearson, 2009.
6. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
7. Mann, F.G.,& Saunders, B.C., Practical Organic Chemistry, Pearson Education (2009).
8. Khosla, B. D., Garg, V. C.,& Gulati, A., Senior Practical Physical Chemistry, R.Chand & Co.: New Delhi (2011).

References:

9. Mann, F.G. & Saunders, B.C., Practical Organic Chemistry Orient-Longman, 1960.
10. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R., Practical Organic Chemistry, 5th Ed., Pearson (2012)
11. Ahluwalia, V.K., &Aggarwal, R., Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
12. Prof. Robert H. Hill Jr., David C. Finster, Laboratory Safety for Chemistry Students, 2nd Edition Wiley ISBN: 978-1-119-02766-9 May 2016
13. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version, ISBN 978-0-309-13864-2 | DOI 10.17226/12654, The National Academies Press, Washington D.C.

Suggestive digital platforms web links: **https://nptel.ac.in/courses/104/105/104105102/**

Suggested equivalent online courses:

1. **https://www.youtube.com/watch?v=EhvemWIluXQ**
2. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=31&cnt=1
3. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=180&cnt=1
4. **http://www.rbmcollege.ac.in/sites/default/files/files/reading%20material/inorganic-qualitative-analysis.pdf**
5. **https://courses.lumenlearning.com/boundless-chemistry/chapter/qualitative-chemical-analysis/**
6. **https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Qualitative_Analysis**
7. **https://courses.lumenlearning.com/boundless-chemistry/chapter/buffer-solutions/**
8. **https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual%3A_Introduction_to_Biotechnology/01%3A_Techniques/1.07%3A_pH_and_Buffers**
9. **https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_12_Experiments/05%3A_pH_Measurement_and_Its_Applications_(Experiment)**
10. **https://www.mt.com/mt_ext_files/Editorial/Generic/1/Guides_to_Electrochemical_Analysis_0x000248ff00025c9a00093c4a_files/guideph.pdf**
11. **https://web.cortland.edu/sternfeld/ph.pdf**
12. **http://webhost.bridgew.edu/c2king/CHEM142/Lab/7_Buffers%20and%20Properties.pdf**

Part D- Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction **Chemical and Lab Safety** 1. Toxicity of the compounds uses in chem 2. istry laboratory. 3. Safety symbol on labels if pack of chemicals and its meaning 4. What is MSDS sheets? Find out MSDS sheets of some hazardous chemicals ($K_2Cr_2O_7$), Benzene, cadmium nitrate, sodium metal, etc.) 5. Precautions in handling and storage of hazardous substances like concentrated acids, ammonia, organic solvents, etc. *Note: description to be written in practical record.*	**15**		**7**
Attendance	**10**	**Practical Record File**	**8**
Assignments (Chart/Model Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/Survey / Industrial visit)	**15**	**Table work/Experiments**	**45**
Total	**40**		**60**

बी.एस–सी. प्रथम सेमेस्टर
प्रायोगिक प्रश्नप्रत्र

भाग अ – परिचय			
कार्यक्रम : प्रमाण पत्र	कक्षा : बी.एस–सी.	सेमेस्टर – प्रथम	सत्र : 2021 – 2022
विषय : रसायन विज्ञान			
1	पाठ्यक्रम कोड	S1 – CHEM1P	
2	पाठ्यक्रम का भीर्षक	गुणात्मक और परिमाणात्मक रासायनिक विश्लेषण (प्रश्नपत्र II)	
3	पाठ्यक्रम का प्रकार : (कोर कोर्स /इलेक्टिव/जेनेरिक इलेक्टिव/ वोकेशनल/.....)	कोर कोर्स	
4	पूर्वापेक्षा (Prerequisite)(यदि कोई हो)	इस पाठयक्रम का अध्ययन करने के लिए विद्यार्थियों के पास कक्षा +2 या समकक्ष में रसायनविज्ञान विषय होना चाहिए।	
5	पाठ्यक्रम अध्ययन की परिलब्धियॉं (कोर्स लर्निंग आउटकम) (CLO)	इस पाठ्यक्रम के उपरांत विद्यार्थी रसायनशास्त्र विषय की प्रयोगशाला के निम्न आयामों का ज्ञान प्राप्त कर लेंगे : 1. प्रयोगशाला में प्रयोग करते समय रासायनिक सुरक्षा और प्रयोगशाला सुरक्षा का महत्व 2. गुणात्मक अकार्बनिक विश्लेषण 3. कार्बनिक यौगिकों का तात्विक विश्लेषण 4. कार्बनिक यौगिकों के कियात्मक समूह की गुणात्मक पहचान 5. पीएच माप की तकनीक	
6	केडिट मान	4	
7	कुल अंक	अधिकतम अंक : 40 + 60	न्यूनतम उत्तीर्ण अंक : 35

भाग ब – पाठ्यक्रम विषयवस्तु		
व्याख्यान की कुल संख्या-(प्रति सप्ताह घंटे में) :**P:**		
इकाई	विषय	अंक
	प्रयोगशाला में किए जाने वाले प्रयोग	
	गुणात्मक अकार्बनिक विश्लेषण दो / तीन अम्लीय एवं दो तीन भास्मिक मूलकों (विशिष्ट संयोजनों सहित) के साथ सरल अकार्बनिक मिश्रण (5 मूलकों) की पहचान, प्रबल, मध्यम एवं दुर्बल विद्युत अपघट्य आयनिक उत्पाद, सामान्य आयन प्रभाव की सैद्धांतिक अवधारणाओं को सीखने पर विशेष बल विलेयता एवं विलेयता उत्पाद **गुणात्मक कार्बनिक विश्लेषण** 1. कार्बनिक यौगिकों में विषम-तत्वों (N, S. CI, Br, I) की पहचान 2. अल्कोहल, एल्डिहाइड, कार्बोक्जिलिक एसिड, कार्बोहाइड्रेट, फिनोल, नाइट्रो, अमीन एवं एमाइड के लिए क्रियात्मक समूह परीक्षण अम्ल, क्षार एवं बफर विलयनों का परिमाणात्मक विश्लेषण आयनिक साम्य 1. pH मीटर का उपयोग कर के अम्ल एवं क्षार के विभिन्न विलयनों के pH का मापन (वातित पेय, फलों के रस, शँपू एवं साबुन का उपयोग कर सकते हैं) नोट-ग्लास इलेक्ट्रोड को नुकसान से बचाने के लिए साबुन एवं शँपू के तनु विलयन का उपयोग करें। 2. बफर बिलयन के pH का मापन एवं सैद्धांतिक मानों के साथ तुलना। 3. बफर विलयन तैयार करना एवं उनकी pH व बफर क्षमता का निर्धारण: (i) सोडियम एसीटेट-एसिटिक अम्ल	

(ii) अमोनियम क्लोराइड-अमोनियम हाइड्रॉक्साइड

भाग स- अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें /ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

1. गोस्वामी ए.के., मेहता, ए., खानम रेहाना, ओ.आर.एस., यूजीसी प्रैक्टिकल केमिस्ट्री वॉल्यूम 1, प्रगति प्रकाशन, 2015.
2. गोयल, एस., बी.एससी. केमिस्ट्री प्रैक्टिकल, कृष्णा पब्लिकेशन, 2017.
3. वोगेल, ए.आई., ए टेक्स्ट बुक ऑफ क्वांटिटेव इनऑर्गेनिक एनालिसिस, ईएलबीएस।
4. स्वेहला, जी., वोगल्स क्वालिटेटिव इनऑर्गेनिक एनालिसिस, पियरसन एजुकेशन, 2012.
5. मेंधम, जे, वोगल्स क्वांटिटेटिव केमिकल एनालिसिस, पियर्सन, 2009.
6. वोगेल, ए.आई., टैचेल, ए.आर., फर्निस, बी.एस., हैनाफोर्ड, ए.जे., एंड स्मिथ, पी.डब्ल्यू.जी., प्रैक्टिकल ऑर्गेनिक केमिस्ट्री की पाठ्यपुस्तक, प्रेंटिस-हॉल, 5वां संस्करण, 1996.
7. मान, एफ.जी., और सॉन्डर्स, बी.सी., प्रैक्टिकल ऑर्गेनिक केमिस्ट्री, पियर्सन एजुकेशन (2009).
8. खोसला, बी.डी., गर्ग, बी.सी., और गुलाटी, ए., सीनियर प्रैक्टिकल फिजिकल केमिस्ट्री, आर. चंद एंड कंपनी, नई दिल्ली (2011).।

संदर्भपुस्तकें

1. मान, एफ.जी., एंड सॉन्डर्स, बी.सी., प्रैक्टिकल ऑर्गेनिक केमिस्ट्री, ओरिएंट-लॉन्गमैन, 1960.
2. फर्निस, बी.एस., हैनाफोर्ड, ए.जे., स्मिथ, पी.डब्ल्यू.जी., टैचेल, एआर, प्रैक्टिकल ऑर्गेनिक केमिस्ट्री, 5वां संस्करण, पियर्सन (2012).
4. अहलूवालिया, वी.के., और डीमरा, एस., कॉम्प्रिहेंसिव प्रैक्टिकल ऑर्गेनिक केमिस्ट्री: क्वालिटेटिव एनालिसिस, यूनिवर्सिटी प्रेस (2000).
5. प्रो. रॉबर्ट एच. हिल जूनियर, डेविड सी., लैबोरेट्री सेफ्टी फॉर केमेस्ट्री स्टूडेंट्स, द्वितीय संस्करण विले आईएसबीएन: 978-1-119-02766-9 मई 2016.
6. प्रयोगशाला में विवेकपूर्ण व्यवहार: रासायनिक खतरों का प्रबंधन और प्रबंधन, अद्यतन संस्करण, आईएसबीएन 978-0-309-13864-2 || DOI 10.17226/12654.. द नेशनल अकादमिस प्रेस, वाशिंगटन डी सी। 2.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक: https://nptel.ac.in/courses/104/105/104105102/

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

1. **https://www.youtube.com/watch?v=EhvemWIuXQ**
2. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=31&cnt=1
3. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=180&cnt=1
4. **http://www.rbmcollege.ac.in/sites/default/files/files/reading%20material/inorganic-qualitative-analysis.pdf**
5. **https://courses.lumenlearning.com/boundless-chemistry/chapter/qualitative-chemical-analysis/**
6. **https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Qualitative_Analysis**
7. **https://courses.lumenlearning.com/boundless-chemistry/chapter/buffer-solutions/**
8. **https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual%3A_Introduction_to_Biotechnology/01%3A_Techniques/1.07%3A_pH_and_Buffers**
9. **https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_12_Experiments/05%3A_pH_Measurement_and_Its_Applications_(Experiment)**
10. **https://www.mt.com/mt_ext_files/Editorial/Generic/1/Guides_to_Electrochemical_Analysis_0x000248ff00025c9a00093e4a_files/guideph.pdf**
11. **https://web.cortland.edu/sternfeld/ph.pdf**
12. **http://webhost.bridgew.edu/e2king/CHEM142/Lab/7_Buffers%20and%20Properties.pdf**

भाग द – अनुशंसित मूल्यांकन विधियां

अनुशंसित सतत मूल्यांकन विधियां

आंतरिक मूल्यांकन	अंक	बह्य मूल्यांकन	अंक
कक्षा में पारस्परिक विचार–विमर्श	15	प्रायोगिक मौखिकी	07

रासायनिक और प्रयोगशाला सुरक्षा 1. रसायन प्रयोगशाला में प्रयुक्त यौगिकों की विषाक्तता। 2. रसायनों के पैकेट के लेबल पर सुरक्षा चिन्ह और उसका अर्थ। 3. एम एस डी शीट क्या है कुछ खतरनाक रसायनों (, बेंजीन, कैडमियम नाइट्रेट, सोडियम धातु, आदि) की शीट का पता लगाएं। 4. खतरनाक पदार्थों के प्रबंधन और भंडारण में सावधानियां जैसे सांद्र अम्ल, अमोनिया, कार्बनिक विलायक, आदि। नोटः विवरण प्रायोगिक रिकॉर्ड में लिखा जाना है।		(वायवा)	
उपस्थिति	10	प्रायोगिक रिकॉर्ड फाइल	08
असाइनमेंट (चार्ट / मॉडल / सेमिनार / ग्रामीण सेवा / प्रौद्योगिकी प्रसार / भ्रमण(कस्कर्शन) की रिपोर्ट / सर्वेक्षण / प्रयोगशाला भ्रमण (लैब विजिट) / औद्योगिक यात्रा	15	टेबल वर्क / प्रयोग	45
कुल अंक	40		60
कोई टिप्पणी / सुझाव :			

B.Sc. II Semester Chemistry Syllabus
CBCS Annual Pattern
From Academic Year 2021-2022
Paper II (Minor)

Part A Introduction			
Program-CERTIFICATE	**Class-B.Sc.**	**Semester-II**	**Session: 2021-2022**
Subject - Chemistry			
Course Code	**S1–CHEM1T**		
Course Title	**Fundamentals of Chemistry (Paper II) (Minor)**		
Course Type	Core Course		
Pre-requisite (if any)	To study this course our students must have had the subject Chemistry in class +2 or equivalent.		
Course Learning Outcomes (CLO)	By the end of this course students will learn the following aspects of Chemistry: 10. Ancient Indian chemical techniques. 11. Various theories and principles applied to reveal atomic structure. 12. Significance of quantum numbers. 13. Concepts of periodic Properties of elements. 14. Theories related to chemical bonding. 15. Acid-base concept, pH, buffer. 16. Factors responsible for reactivity of organic molecules. 17. Basics and mechanism of chemical kinetics. 18. Properties of electrolytes.		
Credit Value	4		
Total Marks	Maximum Marks: CCE - 40, Theory Exam (TE) - 60	Minimum Passing Marks:35	

Part B – Content of the course		
Total No. of Lecture-Tutorials-Practical (In hours per week): L-T-P:60-0-30		
Unit	**Topic**	**No. of lectures**
1	**(a)**Chemical techniques in ancient India: General Introduction **(b)**Contribution of ancient Indian scientists in chemistry e.g. metallurgy, dyes, pigments, cosmetics, Ayurveda, Charak Sanhita. **Atomic Structure:** (i)Review of Bohr's theory and its limitations. Atomic spectrum of Hydrogen. Dual nature of particles and wave, de Broglie's equation, Heisenberg's Uncertainty principle and its significance. (ii)Quantum numbers and their significance. Rules for filling electrons in various orbitals, Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations, Variation of orbital energy with atomic number. Electronic configuration of the stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations. ***Keywords/Tags**: Metallurgy, Dyes, Cosmetics, Charak Sanhita Hydrogen spectrum, Hund's rule, Aufbau principle.*	**2+4**
2	**Elementary idea of the following properties of the elements with reference to s & p-block elements in periodic table.** • Effective nuclear number (EAN), shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.	**6+4**

	• Atomic radii (van der Waals) • Ionic and crystal radii. • Covalent radii (octahedral and tetrahedral) Detailed discussion of the following properties of the elements, with reference to s & p-blocks. • Ionization energy- Successive ionization energy and factors affecting ionization energy. Applications of ionization energy. • Electronegativity- Pauling's/ Mulliken's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization. ***Keywords/Tags**: EAN, Atomic Radii, Ionic Radii, Crystal Radii, Ionization Energy.* **Acid-Base concept** Arrhenius cocepts, Bronsted-Lowry's concepts, conjugate acids and bases, relative strength of acids, Lewis concept. pH, buffer solutions. Acid-base neutralisation curves, Handerson equation. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Indicator, choice of indicators. ***Keywords/Tags**: Acid-Base Concept, Bronsted-Lowry's Concept, Conjugate Acid and Bases, pH, Buffer Solution, Indicator.*	
3	**Chemical Bonding** i. Ionic Bonding: General characteristics of ionic bonding. Ionic bonding &Energy: lattice & solvation energies and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Madelung constant, Born-Haber cycle and its applications. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules. ii. Covalent bonding: Lewis structure. Valence Bond theory (Heitler-London approach).	**20**

	Hybridization- Concept, types (SP, SP^2, SP^3, dSP^2, d^2SP^3) with suitable examples of inorganic and organic molecules Ionic character in covalent compounds- dipole moment and percentage ionic character. *Valence shell electron pair repulsion theory (VSEPR) theory:* Assumptions, need of theory, application of theory to explain geometries or shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar. tetrahedral, trigonal bipyramidal and octahedral arrangements such as: NH_3, H_2O, SF_4, CIF_3, Pcl_5, SF_6, CIF_5, XeF_4. **Molecular orbital (MO) concept of bonding** The approximations of the theory, Linear combination of atomic orbitals (LCAO) (elementary pictorial approach) Rules for the LCAO method. bonding and antibonding MOs. Characteristics for s-s, s-p and p-p combinations of atomic orbitals. nonbonding combination of orbitals. MO diagrams of homonuclear diatomic molecules: H_2, Li_2, Be_2, B_2, C_2, N_2, O_2, F_2, and their ions. Molecular orbitals of heteronuclear diatomic molecules: CO, NO, CN, HF. **Bond parameters:** Definition and factors affecting - bond orders, bond lengths, bond angles. ***Keywords/Tags:*** *Ionic Bonding Covalent Bonding. Hybridization. VSEPR Theory, LCAO, MO Diagrams, Bond Parameters*	
4	**(a) Fundamentals of Organic Chemistry** Structure, shape and reactivity of organic molecules: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Reactive Intermediates: Carbocations, Carbanions and free radicals. Nucleophiles and electrophiles. **(b) Stereochemistry of Organic compounds:** Concept of isomerism.	**12**

	Geometrical isomerism: Determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. **Optical isomerism:** Elements of symmetry, molecular chirality, enantiomers& their properties, stereogeniccentre, optical activity of enantiomers. Concept of chirality (up to two carbon atoms): chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythroisomers, meso isomer, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Conformations and Conformational analysis Conformations of ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations. ***Keywords/Tags:*** *Electronic Displacements, Nucleophiles, Electrophiles, Isomerism, Molecular Chirality, Enantiomers, Sequence Rules, Conformations.*	
5	**Chemical Kinetics:** Rate of reaction, Definition and difference of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for half-life period. Methods to determine the order of reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. **Ionic Equilibria:** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Solubility and solubility product of sparingly soluble salts-applications of solubility product. ***Keywords/Tags:*** *Order of Reaction. Molecularity of Reaction,*	**12**

	Arrhenius Equation, Activation Energy. Electrolytes, Salt Hydrolysis, Solubility Product.	

Part- C- Learning Resources

Text Book, Reference Books, other resources

Text Books:

13. Lee, J.D., Concise Inorganic Chemistry, ELBS, 1991.
14. Khera, H.C. Gurtu, J.N. Singh, J. Chemistry for B.Sc. I year, Pragati prakashan.
15. Bariyar A & Goyal, S., B.Sc. Chemistry combined. (In hindi) Krishna Educational publisher's year: 2019.
16. Puri, B.R., Pathania M.S., Sharma, L.R., Principles of physical chemistry. Vishal Publishing Co. 2020.
17. Gurtu, J, N., Gurtu A., Advanced physical Chemistry, Pragati prakashan, Meerut ISBN: 9789386633347, 9386633345, Edition: IV, 2017.
18. Day, M.C. and Selbin, J. Theortical Inorganic Chemistry, ACS publications 1962.
19. Bahl, A & Bahl, B.S. Advanced organic chemistry, S. Chand, 2010.
20. Kalsi, P.S., Stereochemistry conformation and mechanism, New age international, 2005.
21. Finar, I.L., organic chemistry (Vol. I and II), E.L.B.S.
22. Morrison, R.T. & Boyd, R.N., Organic Chemistry, Pearson, 2010.
23. Clayden, J.< Greeves, N., Warren, S. Wothers, P., Organic Chemistry, Oxord University Press, 2nd Edition, 2012.
24. Atkins' Physical Chemistry, 10th Edition, oxford University Press, 2014.

Reference Books:

11. Prakash, S., Founders of Sciences in Ancient India, published by the Research Institute of Ancient Scientific Studies, New Delhi, 1965 (OCoLC) 594302452.
12. Acharya Prafulla Chandra Ray- A Collection of Writing, Volume III A: A history of Hindu Chemistry (Volume-I). Editor: prof. Anil Bhattacharyya, Publisher: Unviersity of Calcutta. Online information: http://www/calunic.ac.in/news/APCR%20pulication/acharya-prafulla.html.
13. Chemistry in India, in Traditions and Practices of India, Textbooks for Class XI, Module 2, Central Board of Secondary Education.

14. Subbarayappa, B.V., Chemistry and Chemical Techniques in India, Centre for Studies in Civilizations, 2004, ISBN 818758601X.
15. Huheey, J.E., Kieter, E.A., Keiter, R.L. & Medhi, O.K., Inorganic Chemistry: Prinicples of structure and Ractivity, Person Education india, 2006.
16. Douglas, B.E., Mc Daniel, D.H. & Alexander, J.J, concepts and Models in Inorganic Chemistry, John Wiley & Sons, 1994.
17. Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. organic Chemistry, John Wiley & Sons, 12th Edition 2016.
18. McMurry, J.E. Fundamentals of organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
19. Sykes, P., A. Guidebook to Mechanism in organic chemistry, Orient Longman, New Delhi (1988).
20. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill(2007).

Suggested equivalent online courses:

(all URLs accessed in May 2021)

- MOOC: https://alison.com/course/fundamentals-of-chemistry
- NPTEL: https://nptel.ac.in/courses/104/106/104106119/ ; https://nptel.ac.in/courses/104/101/104101121/
- MIT: https://ocw.mit.edu/courses/chemistry/5-12-organic-chemistry-i-spring-2005/syllabus/

Web sources

(all URLs accessed in May 2021)

https://www.sydney.edu.au/science/chemistry/~george/1108/ShapesOfMolecules.pdf

https://artsandculture.google.com/exhibit/rasashala-ancient-indian-alchemical-lab-national-council-of-science-museums/KwJCaP1RF0y-KQ?hl=en

http://sanskrit.uohyd.ac.in/events-new/Ancient-Indian-chemistry.pdf

https://insa.nic.in/writereaddata/UpLoadedFiles/IJHS/Vol01_1_1_PRay.pdf

https://asi.nic.in/Ancient_India/Ancient_India_Volume_9/article_8.pdf

https://ddceutkal.ac.in/Syllabus/MA_history/paper_23.pdf

https://vvm.org.in/study_material/ENG%20-%20Indian%20Contributions%20to%20Science.pdf

https://www.pgurus.com/chemistry-in-ancient-india/

https://en.wikipedia.org/wiki/History_of_chemistry

Part D- Assessment and Evaluation			
Suggested Continuous Evaluation Methods: Continuous Internal Evaluation Shall be based on Allotted Assignment and class tests. The marks shall be as follows:			Marks
Assessment and presentation of Assignment			**06**
Class Test- I (Objective Questions)			**06**
Class Test- II (Descriptive Questions)			**06**
Class Test- I (Objective Questions)			**06**
Class Test- II (Descriptive Questions)			**06**
Overall performance throughout the year (includes attendance, behaviour, discipline, participation in different activities).			**10**
Total			**40**
Elaboration : Assessment Theory			
External Assessment			
Theory Paper	Section A	3 very short question (50 word each)	
	Section B	4 short question (200 words each)	
	Section C	4 long question (500 words each)	
	Total		**60**
Grand Total			**100**

बी.एस–सी. द्वितीय सेमेस्टर
सैद्धांतिक प्रश्नपत्र के पाठ्यक्रम

भाग अ – परिचय			
कार्यक्रम : प्रमाण पत्र	कक्षा : बी.एस–सी.	सेमेस्टर – द्वितीय	सत्र : 2021 – 2022
विषय : रसायन विज्ञान			
1	पाठ्यक्रम कोड	**S1 – CHEM1T**	
2	पाठ्यक्रम का शीर्षक	रसायन विज्ञान के आधारभूत सिद्धांत (प्रश्नपत्र II) माईनर	
3	पाठ्यक्रम का प्रकार : कोर कोर्स /इलेक्टिव/जेनेरिक इलेक्टिव/ वोकेशनल/	कोर कोर्स	
4	पूर्वापेक्षा (Prerequisite) (यदि कोई हो)	इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों के पास कक्षा +2 या समकक्ष में रसायन विज्ञान विषय होना चाहिए	
5	पाठ्यक्रम अध्ययन की परिलब्धियॉं (कोर्स लर्निंग आउटकम) (CLO)	इस पाठ्यक्रम के उपरांत विद्यार्थी रसायनशास्त्र विषय के निम्न आयामों का ज्ञान प्राप्त कर लेंगे। 10. प्राचीन भारतीय रासायनिक तकनकी। 11. परमाणु संरचना को प्रकट करने के लिए लागू विभिन्न सिद्धांत एवं अवधारणाएं। 12. क्वांटम संख्याओं को महत्व। 13. तत्वों के आवधिक गुणों की अवधारणा। 14. रासायनिक बंधन से संबंधित सिद्धांत। 15. अम्ल–क्षार अवधारणा, pH, बफर। 16. कार्बनिक अणुओं की क्रिया ीलता के लिए उत्तरदायी कारक।	

		17. रासायनिक बलगतिकी की आधारभूत अवधारणाएं एवं कियाविधि। 18. विद्युत अपघट्य (इलेक्ट्रोलाइटस) के गुण।	
6	केडिट मान	4	
7	कुल अंक	अधिकतम अंक : 40 + 60	न्यूनतम उत्तीर्ण अंक : 35

भाग ब - पाठ्यक्रम विषयवस्तु		
व्याख्यान की कुल संख्या-ट्यूटोरियल- प्रायोगिक(प्रति सप्ताह घंटे में) :**L-T-P:**		
इकाई	विषय	व्याख्यान की संख्या
1	(ए) प्राचीन भारत में रासायनिक तकनीक: सामान्य परिचय। (बी) रसायन विज्ञान में प्राचीन भारतीय वैज्ञानिकों का योगदान उदाहरणार्थ धातुविज्ञान, रंग, रंगद्रव्य, सौंदर्यप्रसाधन, आयुर्वेद (सी) परमाण्विक संरचनाः (i) बोहर के सिद्धांत एवं उसकी सीमाओं की समीक्षा। हाइड्रोजन परमाणु का स्पेक्ट्रम कण एवं तरंग की द्वैतीप्रकृति, डी ब्रोगली समीकरण, हाइजेनबर्ग का अनिश्चितता सिद्धांत एवं इसका महत्व। (ii) क्वांटम संख्याएँ एवं उनका महत्व। विभिन्न कक्षकों में इलेक्ट्रॉनों को भरने के नियम, पाउली का अपवर्जन सिद्धांत, इंड का अधिकतम बहुलता का नियम, औफबाऊ का सिद्धांत एवं इसकी सीमाएं, परमाणु क्रमांक के साथ कक्षीय ऊर्जा का परिवर्तन । परमाणुओं के इलेक्ट्रॉनिक विन्यास। आधे भरे एवं पूरी तरह से भरे हुए कक्षकों की स्थिरता, विनिमय ऊर्जा की अवधारणा। परमाणु कक्षकों की सापेक्ष ऊर्जा, असामान्य इलेक्ट्रॉनिक विन्यास। *सार बिंदु (की वर्ड) / टैग: धातु विज्ञान, सौदर्य प्रसाधन, चरक संहिता, हाइड्रोजन परमाणु का स्पेक्ट्रम पाउली का अपवर्जन सिद्धांत, हुड*	**2+6**

	का नियम, औफबाऊ सिद्धांत	
2	आवर्त सारणी में s & p समुदाय (ब्लॉक) तत्वों के संदर्भ में तत्वों के निम्नलिखित गुणों की प्रारंभिक अवधारणा । • प्रभावी परमाणु क्रमांक (EAN), परिरक्षण या स्क्रीनिंग प्रभाव, स्लेटर नियम, आवर्त सारणी में प्रभावी परमाणु आवेश का परिवर्तन। • परमाण्विक त्रिज्या (वण्डरवाल्स) • आयनिक एवं क्रिस्टल त्रिज्या • सहसंयोजक त्रिज्या अष्टफलकीय (ऑक्टाहेड्रल) एवं चतुष्फलकीय (टेट्राहेड्रल) s & p-समुदाय (ब्लॉक) के संदर्भ में तत्वों के निम्नलिखित गुणों की विस्तृत चर्चाः •आयनीकरणऊर्जा-क्रमिक आयनीकरण ऊर्जा एवं आयनीकरण ऊर्जा को प्रभावित करने वाले कारक। आयनीकरण ऊर्जा के अनुप्रयोग। •ऋणविद्युतता (इलेक्ट्रोनगेटिविटी)- पॉलिंग / मुल्लिकेन की ऋणविद्युतता स्केल ऋणविद्युतता पर आबंध संख्या (बॉन्ड ऑर्डर), आंशिक आवेश, संकरण (हाइब्रिडाइजेशन) के परिवर्तन का प्रभाव। *सार बिंदु (की वर्ड) / टैगः EAN, परमाण्विक त्रिज्या, आयनिक त्रिज्या, क्रिस्टल त्रिज्या, आयनीकरण ऊर्जा* अम्ल-क्षार अवधारणा अर्हिनियस अवधारणा, ब्रॉस्टेड-लोरी की अवधारणा, संयुग्मी अम्ल व क्षार, अम्लों की सापेक्ष शक्ति, लुईस अवधारणा pH, बफर विलयन अम्ल-क्षार उदासीनीकरण वक्र, हेंडरसन समीकरण। कार्बनिक अम्लों एवं क्षारों की शक्तिः pK मानों को प्रभावित करने वाले कारकों के परिप्रेक्ष्य में तुलनात्मक अध्ययन सूचक, सूचकों का	**6+4**

	चयन। *सार बिंदु (की वर्ड) / टैग: अम्ल-क्षार अवधारणा, ब्रॉस्टेड-लोरी की अवधारणा, संयुग्मी अम्ल व क्षार, pH, बफर विलियन, सूचक।*	
3	रासायनिक आबंधन i. आयनिक बंध: आयनिक बंध की सामान्य अभिलक्षण। आयनिक बंध एवं ऊर्जा-जालक व विनायक ऊर्जा एवं उनका आयनिक यौगिकों की स्थिरता एवं घुलनशीलता के संदर्भ में महत्व जालक ऊर्जा की गणना के लिए बोर्न-लैंडे समीकरण का कथन मैडेलुंग स्थिरांक, बोर्न-हैवर चक्र एवं इसके अनुप्रयोग आयनिक यौगिकों में सहसंयोजक चरित्र, ध्रुवीकरण शक्ति एवं ध्रुवीकरण फजान के नियम। ii. सह संयोजक बंध: लुईस संरचना, सहसंयोजक आबंध सिद्धांत (हिटलर-लंदन दृष्टिकोण)। संकरण अवधारणा व प्रकार (SP, SP^2, SP^3, dSP^2, d^2SP^3) कार्बनिक एवं अकार्बनिक अणुओं के उपयुक्त उदाहरणों के साथ। सहसंयोजक यौगिकों में आयनिक लक्षण दिध्रुव आघूर्ण एवं प्रतिशत आयनिक लक्षण। संयोजकता कक्षक इलेक्ट्रॉन युग्म प्रतिकर्षण सिद्धांत (VSEPR) सिद्धांत: अभिग्रहीत, सिद्धांत की आवश्यकता। VSEPR व संकरण के आधार पर कुछ अकार्बनिक अणुओं एवं आयनी की ज्यामितिया आकार की व्याख्या करने के लिए सिद्धांत का अनुप्रयोग उपयुक्त उदाहरणों सहित रैखिक, समतलत्रिकोणीय, वर्ग समतलीय, समचतुफलकीय (टेट्राहेड्रल) त्रिभुजीय द्विपिरामिड (ट्राइगोनल बाइपिरामाइडल), अष्टफलकीय (ऑक्टाहेड्रल) व्यवस्थाएं जैसे: NH_3, H_2O, SF_4, CIF_3, Pcl_5, SF_6, CIF_5, XeF_4. आश्विक कक्षक (MO) आबंधन की अवधारणा सिद्धांत के सन्निकटन, परमाणु कक्षकों का रैखिक संयोजन (LCAO) (प्राथमिक चित्रात्मक दृष्टिकोण) LCAO विधि के लिए नियम, बंधी व प्रतिआबंधी MOs परमाणु कक्षकों के ss, sp व pp	**20**

	संयोजन के अभिलक्षण, अनाबंधी संयोजन की विशेषताएं। समनाभिकीय द्विपरमाण्विक अणुओं के आण्विक कक्षक आरेख: H_2, Li_2, Be_2, B_2, C_2, N_2, O_2, F व उनके आयन। विषमनाभिकीय द्विपरमाण्विक अणुओं के आण्विक कक्षक आरेख CO, NO, CN, HF. बंध प्राचल: बंध कोटि बंध लंबाई, बंध कोण-परिभाषा एवं प्रभावित करने वाले कारक। *सार बिंदु (की वर्ड) / टैग: आयनिक बंध, सहसयोजक बंध, संकरण, VSEPR सिद्धांत, LCAO, MO आरेख, बंध प्राचल*	
4	(a) कार्बनिक रसायन के आधारभूत सिद्धांत कार्बनिक अणुओं की संरचना, आकृति व क्रियाशीलता: भौतिक प्रभाव, इलेक्ट्रॉनिक विस्थापन प्रेरणिक प्रभाव, इलेक्ट्रोमेरिक प्रभाव, अनुनाद एवं अतिसंयुग्मन। बंध विदलनः समांश व विषमांश बंध विदलन। क्रियाशील मध्यवर्ती: कार्बधनायन, कार्यऋणायन एवं मुक्त मूलक नाभिकस्नेही व इलेक्ट्रान स्नेही । (b) कार्बनिक यौगिकों का त्रिविम रसायन: समावयवता की अवधारणा ज्यामितीय समावयवताः ज्यामितीय समावयवों के विन्यास का निर्धारण नामकरण की ई व जेड (E & Z) प्रणाली, ऑक्सीम्स एवं एलिसाइक्लिक यौगिकों में ज्यामितीय समावयवता । प्रकाशिक समावयवताः सममिति के तत्व, आण्विक किरैलता, प्रतिविम्बी समावयवी (इनैंशियोमर) व उनके गुण, स्टीरियोजेनिक केन्द्र, प्रतिविम्बी समावयवियों की प्रकाशिक सक्रियता। किरैलता की अवधारणा (दो कार्बन परमाणुओं तक): दो स्टीरियोजेनिक केंद्रों के साथ किरैल एवं अकिरैल अणु,	**12**

	अप्रतिबिम्बी समावयवी (डायस्टेरियोमर्स), थ्रेओ एवं एरिथ्रो समावयवी, मेसो समावयवी प्रतिबिम्बी समावयवियों का वियोजन / पृथक्करण, प्रतिलोमन, अप्रतिलोमन / प्रतिधारण एवं रेसिमीकरण सापेक्ष एवं निरपेक्ष विन्यास, अनुक्रम नियम, नामकरण की डी व एल (D & L) एवं आर व एस (R & S) प्रणाली संरूपण एवं संरुपी विश्लेषण ईथेन, ब्यूटेन एवं साइक्लो हेक्सेन के संरूपण। वेजसूत्र, न्यूमैन, सॉहॉर्स एवं फिशर प्रक्षेपण सूत्रों का परस्पर रूपांतरण । *सार बिंदु (की वर्ड) / टैग: इलेक्ट्रॉनिक विस्थापन, नाभिक स्नेही, इलेक्ट्रॉन स्नेही, समावयवता, आण्विक किरैलता, प्रतिविम्बी समावयवी, अनुक्रम नियम, सरूपण*	
5	रासायनिक बल गतिकी: अभिक्रिया की दर, अभिक्रिया की कोटि एवं आणविकता की परिभाषा एवं अंतर, शून्य कोटि, प्रथम कोटि, द्वितीय, तृतीय कोटि की अभिक्रियाओं के लिए दर / वेग स्थिरांक की व्युत्पत्ति एवंउदाहरण अर्द्ध आयुकाल के लिए व्युत्पत्ति अभिक्रिया की कोटि निर्धारण की विधियाँ, अभिक्रिया की दर पर तापमान का प्रभाव, अर्हीनियस समीकरण, सक्रियण ऊर्जा की अवधारणा। आयनिक साम्य: प्रबल, मध्यम एवं दुर्बल विद्युत अपघट्य, आयनीकरण की कोटि, आयनीकरण की कोटि को प्रभावित करने वाले कारक, आयनीकरण स्थिरांक एवं जल का आयनिक उत्पाद। सम आयन प्रभाव। लवण जल अपघटन, जल अपघटन स्थिरांक की गणना, जल अपघटन की कोटि एवं विभिन्न लवणों के लिए पीएच। विरल रूप से घुलनशील लवणों की विलेयता एवं विलेयता उत्पाद, विलेयता उत्पाद के अनुप्रयोग। अभिक्रिया की कोटि अभिक्रिया की आणविकता, अर्हीनियस समीकरण, सक्रियण ऊर्जा विद्युत अपघट्य, लवण जल-अपघटन, विलेयता उत्पाद । *सार बिंदु (की वर्ड) टैग: अभिक्रिया कोटि, आणविकता, अर्हीनियस समीकरण, सक्रियण ऊर्जा विद्युत अपघट्य, लवण जल-अपघटन, विलेयता उत्पाद ।*	**12**

भाग स- अनुशासित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें /ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

1. ली, जे.डी., कंसाईज इनऑर्गेनिक केमिस्ट्री, ईएलबीएस, 1991.
2. खेड़ा, एच.सी., गुर्टू, जे.एन., सिंह, जे., केमिस्ट्री फॉर बीएससी फर्स्ट ईयर, प्रगति प्रकाशन.
3. बरियार, ए. एवं गोयल, एस., बी.एससी. केमिस्ट्री कंबाइंड, (हिंदी में) कृष्णा एजुकेशनल पब्लिशर्स वर्ष: 2019.
4. पुरी, बी.आर., पठानिया, एम.एस., शर्मा, एल.आर., प्रिंसिपल्स ऑफ़ फिजिकल केमिस्ट्री, विशाल पब्लिशिंग कंपनी 2020.
5. गुर्टू, जे.एन., गुर्टू ए., एडवांस्ड फिजिकल केमिस्ट्री, प्रगति प्रकाशन, मेरठ, आईएसबीएन: 9789386633347, 9386633345, 2017, संस्करण: IV.
6. डे, एम.सी. एवं सेलबिन, जे., थ्योरेटिकल इनऑर्गेनिक केमिस्ट्री, एसीएम प्रकाशन 1962.
7. बहल, ए. एवं बहल, बी.एस., एडवांस्ड ऑर्गेनिक केमिस्ट्री, एस. चांद, 2010.
8. क्लसी, पी.एस., स्टीरियोकेमिस्ट्री कॉनफॉर्मेशन एंड मैकेनिज्म, न्यू एज इंटरनेशनल, 2005.
9. फिनार, आई.एल., ऑर्गेनिक केमिस्ट्री (वॉल्यूम I और II), ईएलबीएस
10. मॉरिसन, आर.टी. एंड बॉयड, आर.एन., ऑर्गेनिक केमिस्ट्री, पियरसन, 2010।
11. क्लेडेन, जे., ग्रीव्स, एन., वॉरेन, एस., वोदर्स, पी., ऑर्गेनिक केमिस्ट्री, ऑक्सफोर्ड यूनिवर्सिटी प्रेस, 2nd एडिशन, 2012.
12. एटकिंस फिजिकल केमिस्ट्री, X एडिशन, ऑक्सफोर्ड यूनिवर्सिटी प्रेस, 2014.

सन्दर्भ पुस्तकें:

1. प्रकाश, एस., फाउंडर ऑफ साइंस इन एनशिएंट इंडिया, द रिसर्च इंस्टिट्यूट ऑफ एनशिएंट साइंटिफिक स्टडीज, नई दिल्ली द्वारा प्रकाशित, 1965.
2. आचार्य प्रफुल्ल चंद्र रे - ए कलेक्शन ऑफ राइटिंग्स, वॉल्यूम III A: ए हिस्ट्री ऑफ हिंदू केमिस्ट्री (वॉल्यूम- I), संपादक: प्रो। अनिल भट्टाचार्य, प्रकाशक: कलकत्ता, ऑनलाइन विवरण - https://www.caluniv.ac.in/news/APCR%20Publication/acharya-prafulla.html
3. भारत में रसायन विज्ञान, भारत की परंपराओं और प्रथाओं में, ग्यारहवीं कक्षा के लिए पाठ्यपुस्तक, मॉड्यूल 2, केंद्रीय माध्यमिक शिक्षा बोर्ड.
4. मुब्बारायप्पा, बी.बी., भारत में रसायन विज्ञान और रासायनिक तकनीक, सभ्यताओं में अध्ययन केंद्र, 2004, ISBN 818758601X.
5. हुही, जे.ई., कीटर, ई.ए., कीटर, आर.एल. और मेधी, ओ.के., इनऑर्गेनिक केमिस्ट्री: प्रिन्सिपल्स ऑफ स्ट्रक्चर एंड रिएक्टिविटी, पियर्सन एजुकेशन इंडिया, 2006.
6. हबलस, बी.ई., मैकडैनियल, डी.एच. एंड अलेक्जेंडर, जे.जे., कॉन्सेप्ट्स एंड मॉडल्स इन इनऑर्गेनिक केमिस्ट्री, जॉन विले एंड संस, 1994.
7. ग्राहम सोलोमन, टी. डब्लू, फ्रॉयल, सी. बी., नाइडर, ऐस. ए., ऑर्गेनिक केमिस्ट्री, जॉन विले एंड संस, 12 वां संस्करण, 2016.
8. मैकमुरी, जे.ई. फंडामेंटल्स ऑफ ऑर्गेनिक केमिस्ट्री, 7वां एड। सेंगेज लर्निंग इंडिया संस्करण, 2013.
9. साइक्स, पी., ए गाइडबुक टू मैकेनिज्म इन ऑर्गेनिक केमिस्ट्री, ओरिएंट लॉन्गमैन, नई दिल्ली (1988).
10. बैरो, जी.एम., फिजिकल केमिस्ट्री, टाटा मैकग्रा-हिल 2007.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक (all URLs accessed in May 2021)

https://www.sydney.edu.au/science/chemistry/~george/1108/ShapesOfMolecules.pdf

https://artsandculture.google.com/exhibit/rasashala-ancient-indian-alchemical-lab-national-

council-of-science-museums/KwJCaP1RFUy-KQ?hl=en

http://sanskrit.uohyd.ac.in/events-new/Ancient-Indian-chemistry.pdf

https://insa.nic.in/writereaddata/UpLoadedFiles/IJHS/Vol01_1_1_PRay.pdf

https://asi.nic.in/Ancient_India/Ancient_India_Volume_9/article_8.pdf

https://ddceutkal.ac.in/Syllabus/MA_history/paper_23.pdf

https://vvm.org.in/study_material/ENG%20-%20Indian%20Contributions%20to%20Science.pdf

https://www.pgurus.com/chemistry-in-ancient-india/

https://en.wikipedia.org/wiki/History_of_chemistry

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

- MOOC: https://alison.com/course/fundamentals-of-chemistry
- NPTEL:https://nptel.ac.in/courses/104/106/104106119/https://nptel.ac.in/courses/104/101/104101121/
- MIT: https://ocw.mit.edu/courses/chemistry/5-12-organic-chemistry-i-spring-2005/syllabus/

भाग द – अनुशंसित मूल्यांकन विधियां :		
अनुशंसित सतत मूल्यांकन विधियां : अधिकतम अंक : 100 सतत व्यापक मूल्यांकन सीसीई अंक : 40 सैद्धांतिक परीक्षा अंक : 60		
आंतरिक मूल्यांकनः सतत व्यापक मूल्यांकन सीसीई	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण	25 15 कुल अंकः 40
आकलन : सैद्धांतिक परीक्षा : समय – 02:00 घंटे	अनुभाग (अ) : तीन अति लघु प्रश्न (प्रत्येक 50 शब्द) अनुभाग (ब) : तीन अति लघु प्रश्न (प्रत्येक 200 शब्द) अनुभाग (स) : दो दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	कुल अंक : 60
कोई टिप्पणी / सुझाव :		

B.Sc. II Semester Chemistry Syllabus
CBCS Annual Pattern
From Academic Year 2021-2022
Paper I (Major)

Part A Introduction			
Program-CERTIFICATE	**Class-B.Sc.**	**Semester-II**	**Session: 2021-2022**
Subject - Chemistry			
Course Code	**S1 –CHEM2T**		
Course Title	**Analytical Chemistry (Paper I) (Major)**		
Course Type	Core Course		
Pre-requisite (if any)	To study this course our students must have had the subject Chemistry in class +2 or equivalent.		
Course Learning Outcomes (CLO)	By the end of this course students will learn the following aspects of Chemistry: 7. Basic concepts of Mathematics for Chemists. 8. Fundamentals of analytical chemistry and steps involved in analysis. 9. Basic knowledge of Computer for chemists. 10. Basic Concepts of Chemical equilibrium. 11. Principal of Chromatography and chromatographic techniques. 12. Various techniques of Spectroscopic Analysis.		
Credit Value	4		
Total Marks	Maximum Marks: CCE - 40, Theory Exam (TE) - 60	Minimum Passing Marks:35	

Part B – Content of the course		
Total No. of Lecture-Tutorials-Practical (In hours per week): L-T-P:90-0-30		
Unit	**Topic**	**No. of lectures**
1	**Mathematics for Chemists** Straight line equation, Logarithmic relations, curve sketching, linear graphs & calculation of slopes. Differentiation, differentiation of functions like K_X, e^x, x^n, sinx, logx, maxima & minima, partial differentiation. Integration of some useful relevant functions. ***Keywords/Tags:*** *Linear graphs, Logarithmic Relation, Differentiation, Integration* **Computer for Chemists** Introduction to computer, Introduction to operating systems like -DOS, Windows, Linux and Ubuntu. **Use of computer programs** Running of standard programs & packages such as MS-word, MS-excel, PowerPoint, Execution of linear regression x-y Plot. Use of softwares for drawing structures and molecular formulae. ***Keywords/Tags:*** *Operating Systems, MS-word, MS-excel, PowerPoint.*	**10**
2	**Basic Analytical Chemistry:** Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures. Statistical terms: mean, mean deviation, median. standard deviation, Numerical Problems. **Calculations used in Analytical Chemistry** **Some Important units of measurements-** SI Units, distinction between mass and weight, mole, milli mole and Numerical Problems. **Solution and their concentrations-** Concept of Molarity, molality and normality. Expressing the concentration in parts per million (ppm), parts per billion (ppb), Numerical Problems.	**10**

	Chemical Stoichiometry- Empirical and Molecular Formulas, Stoichiometric Calculations, Numerical Problems. ***Keywords/Tags:*** *Accuracy, Precision, SI units. Units of Concentration, Chemical stoichiometry.*	
3	**Chemical Equilibrium:** Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van't Hoff reaction isotherm. Le-Chatelier's principle and its applications. ***Keywords/Tags:*** *Chemical Equilibrium, Equilibrium constant, Free Energy, Chemical Potential*	**10**
4	**Chromatography** Introduction, Principle and Classification. Mechanism of separation: adsorption, partition & ion-exchange. Development of chromatograms: frontal. elution and displacement methods. Paper Chromatography (ascending, descending and circular), Thin Layer Chromatography (TLC) and Column Chromatography (CC), Gas Chromatography (GC) and High Pressure Liquid Chromatography (HPLC), types of column and column selection, applications, limitations. **Principle and Applications of:** • Flash chromatography, • Ion-exchange chromatography and • Chiral chromatography. ***Keywords/Tags*** *Chromatogram, Ion Exchange, Column Selection Adsorption.*	**10**
5	**Spectral techniques of analysis** **Basics of absorption spectroscopy:** Electromagnetic radiation. Spectral range. Absorbance. Absorptivity, Molar Absorptivity, Fundamental Laws of Absorption. Lambert-Beer Law and its limitations. Constitution & working of photometer, spectrometer, colorimeter. **Ultraviolet (UV) absorption spectroscopy-** Presentation and analysis of UV spectra. Types of electronic transitions, Effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, Hyperchromic and hypochromic shifts. UV spectra of conjugated polyenes and enones.	**10**

	Infra-red (IR) absorption spectroscopy- Molecular vibrations. Hooke's law, selection rules, intensity and position of IR bands, Measurement of IR spectrum, finger print region. characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds. ***Keywords/Tags:*** *Hypsochromic, Hypochromic, Absorption, Spectrum*	

Part C -Learning resources

Text Books, Reference Books, Other Resources

Text Books

1. Gaur, S., Computer for Chemists, Neel Kamal Prakashan, 2017
2. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009
3. Kaur H, Analytical Chemistry, PragatiPrakashan (2008)
4. Gupta, Alka L.,Analytical Chemistry, PragatiPrakashan (2020)
5. Bahl, A. &Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
6. Kaur H, Instrumental Methods of Chemical Analysis, PragatiPrakashan, 2018
7. Sharma B.K., Chromatography, Krishna Prakashan, 2019.
8. Sharma Y.R., Elementary Organic Spectroscopy, S Chand, 2013
9. Singh, DR, Saxena, G., Singh, B., Inorganic Chemicals, Shivlal Aggarwal & Company, Agra
10. Srivastava, S. S., Gehlot, A. S., Chemistry, Ratan Prakashan Temple, Indore
11. Soni, PL, Organic Chemistry, Sultan Chand and Sons, Delhi
12. Singh, R.K. P., Modern Chemistry, Sahitya Bhavan, Agra
13. Agnihotri, PK, Sahu, D
14. P., Pillai, A., Sahu, M., Yugbodh Chemistry, Yugbodh Publications, Raipur

Reference Books:

1. Mitra Surbhi, Handbook of Computer Science & IT, Arihant, 2018
2. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007)
3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill (2007)
5. Atkins' Physical Chemistry, 10th Edition, Oxford University Press, 2014
6. Gurtu J.N, Gurtu A., Advanced Physical Chemistry, PragatiPrakashan, Meerut. ISBN: 9789386633347, 9386633345; Edition: IV, 2017
7. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.
8. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
9. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
10. Banwell, Molecular Spectroscopy, 2017.
11. Silverstien Robert, Spectrometric Identification of Organic Compounds, Wiley, 2014
12. Dyer J.R., Applications of Absorption Spectroscopy of Organic Compounds, 2009.

Suggested equivalent online courses:

MOOC : https://www.edx.org/course/basic-analytical-chemistry

NPTEL: https://nptel.ac.in/courses/104/105/104105084/

Web sources

1. http://www.freebookcentre.net/Chemistry/Analytical-Chemistry-Books.html
2. https://www.springer.com/journal/216

Part D- Assessment and Evaluation	
Suggested Continuous Evaluation Methods: Continuous Internal Evaluation Shall be based on Allotted Assignment and class tests. The marks shall be as follows:	Marks
Assessment and presentation of Assignment	**06**
Class Test- I (Objective Questions)	**06**
Class Test- II (Descriptive Questions)	**06**
Class Test- I (Objective Questions)	**06**
Class Test- II (Descriptive Questions)	**06**
Overall performance throughout the year (includes attendance, behaviour, discipline, participation in different activities).	**10**
Total	**40**
Elaboration : Assessment Theory	
External Assessment	
Theory Paper	**60**
Grand Total	**100**

बी.एस–सी. द्वितीय सेमेस्टर
सैद्धांतिक प्रश्नपत्र के पाठ्यक्रम

भाग अ – परिचय			
कार्यक्रम : प्रमाण पत्र	कक्षा : बी.एस–सी.	सेमेस्टर – द्वितीय	सत्र : 2021 – 2022
विषय : रसायन विज्ञान			
1	पाठ्यक्रम कोड	**S1 – CHEM2T**	
2	पाठ्यक्रम का शीर्षक	विशेषणात्मक रसायन विज्ञान (प्रश्नपत्र I) मेजर	
3	पाठ्यक्रम का प्रकार : कोर कोर्स /इलेक्टिव /जेनेरिक इलेक्टिव/ वोकेशनल /	कोर कोर्स	
4	पूर्वापेक्षा (Prerequisite) (यदि कोई हो)	इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों के पास कक्षा +2 या समकक्ष में रसायन विज्ञान विषय होना चाहिए	
5	पाठ्यक्रम अध्ययन की परिलब्धियाँ (कोर्स लर्निंग आउटकम) (CLO)	इस पाठ्यक्रम के उपरांत विद्यार्थी रसायनशास्त्र विषय के निम्न आयामों का ज्ञान प्राप्त कर लेंगे। 7. रसायनज्ञों के लिए गणित की आधारभूत अवधारणाएं। 8. विश्लेषणात्मक रसायनविज्ञान के आधारभूत और विश्लेषण में शामिल तरीके 9. रसायनज्ञों के लिए कंप्युटर का आधारभूत ज्ञान 10. रसायनिक साम्य की आधारभूत अवधारणाएँ। 11. वर्णलेखिकी (क्रोमेटोग्राफी) और वर्णलेखन (क्रोमेटोग्राफीक) तकनीकी के सिद्धांत 12. स्पेक्ट्रोस्कोपिक विश्लेषण की विभिन्न तकनीक।	
6	केडिट मान	4	
7	कुल अंक	अधिकतम अंक : 40 + 60	न्यूनतम उत्तीर्ण अंक : 35

भाग ब - पाठ्यक्रम विषयवस्तु		
व्याख्यान की कुल संख्या-ट्यूटोरियल- प्रायोगिक (प्रति सप्ताह घंटे में) : **L-T-P:**		
इकाई	विषय	व्याख्यान की संख्या
1	रसायनज्ञों के लिए गणित सरल रेखा समीकरण, लघुगणकीय सम्बन्ध, वक्र आलेखन, रेखीय ग्राफ व ढाल का परिकलन अवकलन, K_x, e^x, x^n, sinx, logx, फलनों के अवकलन, उच्चिष्ठ व् निम्निष्ट, आंशिक अवकलन कुछ उपयोगी व् सार्थक फलनों के समाकलन. *सार बिंदु (की वर्ड) /टैग: रेखीय ग्राफ, अवकलन, समाकलन.* रसायनज्ञों के लिए कंप्यूटर कंप्यूटर का परिचय, डॉस, विंडोज, लिनक्स और उबंटू जैसे ऑपरेटिंग सिस्टम का परिचय कंप्यूटर प्रोग्राम का उपयोग एमएस वर्ड, एम एस-एक्सेल, पॉवर पॉइंट जैसे मानक प्रोग्राम और पैकेज को चलाना। रेखीय | प्रतिगमन x-y प्लॉट का निष्पादन। संरचनाओं और आणविक सूत्रों के चित्रांकन हेतु सॉफ्टवेयर का उपयोग। *सार बिंदु (की वर्ड) /टैग: ऑपरेटिंग सिस्टम, एमएस-वर्ड, एमएस-एक्सेल, पावरपॉइंट*	**10**
2	आधारभूत विश्लेषणात्मक रसायन: विश्लेषणात्मक रसायन का परिचय और इसकी अंतर्विषयक प्रकृति प्रतिदर्शी (sampling) की अवधारणा विश्लेषणात्मक मापन में यथार्थता (accuracy), परिशुद्धता (precision) और त्रुटि के स्त्रोतों का महत्व । प्रायोगिक डेटा और परिणामों की प्रस्तुति, सार्थक अंकों के दृष्टिकोण से सांख्यिकीय शब्दावली- माध्य माध्यविचलन, माध्यिका, मानकविचलन, संख्यात्मकप्रश्न विश्लेषणात्मक रसायन में प्रयुक्त गणनाएं माप की कुछ महत्वपूर्ण इकाइयाँ- SI इकाइयाँ, द्रव्यमान व भार के बीच अंतर, मोल, मिलीमोल व संख्यात्मक प्रश्न ।	**10**

	विलयन और उनकी सांद्रता- मोलरता, मोललता और नॉर्मलता की अवधारणा । भाग प्रति मिलियन (ppm), भाग प्रति बिलियन (ppb) में सांद्रता को व्यक्त करना संख्यात्मक प्रश्न । रासायनिक रससमीकरणमिति- आनुभविक और आणविक सूत्र, रससमीकरणमिति (Stoichiometric) गणना। संख्यात्मक प्रश्न । *सार बिंदु (की वर्ड)/टैग: यथार्थता परिशुद्धता SI इकाइयों, सांद्रता की इकाइयाँ, रासायनिक रससमीकरणमिति*	
3	रासायनिक साम्य: साम्य स्थिरांक एवं मुक्त ऊर्जा, रासायनिक विभव की अवधारणा, रासायनिक साम्य के नियम की ऊष्मागतिक व्युत्तपत्ति, रासायनिक साम्य की ताप पर निर्भरता, वाण्टहॉफ अभिक्रिया समआयतनिक, वाण्टहॉफ अभिक्रिया समतापी, ले-चेटेलियर का सिद्धांत और उसके अनुप्रयोग। *सार बिंदु (की वर्ड)/टैग: रासायनिक साम्य, साम्य स्थिरांक स्थिर, मुक्त ऊर्जा, रासायनिक विभव*	**10**
4	वर्णलेखिकी (क्रोमैटोग्राफी) परिचय, सिद्धांत और वर्गीकरण पृथक्करण की क्रियाविधिः अधिशोषण, वितरण, आयन-विनिमय। क्रोमैटोग्राम का विकास: अग्र-भाग, निक्षालन और विस्थापन की विधियां । कागज़ वर्णलेखिकी (आरोही, अवरोही और गोलाकार), पतली परत वर्ण लेखिकी (TLC) एवं कॉलम वर्णलेखिकी (CC), गैस वर्णलेखिकी (GC) और उच्चदबाव तरल- वर्णलेखिकी (HPLC), कॉलम के प्रकार एवं कॉलम चयन, अनुप्रयोग, सीमाएं सिद्धांत और अनुप्रयोगः • फ्लैश क्रोमैटोग्राफी • आयन-विनिमय क्रोमैटोग्राफी	**10**

	• चिरल क्रोमैटोग्राफी *सार बिंदु (की वर्ड) / टैग: क्रोमैटोग्राम, आयन-विनिमय, कॉलम चयन, अधिशोषण*	
5	विश्लेषण की वर्णक्रमीय तकनीक अवशोषण स्पेक्ट्रोस्कोपी का आधारभूत परिचयः विद्युतचुम्बकीय विकिरण, स्पेक्ट्रल परास। अवशोषण, अवशोषकता, आणविक अवशोषकता, अवशोषण के आधारभूत नियम, लैम्बर्ट बीयर नियम व इस की सीमाएं। | फोटोमीटर, स्पेक्ट्रोमीटर, वर्णमापी की संरचना एवं कार्यप्रणाली। पराबैंगनी (UV) अवशोषण स्पेक्ट्रोस्कोपी- UV स्पेक्ट्रा की प्रस्तुति और विश्लेषण, इलेक्ट्रॉनिक संक्रमण के प्रकार, संयुग्मन का प्रभाव। क्रोमोफोर और ऑक्सोक्रोम की अवधारणा वर्णोत्कर्षी (बैथोक्रोमिक), वर्णापकर्षी (हिप्सोक्रोमिक). वर्णातिशयी (हाइपरकोमिक) और वर्णापशयी (हाइपोक्रोमिक) विस्थापन (शिफ्ट)। संयुग्मित पोलीन्स और एनोन का पराबैंगनी वर्णक्रम (UV स्पेक्ट्रा) । अवरक्त (इन्फ्रा-रेड) अवशोषण स्पेक्ट्रोस्कोपी- आणविक कंपन, हुक का नियम, वरण नियम, अवरक्त बैंड की तीव्रता और स्थिति, अवरक्त | स्पेक्ट्रम का मापन, फिंगर प्रिंट क्षेत्र विभिन्न क्रियात्मक समूहों का अभिलाक्षणिक अवशोषण और सरल कार्बनिक यौगिकों के अवरक्त स्पेक्ट्रा की व्याख्या। *सार बिंदु (की वर्ड) टैग: वर्णातिशयी (हाइपरक्रोमिक) वर्णापशयी (हाइपोक्रोमिक), अवशोषण, स्पेक्ट्रम*	**10**

भाग स – अनुशंसित अध्ययन संसाधन

पाठय पुस्तकें , संदर्भ, पुस्तके, अन्य संसाधन

अनुशंसित सहायक पुस्तकें /ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

1. गौर, एस., कंप्यूटर फॉर केमिस्ट, नील कमल प्रकाशन, 2017

2. खोपकर, एस.एम. विश्लेषणात्मक रसायन विज्ञान की मूल अवधारणाएँ। न्यू एज, इंटरनेशनल पब्लिशर, 2009

3. कौर एच, विश्लेषणात्मक रसायन विज्ञान, प्रगति प्रकाशन (2008)

4. गुप्ता, अलका एल., एनालिटिकल केमिस्ट्री, प्रगति प्रकाशन (2020)

5. बहल, ए. और बहल, बी.एस. उन्नत कार्बनिक रसायन विज्ञान, एस चंद, 2010।

6. कौर एच, रासायनिक विश्लेषण के वाद्य तरीके, प्रगति प्रकाशन, 2018

7. शर्मा बी.के., क्रोमैटोग्राफी, कृष्ण प्रकाशन, 2019।

8. शर्मा वाई.आर., प्राथमिक कार्बनिक स्पेक्ट्रोस्कोपी, एस चंद, 2013,

हिंदी की प्रकाशित पुस्तकें

9. सिंह, डी. आर., सक्सेना, जी.,सिंह, बी., अकार्बनिक रसायन, शिवलाल अग्रवाल एंड कंपनी, आगरा

10. श्रीवास्तव, एस. एस.,गहलोत, ए. एस., रसायन विज्ञान, रतन प्रकाशन मंदिर, इंदौर

11. सोनी, पी. एल., कार्बनिक रसायन, सुल्तान चंद एंड संस, दिल्ली

12. सिंह, आर. पी., आधुनिक रसायन, साहित्य भवन ,आगरा

13. अग्निहोत्री, पी.के.,साहू, डी

14. पी., पिल्लई, ए.,साहू, एम., युगबोध रसायन, युगबोध प्रकाशन ,रायपुर

सन्दर्भपुस्तकें:

1. मित्रा सुरभि, हैंडबुक ऑफ कंप्यूटर साइंस एंड आईटी, अरिहंत, 2018

2. हैरिस, डी.सी. मात्रात्मक रासायनिक विश्लेषण। छठा संस्करण, फ्रीमैन (2007)

भाग द – अनुशंसित मूल्यांकन विधियां :		
अनुशंसित सतत मूल्यांकन विधियां : अधिकतम अंक : 100 सतत व्यापक मूल्यांकन सीसीई अंक : 40 सैद्धांतिक परीक्षा अंक : 60		
आंतरिक मूल्यांकनः सतत व्यापक मूल्यांकन सीसीई	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण	25 15 कुल अंकः 40
आकलन : सैद्धांतिक परीक्षा : समय – 02:00 घंटे	अनुभाग (अ) : तीन अति लघु प्रश्न (प्रत्येक 50 शब्द) अनुभाग (ब) : तीन अति लघु प्रश्न (प्रत्येक 200 शब्द) अनुभाग (स) : दो दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	कुल अंक : 60
कोई टिप्पणी /सुझावः		

B.Sc. II Semester
Syllabus of Theory Paper

Syllabus of Theory Paper

Part A Introduction				
Program-CERTIFICATE		**Class-B.Sc.**	**Semester-II**	**Session: 2021-2022**
Subject - Chemistry				
	Course Code	S1–CHEM1G		
	Course Title	**General Aspects of Chemistry**		
	Course Type	Elective		
	Pre-requisite (if any)	To study this course a students must have had the subject Chemistry in class +2 or equivalent.		
	Course Learning Outcomes (CLO)	By the end of this course students are expected to- 1. Learn about the chemistry of ancient India, ancient medicines, dyes & preservatives. 2. Gain information about-water its analysis and its treatment. Also, about laws & standard to improve quality of water. 3. Have an idea of environment with respect to air & soil. To improve their qualities. 4. Students will be able to maintain the health through the knowledge of blood & knowledge of biological system. 5. The students will be able to prevent common diseases, through the knowledge of this unit.		
	Credit Value	4		
	Total Marks	Maximum Marks: 40+60		Minimum Passing Marks:35

Part B – Content of the course		
Total No. of Lecture-Tutorials-Practical (In hours per week): **L-T-P:**		
Unit	**Topic**	**No. of lectures**
I	**Chemistry in Ancient India –** **Food & Textile –** • Food – Preservatives and edible dyes. • Textile – Dyes: types and applications. Dying process in ancient times • Drug – herbal medicines used in ancient times Haldi, Tulsi, Ginger, Ashwagandha, Amla.	**12**
II	**Analysis of Water –** • Water – Analysis-Hardness, TDS, DO, BOD, COD; water treatment plant – Potable water & treatment of industrial effluent; water pollution-laws and standards.	**12**
III	**Analysis of Air & Soil –** • Air – Atmospheric layer, Acid rains, Green House Effect, Global warming, Ozone layer depletion. • Soil – Soil composition, soil pollutants – heavy metals, pesticides.	**12**
IV	**Clinical Chemistry –** Blood volume, Blood pressure, Blood sugar, Blood group, Haemoglobin. Metals in Biological system – Macro & Micro nutrients, Na^+ / K^+ pump.	**12**
V	**Common Diseases & Remedies –** Jaundice, Diabetes, Anaemia, Goitre, Ulcer, Arthritis, Endocrine Glands & their secretions.	**12**

Part C – Learning Resources
Text Book, Reference Books, Other Resources
Suggested Readings:

12. Cox H.E.: ANALYSIS OF FOODS 13.
13. Cox H.E. AND PEARSON CHEMICAK ANALYSIS OF FOODS.
14. SHAKUNTALA MANY N. AND SWAMY S. FOODS: FACTS AND PRINCIPLES. 4th ED. NEW AGE INTERNATIONAL (1998)
15. JAIN AND JAIN ENGINEERING CHEMISTRY, DHANPATRAI PUBLISHING COMPANY
16. Garforth, F. (1986). Chemistry through the looking glass. In P.E. Childs (ed.)
17. Limerick, Everyday Chemistry (pp.4-45). Thomond College.
18. Bailin, S. (2002). Critical thinking and science education. Science & Education, 11,361-375.
19. Childs. P.E. (1986). What is everyday chemistry? In P.E. Childs (ed.), Everyday chemistry. Limerick: Thomond College.
20. Chemical Education 60, 1031
21. Hatfield: ASE (1985). Education through science
22. Ray Prafulla Chandra History of Chemistry in Ancient and Medieval India: Incorporating the History of Hindu Chemistry 1 January 2004 Chowkhambha Sanskrit series office

MOOCs, NPTEL, SWAYAM, HE E-Contents-
https://tamilandvedas.com/2019/11/04/rare-chemistry-alchemy-medicine-books-of-ancient-india-post-no-7178/
https://nptel.ac.in/content/storage2/courses/103107082/module1/lecture1/lecture1.pdf
https://nptel.ac.in/courses/104/103/104103071/
https://ncert.nic.in/textbook/pdf/gesc105.pdf
https://onlinecourses.swayam2.ac.in/ugc19_bt16/preview

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 40 Marks Theory Exam (TE) 60 Marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 40	Class Test Assignment/Presentation	25 15 Total = 40
External Assessment: Theory Exam Section: 60 Time : 02.00 Hours	**Section(A):** Three Very Short Questions (50 Words Each) **Section(B):** four Short Questions (200 Words Each) **Section(C):** Two Long	

	Questions (500 Words Each)	Total = 60
Any remarks/suggestions:		

बी.एस–सी. द्वितीय सेमेस्टर
सैद्धांतिक प्रश्नपत्र के पाठ्यक्रम

भाग अ – परिचय			
कार्यक्रम : प्रमाण पत्र	कक्षा : बी.एस–सी.	सेमेस्टर – द्वितीय	सत्र : 2021 – 2022
विषय : रसायन विज्ञान			
1	पाठ्यक्रम कोड	S1 – CHEM1G	
2	पाठ्यक्रम का भीर्षक	रसायन विज्ञान के सामान्य पहल	
3	पाठ्यक्रम का प्रकार : कोर कोर्स /इलेक्टिव/जेनेरिक इलेक्टिव/ वोकेशनल/	इलेक्टिव	
4	पूर्वापेक्षा (Prerequisite)(यदि कोई हो)	इस कोर्स का अध्ययन करने के लिए, छात्र ने विषय विज्ञान/कला/वाणिज्य अध्ययन कक्षा 12वी में किया हो।	
5	पाठ्यक्रम अध्ययन की परिलब्धियॉं (कोर्स लर्निंग आउटकम) (CLO)	इस पाठ्यक्रम के उपरांत विद्यार्थी रसायनशास्त्र विषय के निम्न आयामों का ज्ञान प्राप्त कर लेंगे। 6. प्राचीन भारत की दवाईया, रंग एवं परिरक्षक का ज्ञान। 7. पनी का विश्लेषण एवं उपचार तथा उससे जुड़े कानून। पानी की गुणवत्ता के मानक का ज्ञानवर्धन। 8. पर्यावरण के परिपेक्ष्य में वायु तथा मृदा के संबंध में सामान्य जानकारी एवं उनकी गुणवत्ता में सुधार। 9. विद्यार्थी अपनी सेहत बनाए रख सकेंगे। ब्लड ग्रुप एवं जैविक प्रणाली का ज्ञान प्राप्त होगा। 10. सामान्य रोगों की जानकारी से विद्यार्थी उसके बचाव/उपचार में सक्षम हो पायेंगे।	
6	केडिट मान	4	
7	कुल अंक	अधिकतम अंक : 40 + 60	न्यूनतम उत्तीर्ण अंक : 35

भाग ब – पाठ्यक्रम विषयवस्तु		
व्याख्यान की कुल संख्या- (प्रति सप्ताह घंटे में) :**L-T-P:**		
इकाई	विषय	व्याख्यान की संख्या
प्रथम	प्राचीन भारत में रसायन विज्ञान– खाद्य एवं कपड़ा – • खाद्य – परिरक्षक एवं खाद्य डाई • कपड़ा – डाई : प्रकार एवं अनुप्रयोग। प्राचीन समय में डाईंग प्रकिया। • ड्रग – जड़ी बूटीयॉं : प्राचीन भारत में उपयोगी – हल्दी, तुलसी, अदरक, अश्वगंधा, ऑवला।	12
द्वितीय	पानी का विश्लेषण – पानी – पानी की कठोरता, टीडीएस, डी.ओ., बी.ओ.डी., सी.ओ.डी., जल उपचार संयत्र – पेयजल, औद्योगिक बहिःस्त्राव का उपचार संयंत्र, जल प्रदूषण – कानून एवं मानक।	12
तृतीय	वायु एवं मृदा का विश्लेषण – • वायुमंडल की परतें, अम्लीय वर्षा, ग्रीन हाउस प्रभाव, ग्लोबल वार्मिंग, ओजोन परत क्षय। • मृदा / मिट्टी – मृदा संरचना, मृदा प्रदूषण– भारी धातु, कीटनाशक।	12
चतुर्थ	नैदानिक रसायन विज्ञान – ब्लड आयतन, ब्लड दाब, ब्लड ग्रुप, हिमोग्लोबिन। जैविक प्रणाली में धातु – माइक्रो एवं मैंक्रो न्युट्रिंयट Na^+ / K^+ पंप।	12
पंचम	सामान्य रोग एवं उपचार – पीलिया, मधुमेह, एनीमिया, घेंघा, अल्सर, गठिया, अंतःस्त्रावी ग्रंथिया एवं उनके स्त्राव।	12

भाग स- अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें /ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

1. कॉक्स एचई: फूड्स का विश्लेषण 13.
2. कॉक्स एचई और पियर्सन फूड्स का रासायनिक विश्लेषण।
3. शकुंतला मैनी एन. और स्वामी एस. फूड्स: तथ्य और सिद्धांत। चौथा संस्करण। न्यू एज इंटरनेशनल (1998)
4. जैन और जैन, इंजीनियरिंग रसायन विज्ञान, धनपतराय प्रकाशन कंपनी
5. गारफोर्थ , एफ। (1986)। लुकिंग ग्लास के माध्यम से रसायन विज्ञान। पीई चाइल्ड्स (एड।) ।.
6. लिमरिक , एवरीडे सी हेमिस्ट्री (पीपी.4-45)। थॉमोंड कॉलेज।
7. बेलिन , एस। (2002)। महत्वपूर्ण सोच और विज्ञान शिक्षा। विज्ञान और शिक्षा, 11, 361-375.
8. चाइल्ड्स, पीई (1986)। रोजमर्रा की रसायन शास्त्र क्या है? पीई चिल्ड्स (एड।), एवरीडे केमिस्ट्री में। लिमरिक: थॉमोंड कॉलेज।
9. रासायनिक शिक्षा का जर्नल 60 , 1031
10. हैटफील्ड: एएसई (1985)। विज्ञान के माध्यम से शिक्षा।
11. रे प्रफुल्ल चंद्र प्राचीन और मध्यकालीन भारत में रसायन विज्ञान के इतिहास: हिन्दू रसायन विज्ञान का इतिहास 1 जनवरी 2004 चौखंबा संस्कृत श्रृंखला कार्यालय
12.

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम: MOOCs, NPTEL, स्वयं, ई-सामग्री

https://tamilandvedas.com/2019/11/04/rare-chemistry-alchemy-medicine-books-of-ancient-india-post-no-7178/

https://nptel.ac.in/content/storage2/courses/103107082/module1/lecture1/lecture1.pdf

https://nptel.ac.in/courses/104/103/104103071/

https://ncert.nic.in/textbook/pdf/gesc105.pdf

https://onlinecourses.swayam2.ac.in/ugc19_bt16/preview

भाग द – अनुशंसित मूल्यांकन विधियां :			
अनुशंसित सतत मूल्यांकन विधियां : अधिकतम अंक : 100 सतत व्यापक मूल्यांकन (CCE) अंक : 40 सैद्धांतिक परीक्षा (TE) अंक : 60			
	आंतरिक मूल्यांकन : सतत व्यापक मूल्यांकन(CCE) :40	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण(प्रेजेंटेशन)	25 15 कुल अंक : 40
	आकलन : सैद्धांतिक परीक्षा:60 समय–02.00 घंटे	अनुभाग(अ): तीन अति लघु प्रश्न (प्रत्येक 50 शब्द) अनुभाग(ब): चार लघु प्रश्न (प्रत्येक 200 शब्द) अनुभाग(स): दो दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	कुल अंक : 60
कोई टिप्पणी / सुझाव :			

B.Sc. II Semester

PRACTICAL				
Program- CERTIFICATE		Class: B.Sc.	Semester - II	Session:2021-22
Subject : Chemistry				
1	Course Code	S1-CHEM2P		
	Course Title	**Analytical Processes and Techniques**		
2	Course Type	Core course		
3	Course Learning outcomes (CLO)	**By the end of this course students will learn the following aspects of Laboratory exercises in Chemistry:** 1. Concepts and analytical methods in Chemistry. 2. Preparation of solutions if different concentrations. 3. Standardization of the solution. 4. Identification of Organic compound by chromatographic techniques. 5. Analysis by Spectral Techniques.		
4	Credit Value	2		
	Total Marks	Maximum Marks: Theory Exam (TE)- 60 CCE - 40	Minimum Passing Marks : 35	

External Assessment		
	Experiments to be performed in laboratory	60
1	**Basic analytical exercises** • Calibration of different weights and glass apparatus (measuring cylinder, burette, pipette, volumetric flasks). • Preparation of solutions of different molarity/normality by weighing and dilution.	10
2	**Quantitative Analysis** • **Titrimetric Analysis** o Standardization of NaOH with Oxalic acid. o Determination of carbonate and hydroxide present in mixture. o Determination of carbonate and bicarbonate present in a mixture.	10

	○ Determination of free alkali present in different soaps/detergents.	
3	**Quantitative Analysis by Colorimetry** • Verification of Lambert-Beer Law • Determination of concentration of coloured compounds (e.g., $CuSO_4$, $KMnO_4$)	10
4	**Qualitative Analysis** • Systematic identification of organic compound by qualitative analysis. • **Chromatography:** Identification by determination of the R_f values of the given organic/inorganic compounds by paper/thin layer chromatography.	15
5	**Diary**	08
6	**Viva**	07
	Keywords/Tag: *Analytical, Authentication, Molarity / Normality, Standardization, Colorimetry, Qualitative Analysis*	

Part C – Learning Resources

Text Book, Reference Books, Other Resources

References:

1. Skoog, D.A. and Leary, J.J.: Instrumental Methods of Analysis, Saunders College Publications, New York, 1992
2. Vogel's textbook of quantitative chemical analysis, 7th edition.
3. Goswami A.K., Mehta Anita, Khanam Rehana, ORS., UGC Practical Chemistry VOL. I, PragatiPrakashan, 2015.
4. Goyal Sudha, B.Sc. Chemistry Practical, Krishna Publication, 2017.
5. Tandon, M.N., Unified RasayanVigyan, Shivlal Agarwal & Company, 2018

Suggestive digital platforms web links:

1. https://www.youtube.com/watch?v=OAImRDzuTh8
2. http://amrita.olabs.edu.in/?sub=73&brch=8&sim=133&cnt=1
3. http://chemcollective.org/vlabs
4. http://mas-iiith.vlabs.ac.in/exp6/Quiz.html
5. https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_9_Experiments/02%3A_Paper_Chromatography_of_Gel_Ink_Pens_(Experiment)
6. https://edu.rsc.org/experiments/leaf-chromatography/389.article
7. https://edu.rsc.org/experiments/chromatography-of-sweets/455.article
8. http://swe.mit.edu/outreach/virtual_resources/paper_chromatography.pdf
9. http://www.chem.latech.edu/~deddy/chem104/104Standard.htm
10. https://www.chem.purdue.edu/courses/chm224/Miscellaneous/Model_report_Expt2-revised_2009.pdf
11. https://www.webpages.uidaho.edu/ifcheng/Chem%20253/labs/Experiment%203.pdf
12. http://faculty.ccbcmd.edu/~cyau/122%2007%20Acid-base%20titration%20AUG%202013.pdf
13. https://labbalances.net/blogs/blog/guide-to-calibration-weights
14. https://cdn2.hubspot.net/hubfs/2203666/Beamex_White_Papers/Beamex%20White%20Paper%20-%20Weighing%20scale%20calibration%20ENG.pdf?__hssc=107807261.6.1518193235316&__hstc=107807261.e215aea6ed7779e95a49b7830c0f9aad.1516987215921.1518111962556.1518193235316.17&__hsfp=2102249448&hsCtaTracking=8918cffa-b755-4f72-b4b1-24c1fa8d1a6d%7C12eb2e3f-4b62-43eb-baf0-2da2a5d102b6

Part D- Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction on- • Common glassware and lab wares for solution preparation and analysis. • Numerical problem related to solution preparation. • Any other discussion. *Note: description to be written in practical record.*	**15**	**Viva Voce on Practical**	**07**
Attendance	**10**	**Practical Record File**	**08**
Assignments (Chart/Model Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/Survey / Industrial visit)	**15**	**Table work/Experiments**	**45**
Total	**40**		**60**

बी.एस–सी. द्वितीय सेमेस्टर
प्रायोगिक प्रश्नप्रत्र

भाग अ – परिचय			
कार्यक्रम : प्रमाण पत्र	कक्षा : बी.एस–सी.	सेमेस्टर – द्वितीय	सत्र : 2021 – 2022
विषय : रसायन विज्ञान			

1	पाठ्यक्रम कोड	S1 – CHEM1P	
2	पाठ्यक्रम का शीर्षक	विश्लेषणात्मक प्रकियाएं और तकनीक (प्रश्नपत्र II)	
3	पाठ्यक्रम का प्रकार : (कोर कोर्स / इलेक्टिव / जेनेरिक इलेक्टिव / वोकेशनल / .....)	कोर कोर्स	
4	पूर्वापेक्षा (Prerequisite)(यदि कोई हो)	इस पाठयक्रम का अध्ययन करने के लिए विद्यार्थियों के पास कक्षा +2 या समकक्ष में रसायनविज्ञान विषय होना चाहिए।	
5	पाठ्यक्रम अध्ययन की परिलब्धियों (कोर्स लर्निंग आउटकम) (CLO)	इस पाठ्यक्रम के उपरांत विद्यार्थी रसायनशास्त्र विषय कि प्रयोगशाला के निम्न आयामों का ज्ञान प्राप्त कर लेंगे : 1. रसायनविज्ञान की विश्लेषणात्मक विधियां व अवधारणाएं। 2. विभिन्न सांद्रता के विलयन तैयार करना। 3. विलयन का मानकीकरण। 4. कोमैटोग्राफिक तकनीकों द्वारा कार्बनिक यौगिकों की पहचान। 5. वर्णक्रमीय तकनीकों द्वारा विश्लेषण।	
6	क्रेडिट मान	2	
7	कुल अंक	अधिकतम अंक : 40 + 60	न्यूनतम उत्तीर्ण अंक : 35

भाग ब – पाठ्यक्रम विषयवस्तु		
व्याख्यान की कुल संख्या-(प्रति सप्ताह घंटे में) :P:		
इकाई	विषय	अंक

	प्रयोगशाला में किए जाने वाले प्रयोग	
	1. आधारभूत विश्लेषणात्मक अभ्यास • विभिन्न भारो और कांच के उपकरणों (मारक सिलेंडर व्यूरेट, पिपेट, आयतनात्मक फ्लास्क) का प्रमाणीकरण • विभिन्न मोलरता / नॉर्मलता का विलयन तौल तनुकरण द्वारा बनाना	10
	2. आयतनात्मक विश्लेषण • ऑक्सैलिक अम्त के द्वारा NaOH का मानकीकरण। • मिश्रण में उपस्थित कार्बोनेट और हाइड्रॉक्साइड का निर्धारण • मिश्रण में उपस्थित कार्बोनेट और बाइकार्बनेट का निर्धारण • विभिन्न साबुनों / अपमार्जकों में उपस्थित मुक्त आर का निर्धारण	10
	3. वर्णमिति द्वारा मात्रात्मक विश्लेषण • लैम्बर्ट-बीयर नियम का सत्यापन • रंगीन यौगिकों की सांद्रता का निर्धारण (जैसे- $CuSO_4$ $KMnO_4$)	10
	4. गुणात्मक विश्लेषण • गुणात्मक विश्लेषण द्वारा कार्बनिक यौगिकों की क्रमबद्ध पहचान • वर्णलेखिकी: पेपरवर्णलेखिकी / पतली परत वर्णलेखिकी द्वारा R_f मान ज्ञात करना व दिए गए कार्बनिक / अकार्बनिक यौगिकों की पहचान	15
	5. प्रायोगिक रिकार्ड	08
	6. मौखिकी	07
सार बिंदु (की वर्ड) /टैग: विधेषणात्मक प्रमाणीकरण, मोलरता/ नॉर्मलता, मानकीकरण, वर्णमिति, गुणात्मक विश्लेषण		

आंतरिक मूल्यांकन	अंक	बह्य मूल्यांकन	अंक
कक्षा में पारस्परिक विचान–विमर्श रासायनिक और प्रयोगशाला सुरक्षा • विलयन तैयार करने और विश्लेषण के लिए सामान्य कांच के बने पदार्थ और प्रयोगशाला के सामान। • विलयन तैयार करने से संबंधित संख्यात्मक समस्याएं।	15	प्रायोगिक मौखिकी (वायवा)	07

• कोई अन्य चर्चा। नोटः विवरण प्रायोगिक रिकॉर्ड में लिखा जाना है।			
उपस्थिति	10	प्रायोगिक रिकॉर्ड फाइल	08
असाइनमेंट (चार्ट / मॉडल / सेमिनार / ग्रामीण सेवा / प्रौद्योगिकी प्रसार / भ्रमण(कस्कर्शन) की रिपोर्ट / सर्वेक्षण / प्रयोगशाला भ्रमण (लैब विजिट) / औद्योगिक यात्रा	15	टेबल वर्क / प्रयोग	45
कुल अंक	40		60
कोई टिप्पणी / सुझाव :			

भाग स- अनुशंसित अध्ययन संसाधन
पाठ्य पुस्तकें संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें /ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

1. स्कोग, डी.ए. और लेरी, जे.जे.: इंस्ट्रुमेंटल मेथड्स ऑफ एनालिसिस, सॉन्डर्स कॉलेज पब्लिकेशन्स, न्यूयॉर्क, 1992
2. वोगेल की मात्रात्मक रासायनिक विश्लेषण की पाठ्यपुस्तक, 7 वां संस्करण।
3. गोस्वामी ए.के., मेहता अनीता, खानम रेहाना, ओआरएस।, यूजीसी प्रैक्टिकल केमिस्ट्री वॉल्यूम I, प्रगति प्रकाशन, २०१५।
4. गोयल सुधा, बी.एससी. केमिस्ट्री प्रैक्टिकल, कृष्णा पब्लिकेशन, 2017।
5. टंडन, एम.एन., एकीकृत रसायन विज्ञान, शिवलाल अग्रवाल एंड कंपनी, 2018।

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

1. https://www.youtube.com/watch?v=OAImRDzuTh8
2. http://amrita.olabs.edu.in/?sub=73&brch=8&sim=133&cnt=1
3. http://chemcollective.org/vlabs
4. http://mas-iiith.vlabs.ac.in/exp6/Quiz.html
5. https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_xperiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_9_Eriments/02%3A_Paper_Chromatography_of_Gel_Ink_Pens_(Experiment)
6. https://edu.rsc.org/experiments/leaf-chromatography/389.article
7. https://edu.rsc.org/experiments/chromatography-of-sweets/455.article
8. http://swe.mit.edu/outreach/virtual_resources/paper_chromatography.pdf
9. http://www.chem.latech.edu/~deddy/chem104/104Standard.htm
10. https://www.chem.purdue.edu/courses/chm224/Miscellaneous/Model_report_Expt2_revised_2009.pdf

B.Sc. I Semester

PRACTICAL				
Program- CERTIFICATE		**Class- B.Sc.**	**Semester - I**	**Session: 2021-2022**
Subject - Chemistry				
1	Course Code	S1 –CHEM1P		
	Course Title	**Qualitative & Quantitative Chemical Analysis (Paper II)**		
2	Course Type	Core Course		

3	Course Learning Outcomes (CLO)	By the end of this course students will learn the following aspects of Laboratory exercises in Chemistry: 7. Importance of chemical safety and lab safety while performing experiments in laboratory 8. Qualitative inorganic analysis 9. Elemental analysis of organic compounds (non-instrumental) 10. Qualitative identification of functional group of organic compounds 11. Techniques of pH measurements 12. Preparation of buffer solutions	
4	Credit Value	2	
	Total Marks	Maximum Marks: Theory Exam (TE)- 60 CCE-40	Minimum Passing Marks:35

	Part B – Content of the course	Marks
1	**Experiments to be performed in laboratory**	**50**
	Qualitative inorganic analysis **20 Marks** Identification of simple inorganic mixture (5 radicals) with two/three acidic and two/three basic radicals (including typical combinations), special emphasis on learning theoretical concepts of strong, moderate and weak electrolytes, ionic product, common ion effect. Solubility and solubility product. **Qualitative organic analysis** **7+8 Marks** 1. Detection of hetero-elements (N,S, Cl, Br, I) in organic compounds 2. Functional group tests for alcohol, aldehyde, carboxylic acid, carbohydrate, phenols, nitro, amine and amide. **Qualitative analysis of acid, alkali and buffer solutions** **15 Marks** **Ionic Equilibria** 1. Measurement of pH of different solutions if acids and alkalis using pH- meter (May use aerated drinks, fruit juices, shampoos and soaps)	

	Note – use dilute solutions of soaps and shampoos to prevent damage to the glass electrode. 2. Measurement of the pH of buffer solutions and comparison of the values with theoretical values. 3. Preparation of buffer solutions and determination of their pH and buffer capacity: (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide	

Part- C- Learning Resources
Text Book, Reference Books, other resources
Text Books:

1. Goswami A.K., Mehta, A., Khanam Rehana, O.R.S., UGC Practical Chemistry VOL. I, Pragati Prakashan, 2015
2. Goyal, S., B.Sc. Chemistry Practical, Krishna Publication, 2017.
3. Vogel, A.I., A Textbook of Quantitative Inorganic Analysis, ELBS.
4. Svehla, G., Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
5. Mendham, J., Vogel's Quantitative Chemical Analysis, Pearson, 2009.
6. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
7. Mann, F.G.,& Saunders, B.C., Practical Organic Chemistry, Pearson Education (2009).
8. Khosla, B. D., Garg, V. C.,& Gulati, A., Senior Practical Physical Chemistry, R.Chand & Co.: New Delhi (2011).

References:

9. Mann, F.G. & Saunders, B.C., Practical Organic Chemistry Orient-Longman, 1960.
10. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R., Practical Organic Chemistry, 5th Ed., Pearson (2012)
11. Ahluwalia, V.K., &Aggarwal, R., Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
12. Prof. Robert H. Hill Jr., David C. Finster, Laboratory Safety for Chemistry Students, 2nd Edition Wiley ISBN: 978-1-119-02766-9 May 2016
13. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version, ISBN 978-0-309-13864-2 | DOI 10.17226/12654, The National Academies Press, Washington D.C.

Suggestive digital platforms web links: **https://nptel.ac.in/courses/104/105/104105102/**

Suggested equivalent online courses:

1. **https://www.youtube.com/watch?v=EhvemWIluXQ**
2. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=31&cnt=1
3. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=180&cnt=1
4. **http://www.rbmcollege.ac.in/sites/default/files/files/reading%20material/inorganic-qualitative-analysis.pdf**
5. **https://courses.lumenlearning.com/boundless-chemistry/chapter/qualitative-chemical-analysis/**
6. **https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Qualitative_Analysis**
7. **https://courses.lumenlearning.com/boundless-chemistry/chapter/buffer-solutions/**
8. **https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual%3A_Introduction_to_Biotechnology/01%3A_Techniques/1.07%3A_pH_and_Buffers**
9. **https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_12_Experiments/05%3A_pH_Measurement_and_Its_Applications_(Experiment)**
10. **https://www.mt.com/mt_ext_files/Editorial/Generic/1/Guides_to_Electrochemical_Analysis_0x000248ff00025c9a00093c4a_files/guideph.pdf**
11. **https://web.cortland.edu/sternfeld/ph.pdf**
12. **http://webhost.bridgew.edu/c2king/CHEM142/Lab/7_Buffers%20and%20Properties.pdf**

Part D- Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction **Chemical and Lab Safety** 6. Toxicity of the compounds uses in chemistry laboratory. 7. Safety symbol on labels if pack of chemicals and its meaning 8. What is MSDS sheets? Find out MSDS sheets of some hazardous chemicals ($K_2Cr_2O_7$), Benzene, cadmium nitrate, sodium metal, etc.) 9. Precautions in handling and storage of hazardous substances like concentrated acids, ammonia, organic solvents, etc. *Note: description to be written in practical record.*	**15**		**7**
Attendance	**10**	**Practical Record File**	**8**
Assignments (Chart/Model Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/Survey / Industrial visit)	**15**	**Table work/Experiments**	**45**
Total	**40**		**60**

बी.एस–सी. प्रथम सेमेस्टर
प्रायोगिक प्रश्नप्रत्र

भाग अ – परिचय				
कार्यक्रम : प्रमाण पत्र		कक्षा : बी.एस–सी.	सेमेस्टर – प्रथम	सत्र : 2021 – 2022
विषय : रसायन विज्ञान				
1	पाठ्यक्रम कोड	S1 – CHEM1P		
2	पाठ्यक्रम का भीर्षक	गुणात्मक और परिमाणात्मक रासायनिक विश्लेषण (प्रश्नपत्र II)		
3	पाठ्यक्रम का प्रकार : (कोर कोर्स /इलेक्टिव/जेनेरिक इलेक्टिव/ वोकेशनल/.....)	कोर कोर्स		
4	पूर्वापेक्षा (Prerequisite)(यदि कोई हो)	इस पाठयक्रम का अध्ययन करने के लिए विद्यार्थियों के पास कक्षा +2 या समकक्ष में रसायनविज्ञान विषय होना चाहिए।		
5	पाठ्यक्रम अध्ययन की परिलब्धियॉं (कोर्स लर्निंग आउटकम) (CLO)	इस पाठ्यक्रम के उपरांत विद्यार्थी रसायनशास्त्र विषय की प्रयोगशाला के निम्न आयामों का ज्ञान प्राप्त कर लेंगे : 1. प्रयोगशाला में प्रयोग करते समय रासायनिक सुरक्षा और प्रयोगशाला सुरक्षा का महत्व 2. गुणात्मक अकार्बनिक विश्लेषण 3. कार्बनिक यौगिकों का तात्विक विश्लेषण 4. कार्बनिक यौगिकों के कियात्मक समूह की गुणात्मक पहचान 5. पीएच माप की तकनीक		
6	केडिट मान	4		
7	कुल अंक	अधिकतम अंक : 40 + 60	न्यूनतम उत्तीर्ण अंक : 35	

भाग ब – पाठ्यक्रम विषयवस्तु		
व्याख्यान की कुल संख्या-(प्रति सप्ताह घंटे में) :**P:**		
इकाई	विषय	अंक
	प्रयोगशाला में किए जाने वाले प्रयोग	
	गुणात्मक अकार्बनिक विश्लेषण दो / तीन अम्लीय एवं दो तीन भास्मिक मूलकों (विशिष्ट संयोजनों सहित) के साथ सरल अकार्बनिक मिश्रण (5 मूलकों) की पहचान, प्रबल, मध्यम एवं दुर्बल विद्युत अपघट्य आयनिक उत्पाद, सामान्य आयन प्रभाव की सैद्धांतिक अवधारणाओं को सीखने पर विशेष बल विलेयता एवं विलेयता उत्पाद **गुणात्मक कार्बनिक विश्लेषण** 1. कार्बनिक यौगिकों में विषम-तत्वों (N, S. CI, Br, I) की पहचान 2. अल्कोहल, एल्डिहाइड, कार्बोक्जिलिक एसिड, कार्बोहाइड्रेट, फिनोल, नाइट्रो, अमीन एवं एमाइड के लिए क्रियात्मक समूह परीक्षण अम्ल, क्षार एवं बफर विलयनों का परिमाणात्मक विश्लेषण आयनिक साम्य 1. pH मीटर का उपयोग कर के अम्ल एवं क्षार के विभिन्न विलयनों के pH का मापन (वातित पेय, फलों के रस, शँपू एवं साबुन का उपयोग कर सकते हैं) नोट-ग्लास इलेक्ट्रोड को नुकसान से बचाने के लिए साबुन एवं शँपू के तनु विलयन का उपयोग करें। 2. बफर बिलयन के pH का मापन एवं सैद्धांतिक मानों के साथ तुलना। 3. बफर विलयन तैयार करना एवं उनकी pH व बफर क्षमता का निर्धारण: (i) सोडियम एसीटेट-एसिटिक अम्ल	

(ii) अमोनियम क्लोराइड-अमोनियम हाइड्रॉक्साइड

भाग स- अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

अनुशंसित सहायक पुस्तकें /ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री:

1. गोस्वामी ए.के., मेहता, ए., खानम रेहाना, ओ.आर.एस., यूजीसी प्रैक्टिकल केमिस्ट्री वॉल्यूम 1, प्रगति प्रकाशन, 2015.
2. गोयल, एस., बी.एससी. केमिस्ट्री प्रैक्टिकल, कृष्णा पब्लिकेशन, 2017.
3. वोगेल, ए.आई., ए टेक्स्ट बुक ऑफ क्वांटिटेव इनऑर्गेनिक एनालिसिस, ईएलबीएस।
4. स्वेहला, जी., वोगल्स क्वालिटेटिव इनऑर्गेनिक एनालिसिस, पियरसन एजुकेशन, 2012.
5. मेंधम, जे, वोगल्स क्वांटिटेटिव केमिकल एनालिसिस, पियर्सन, 2009.
6. वोगेल, ए.आई., टैचेल, ए.आर., फर्निस, बी.एस., हैनाफोर्ड, ए.जे., एंड स्मिथ, पी.डब्ल्यू.जी., प्रैक्टिकल ऑर्गेनिक केमिस्ट्री की पाठ्यपुस्तक, प्रेंटिस-हॉल, 5वां संस्करण, 1996.
7. मान, एफ.जी., और सॉन्डर्स, बी.सी., प्रैक्टिकल ऑर्गेनिक केमिस्ट्री, पियर्सन एजुकेशन (2009).
8. खोसला, बी.डी., गर्ग, बी.सी., और गुलाटी, ए., सीनियर प्रैक्टिकल फिजिकल केमिस्ट्री, आर. चंद एंड कंपनी, नई दिल्ली (2011)।

संदर्भपुस्तकें

1. मान, एफ.जी., एंड सॉन्डर्स, बी.सी., प्रैक्टिकल ऑर्गेनिक केमिस्ट्री, ओरिएंट-लॉन्गमैन, 1960.
2. फर्निस, बी.एस., हैनाफोर्ड, ए.जे., स्मिथ, पी.डब्ल्यू.जी., टैचेल, एआर, प्रैक्टिकल ऑर्गेनिक केमिस्ट्री, 5वां संस्करण, पियर्सन (2012).
4. अहलूवालिया, वी.के., और धींगरा, एस., कॉम्प्रिहेंसिव प्रैक्टिकल ऑर्गेनिक केमिस्ट्री: क्वालिटेटिव एनालिसिस, यूनिवर्सिटी प्रेस (2000).
5. प्रो. रॉबर्ट एच. हिल जूनियर, डेविड सी., लैबोरेट्री सेफ्टी फॉर केमेस्ट्री स्टूडेंट्स, द्वितीय संस्करण विले आईएसबीएन: 978-1-119-02766-9 मई 2016.
6. प्रयोगशाला में विवेकपूर्ण व्यवहार: रासायनिक खतरों का प्रबंधन और प्रबंधन, अद्यतन संस्करण, आईएसबीएन 978-0-309-13864-2 || DOI 10.17226/12654.. द नेशनल अकादमिस प्रेस, वाशिंगटन डी सी। 2.

अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक: https://nptel.ac.in/courses/104/105/104105102/

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:

1. **https://www.youtube.com/watch?v=EhvemWIuXQ**
2. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=31&cnt=1
3. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=180&cnt=1
4. **http://www.rbmcollege.ac.in/sites/default/files/files/reading%20material/inorganic-qualitative-analysis.pdf**
5. **https://courses.lumenlearning.com/boundless-chemistry/chapter/qualitative-chemical-analysis/**
6. **https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Qualitative_Analysis**
7. **https://courses.lumenlearning.com/boundless-chemistry/chapter/buffer-solutions/**
8. **https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual%3A_Introduction_to_Biotechnology/01%3A_Techniques/1.07%3A_pH_and_Buffers**
9. **https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_12_Experiments/05%3A_pH_Measurement_and_Its_Applications_(Experiment)**
10. **https://www.mt.com/mt_ext_files/Editorial/Generic/1/Guides_to_Electrochemical_Analysis_0x000248ff00025c9a00093e4a_files/guideph.pdf**
11. **https://web.cortland.edu/sternfeld/ph.pdf**
12. **http://webhost.bridgew.edu/e2king/CHEM142/Lab/7_Buffers%20and%20Properties.pdf**

भाग द – अनुशंसित मूल्यांकन विधियां

अनुशंसित सतत मूल्यांकन विधियां

आंतरिक मूल्यांकन	अंक	बह्य मूल्यांकन	अंक
कक्षा में पारस्परिक विचार–विमर्श रासायनिक और प्रयोगशाला सुरक्षा 5. रसायन प्रयोगशाला में प्रयुक्त यौगिकों की विषाक्तता। 6. रसायनों के पैकेट के लेबल पर सुरक्षा चिन्ह और उसका अर्थ। 7. एम एस डी शीट क्या है कुछ खतरनाक रसायनों (, बेंजीन, कैडमियम नाइट्रेट, सोडियम धातु, आदि) की शीट का पता लगाएं। 8. खतरनाक पदार्थों के प्रबंधन और भंडारण में सावधानियां जैसे सांद्र अम्ल, अमोनिया, कार्बनिक विलायक, आदि। नोटः विवरण प्रायोगिक रिकॉर्ड में लिखा जाना है।	15	प्रायोगिक मौखिकी (वायवा)	07
उपस्थिति	10	प्रायोगिक रिकॉर्ड फाइल	08
असाइनमेंट (चार्ट / मॉडल / सेमिनार / ग्रामीण सेवा / प्रौद्योगिकी प्रसार / भ्रमण(कस्कर्शन) की रिपोर्ट / सर्वेक्षण / प्रयोगशाला भ्रमण (लैब विजिट) / औद्योगिक यात्रा	15	टेबल वर्क / प्रयोग	45
कुल अंक	40		60

कोई टिप्पणी / सुझाव :

Part A: Introduction for code: 205-I

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Chemistry	
Syllabus Session – 2021-2022	
Class – B.Sc. – IInd YEAR	
Title of the Paper : Physical Chemistry	**Paper Code: 205-I**
Course Objective	
Know the concept and application of classical thermo dynamic electrochemical and other physical phenomenon.	
Course Learning Outcomes	
C01	1. Thermodynamics is a branch of physical chemistry that deals with heat, work and temperature and their relation to energy, radiation and physical properties of matter. 2. Thermodynamics applies to a wide variety of topics in science and engineering, especially physical chemistry biochemistry, chemical engineering, mechanical engineering and meteorology.
C02	1. Phase rule is useful to metallurgists, materials engineers – Development of new alloys for special application. 2. Fabrication of these alloys in to useful configuration. 3. Design and control of heat treatment procedure for specific alloys. These are many application of distribution law (a) Solvent Extraction. (b) Partition chromatography. (c) Desilverisation of Lead. (d) Determination of dissociation and association.
C03	Explain electrolytic conduction and various types of conductance (molecular & equivalent). Describe kohlrausch law and transport numbers. Explain the functions of various electrode reactions.
C04	Describe the functions various types of electrodes and also the knowledge of pH and Buffer solution and Henderson Hazal equation.
C05	1. Surface chemistry plays an important role in industrial technologies for chemical and energy conversion, health care material and environment protection. 2. Used in syrups, paints, tooth paste, digestion of fats, pigment and dye.

Part B : Content of the course

Unit	Syllabus
Unit-I	**A. Thermodynamics**: Basic concepts of thermodynamics. First law, Second law of Thermodynamics: Need for the law, Different statements of the law, Cornot cycle and its efficiency. Thermodynamic scale of temperature, concept of Entropy: entropy as a state function, entropy as a function of P&T and T&V entropy change in physical change. Clausius inequality, entropy as criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases, Third law of thermoynamics, Nernst heat theorem, statement and

	concept of residual entropy, Gibbs and Helmholtz functions, Gibbs function (G) and Helmholtz function (A) as a thermodynamic quantities, A and G as a criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Clausius – Clayperon equation. **B. Thermochemistry:** Standard state, standard enthalpy of formation: Hess's Law of heat summation and its application. Enthalpy of neutralization
	अ. उष्मागतिकी: उष्मागतिकी की मूल अवधारणाएँ, प्रथम नियम, उष्मागतिकी का द्वितीय नियम, नियम की आवश्यकता, नियम के विभिन्न कथन, कार्नो चक्र, इसकी दक्षता, तापमान का उष्मागतिकी पैमाना। एण्ट्रॉपी की अवधारणा, एण्ट्रॉपी–अवस्था फलन के रूप में, एण्ट्रॉपी P&T एवं T&V अवस्था के रूप में, भौतिक परिवर्तन में एण्ट्रॉपी परिवर्तन, क्लॉसियस असमता, एण्ट्रॉपी उष्मागतिकी, साम्य एवं स्वतः प्रवर्तिता की कसौटी के रूप में, आदर्श गैसों में एण्ट्रॉपी परिवर्तन एवं गैसों को मिलाने की एण्ट्रॉपी, उष्मागतिकी का तृतीय नियम, नर्नस्ट उष्मा प्रमेय कथन तथा अवशिष्ट एण्ट्रॉपी की अवधारणा, गिब्बज तथा हेल्महोल्टज फलन, गिब्बज फलन (G) तथा (A) हेल्महोल्टज फलन, उष्मागतिक राशियों के रूप में (A) तथा (G) उष्मागतिक सोम्य और स्वतः प्रवर्तित की कसौटी की कसौटी के रूप में, एण्ट्रॉपी परिवर्तन की तुलना में इनके लाभ। **ब. उष्मा रसायन:** प्रामाणिक अवस्था, प्रामाणिक संभवन की एंथैल्पी, हेस का उष्मा संकलन का नियम एवं इसके अनुप्रयोग, उदासीकरण की एंथैल्पी।
Unit-II	**Phase equilibrium:** Statement and the meaning of terms: phase, component and the degree of freedom, thermodynamic derivation of the Gibbs phase rule, one component system: water, CO_2 and S system, two component system: solid-liquid equilibrium, simple eutectic system: Bi-Cd, Pb-Ag system. Desilverisation of lead. **Solid solution:** Systems in which compound formation with congruent melting point (Zn-Mg) and incongruent melting point. ($NaCl-H_2O$) and ($CuSO_4 - H_20$) system, Freezing Mixtures: acetone-dry ice, **Liquid Liquid mixtures:** Ideal liquid mixtures. Raoult's and Henry's law. Non-ideal system, azeotrops: HCl- H_2O and ethanol water system. **Partial miscible liquids:** Phenol-water, trimethylamine-water and nicotine-water system. Immiscible Liquids, steam distillation, Nernst distribution law: thermodynamic derivation, applications.
	अ. प्रावस्था साम्य : कथन एवं विभिन्न पदों का अर्थ, प्रावस्था, घटक तथा स्वतंत्रता की कोटि, गिब्ज प्रावस्था नियम का ऊष्मागतिक व्युत्पन्न, एक घटक तंत्र–जल तंत्र, CO_2 तंत्र एवं सल्फर तंत्र, दो घटक तंत्र : ठोस–द्रव साम्य, सरल गलन क्रांतिक तंत्र : बिस्मथ–कैडमियम तंत्र, सीसा–चाँदी तंत्र, सीसे का विरजतीकरण। ब. ठोस विलयन : तंत्र जिनमें सर्वांगसम गलनांक वाले यौगिक बनते है : (Zn-Mg) तथा जिसमें असर्वांगसम गलनाकं वाले यौगिक बनते हैं ($NaCl-H_2O$) एवं ($CuSO_4-H_2O$) तंत्र, हिम मिश्रण: एसिटोन –शुष्क बर्फ। स. द्रव–द्रव मिश्रण : आदर्श द्रव मिश्रण, राउल्ट एवं हेनरी का नियम, अनादर्श तंत्र , स्थिर क्वथनांकी मिश्रण : $HCl-H_2O$ तथा एथिल अल्कोहल–जल तंत्र।

	द. आंशिक मिश्रणीय द्रव : फीनॉल–जल, ट्राइमेथिल एमीन–जल एवं निकोटिन–जल तंत्र, संविलयन तापक्रम, अमिश्रणीय द्रव, भाप आसवन, नर्नस्ट का वितरण नियम : ऊष्मागतिक व्युत्पन्न, अनुप्रयोग।
Unit-III	**Electrochemistry: I** Electrical transport, conduction in metals and in electrolyte solutions, specific and equivalent conductivity, measurement of equivalent conductance, effect of dilution on conductivity, migration of ions and Kohlrausch law, arrhenius theory of electrolyte dissociation and its limitations. Weak and strong electrolytes, Ostwald's dilution law, theory of strong electrolytes. Deby- Huckel- Onsager'sed (elementary treatment only) theory and equation, transport numbers, determination of transport numbers by Hittorf method and moving boundary method. Electrodes reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, electrochemical series and its significance.
	विद्युतीय रसायनः I अ. **विद्युतीय अभिगमन** : धातुओं और विद्युत अपघट्य के विलयनों मे चालन, विशिष्ट चालकता तथा तुल्यांकी चालकता, तुल्यांकी चालकता का मापन, विशिष्ट चालकता एवं तुल्यांकी चालकता पर तनुता का प्रभाव, आयनों का अभिगमन तथा कालेरॉश नियम, आरहीनियस का विद्युत अपघटनी वियोजन सिद्धातं एवं इसकी सीमाऐं : प्रबल तथा दुर्बल विद्युत अपघट्य, ओस्टवाल्ड का तनुता नियम, प्रबल विद्युत अपघट्यो का सिद्धांत, डिबाई – ह्यकूल–ओनसेगर सिद्धात समीकरण (केवल प्राथमिक परिचय), अभिगमनांक; परिभाषा, हिटार्फ एव गतिमान सीमा विधि द्वारा इसका निर्धारण। इलेक्ट्रोड अभिक्रिया। नर्नस्ट समीकरण, सेल, वि.वा.ब. एवं एकल इलेक्ट्रोड विभव का निर्धारण, मानक हाइड्रोजन इलेक्ट्रोड मानक इलेक्ट्रोड विभव, विद्युत रसायन श्रेणी एवं उसका महत्व।
Unit-IV	**Electrochemistry II** Types of reversible electrodes: Gas - metal ion, metal-metal ion, metal - insoluble salt anion and redox electrodes, Concentration cell (with and without transport), liquid junction potential, application of concentration cells, valancy of ions, solubility product and activity coefficient, potentiometric titration. Definition of pH and pK. determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods. Buffers: mechanism of buffer action, Henderson - Hazal equation, hydrolysis of salts. Processes at electrodes, rate of charge transfer, current density, polarography, amperometry, ion selective electrodes and their uses.
	विद्युतीय रसायन : **II** **उत्क्रमणीय इलेक्ट्रोड के प्रकार** : गैस–धातु आयन, धात–ु धातु आयन, धातु–अविलेय लवण ऐनायन तथा रेडॉक्स इलेक्ट्रोड: सांद्रता सेल, (अभिगमन एवं बिना अभिगमन के) द्रव संधि विभव, सांद्रता सेल के अनुप्रयोग, आयनो की संयोजकता, विलेयता गुणनफल एव सक्रियता गुणाक, विभवमापी अनुमापन, pH तथा pK की परिभाषा, हाइड्रोजन इलेक्ट्रोड , क्विनहाइड्रोजन इलेक्ट्रोड एवं ग्लास इलेक्ट्रोड की सहायता से pH का निर्धारण। बफर– बफर क्रिया की क्रियाविधि, हेन्डरसन–हजल समीकरण। लवणों का जल अपघटन।

	इलेक्ट्रोड पर अभिक्रियाऐं, आवेश स्थानांतरण, धारा–घनत्व, पोलेरोग्राफी, एमपेरोमेट्री, आयन वर्णात्मक इलेक्ट्रोड एवं उनके उपयोग।
Unit-V	**Surface Chemistry: (a)** Adsorption, adsorption and absorption, types of adsorption, adsorption of gases and liquids on solid adsorbent- Freundlich and Langmuir adsorption isotherms, surface area and determination of surface area. **(b) Catalysis:** characteristics of catalyzed reactions, classification of catalysis, application of catalysts, miscellaneous examples.
	अ. पृष्ट रसायनः अधिशोषण, अधिशोषण एवं अवशोषण, अधिशोषण के प्रकार, ठोस अधिशोषकों पर गैसों तथा द्रवों का अधिशोषण, फ्रेण्डलिच तथा लेंग्म्योर अधिशोषण समतापी प्रक्रम, पृष्ठ क्षेत्र एवं पृष्ठ क्षेत्र का निर्धारण। ब. उत्प्रेरण : उत्प्रेरित अभिक्रियाओं के अभिलक्षण, उत्प्रेरक का वर्गीकरण, उत्प्रेरक के अनुप्रयोग, विविध उदाहरण।

Part C: Learning Resources

1. Physical Chemistry – Puri , Sharma and Pathania – Vikas publications, New Delhi
2. Physical Chemistry – G M Barrow , International Student Edition McGraw Hills
3. The Elements of physical Chemistry , PW Atkins , Oxford University Press
4. Physical Chemistry – R A Alberty , Willey Eastern Limited
5. Physical Chemistry Through Problems , S K Dogra and S Dogra , Wiley

Part A: Introduction for code: 205-II

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Chemistry	
Syllabus Session – 2021-2022	
Class – B.Sc. – IInd YEAR	
Title of the Paper : Inorganic Chemistry	**Paper Code: 205-II**
Course Objective	
To introduce students, d & f block elements, coordination compounds, oxidation reduction and acid-base concepts.	
Course Learning Outcomes	
CO1	The students will be able to explain characteristic properties of elements of first transition series & their compounds with stability & geometry.
CO2	Students will able to describe properties of 2nd & 3rd transition series elements and their comparative study with 1st series elements.
CO3	The students will be able to explain fundamental concept of coordination chemistry, structure and bonding in coordination compounds, oxidation reduction & principles involved in extraction of metals.
CO4	The students will get complete understanding of f block elements & their properties.
CO5	The students will be able to classify the compounds into acid or base, using different concepts & will be familiar with reactions occurring in non aquous solvents.

Part B : Content of the course:

Unit	Syllabus
Unit-I	**Chemistry of Elements of First Transition Series.** Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds such as Carbides. Oxides and Sulphides. Complexes illustrating relative stability of their oxidation states, co-ordination number and geometry.
	अ. प्रथम संक्रमण श्रेणी के तत्वों का रसायन : d ब्लॉक तत्वों के लाक्षणिक गुण, प्रथम संक्रमण श्रेणी के तत्वो के गुण, द्विअंगी यौगिक जैसे –कार्बाइड, ऑक्साइड एवं सल्फाइड। संकुल यौगिकों के द्वारा ऑक्सीकरण अवस्था का आपेक्षिक स्थायित्व, उपसहसंयोजन अंक एवं ज्यामिति।
Unit-II	**Chemistry of Elements of Second and Third Transition Series.** General characteristics, comparative treatment with their.3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry
	द्वितीय एवं तृतीय संक्रमण श्रेणी के तत्वो का रसायन: सामान्य गुण, द्वितीय एवं तृतीय संक्रमण श्रेणी के तत्वों के मुख्य गुणों की 3d श्रेणी के तत्वों से

	तुलना– आयनिक त्रिज्या, ऑक्सीकरण अवस्था, चुम्बकीय व्यवहार, स्पेक्ट्रल गुण एवं त्रिविम रसायन।
Unit-III	**A. Co-ordination Compounds** Werner's co-odination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of co-ordination compounds, isomerism in co-ordination compounds, valence bond theory of transition metal complexes. **B. Oxidation and Reduction** Use of redox potential data : analysis of redox cycle, redox stability in water : Frost, latimer and Pourbaix diagrams. Principles involved in the extraction of elements.
	अ. उप–सहसंयोजक यौगिक वर्नर का उपसहसंयोजक सिद्धांत एवं इसका प्रायोगिक सत्यापन, प्रभावी परमाणु संख्या अवधारणा, कीलेट, संकर यौगिको का नामकरण, संकर यौगिकों में समायवता, संक्रमण धातु संकुलाके का संयोजकता बंध सिद्धांत। ब. ऑक्सीकरण एवं अपचयन: रेडॉक्स विभव ऑकडों का प्रयोग– रेडॉक्स चक्र का विश्लेषण, जल में रेडॉक्स स्थायित्व–फ्रास्ट, लेटिमर एवं पोरबेक्स आरेख, तत्वों के निष्कर्षण में लागू होने वाले सिद्धांत।
Unit-IV	**General Chemistry of F- Block elements.** Lanthanide and actinides, Electronic structure, ionic radii, complex formation, separation, oxidation states, magnetic and spectral properties, Lanthanide contraction.
	F- ब्लॉक तत्वों के सामान्य रसायन: लेन्थेनाइड और एक्टिनाइड, इलेक्ट्रॉनिक संरचना, आयनिक त्रिज्या, संकुल निर्माणख पृथक्करण, ऑक्सीकरण अवस्था, चुम्बकीय तथा स्पेक्ट्रल गुण लेन्थेनाइड संकुचन।
Unit-V	**A. Acids and Bases** Arrhenius, Bronsted- Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases. **B. Non-aqueous Solvents** Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.
	अ. अम्ल एवं क्षारक : अम्ल एवं क्षारकों का आरहीनियस, ब्रान्स्टेड–लॉरी, लक्स–फ्लड विलायक तंत्र एवं लुईस की अभिधारणा। ब. अजलीय विलायक: विलायक के भौतिक गुण, विलायकों के प्रकार एवं उनकी सामान्य विशिष्टताऐं, द्रव अमोनिया (NH_3) एवं द्रव (SO_2) के संदर्भ मे अजलीय विलायकों मे अभिक्रियायें।

Part C: Learning Resources

Inorganic Chemistry – J D Lee , John Wiley
Inorganic Chemistry – Cotton and Wilkinson ,John Wiley
Inorganic Chemistry – Huheey , Harper Collins Pub.USA
Inorganic Polymer – G R Chhatwal , Himalaya Publication
Synthesis and Characterization of Some Novel Nitrosyl Complexes – R. C. Maurya , Pioneer Publication
मध्यप्रदेश हिंदी ग्रंथ अकादमी भोपाल द्वारा प्रकाशित रसायन विज्ञान की पाठ्यपुस्तक ।
मध्यप्रदेश हिंदी ग्रंथ अकादमी भोपाल द्वारा प्रकाशित प्रायोगिक रसायन की पाठ्यपुस्तक ।
Spectroscopy of Organic Compound - P.S.Kalsi , New Age International (p) Limited
Advanced Organic Chemistry – Jerry March ,National Print ,O Pack Noida
Fundamental concepts of Inorganic Chemistry – Esmarch, S Gilreath , McGraw Hill

Part A: Introduction for code: 205-III

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Chemistry	
Syllabus Session – 2021-2022	
Class – B.Sc. IInd YEAR	
Title of the Paper : Organic Chemistry	**Paper Code: 205-III**
Course Objective	
To understand the structure of molecules through spectroscopy, reaction mechanism, different functional groups, their properties, structure activity relationship. This is of great help in the industry.	
Course Learning Outcomes	
CO1	To enable the students to know about Electromagnetic spectra, absorption and emission spectra, mainly UV and IR. UV and IR spectroscopy is a branch of organic chemistry which helps in the structure elucidation of organic molecules.
CO2	To help students to learn about the different types of alcohols and phenols and to know their preparation properties, structure and uses.
CO3	To help students to know about the different types of aldehydes and ketones and to learn about their preparation, properties, structure and uses.
CO4	To help students to know about the different types of carboxylic acids and to learn about their preparation, properties, structure and uses.
CO5	To help students to know about the different types of compounds of nitrogen like amino compounds, nitro compounds, azo compounds and to learn about their preparation, properties structure and uses.

Part B : Content of the course :

Unit	Syllabus
Unit-I	**Electromagnetic Spectrum**: Absorption spectra, Ultraviolet (UV) absorption spectroscopy- absorption laws (Beer & Lambert Law), Molar absorptivity, Presentation and analysis of UV spectra, Types of electronic transitions, Effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, Hyperchromic and hypochromic shifts. UV spectra of conjugated dienes and enones. Infra red (IR) absorption spectroscopy-Molecular vibrations, Hookes law, selection rules, intensity and position of IR bands, Measurement of IR spectrum, finger print region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.
	विद्युत चुम्बकीय स्पेक्ट्रमः अवशोषण स्पेक्ट्रम– पराबैंगनी अवशोषण स्पेक्ट्रामितीय– अवशोषण के नियम (वियर एवं लेम्बर्ट नियम) आण्विक अवशोषिता, पराबैंगनी स्पेक्ट्रम का प्रस्तुतिकरण एवं विश्लेषण, इलेक्ट्रानिक संक्रमण के प्रकार, संयुग्मन का प्रभाव। वर्णमूलक तथा वर्णवर्धक की संकल्पना, वर्णापकरणी, वर्णोत्कर्णी, अतिवर्णक तथा अधोवर्णक विस्थापन। संयुग्मित डाइन तथा इनोन का पराबैंगनी स्पेक्ट्रा। **अवरक्त स्पेक्ट्रामितीय** – आण्विक कंपन, हुक का नियम, वरण नियम, अवरक्त बैंड की स्थित एवं तीव्रता अवरक्त स्पेक्ट्रा का मापन, फिंगरप्रिंट क्षेत्र, विभिन्न क्रियात्मक समूहों के अभिलाक्षणिक अवशोषण तथा सरल कार्बनिक यौगिकों के अवरक्त स्पेक्ट्रा का निर्वचन।
Unit-II	**A - Alcohols**: Classification and nomenclature. Monohydric alcohols-Nomenclature, methods of formation - reduction of aldehydes ketones, carboxylic acids and esters. Hydrogen bonding, acid nature and reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage[$Pb(OAc)_4$] and {HIO_4} and pinacol -pinacolone rearrangement. **Trihydric alcohols**-Nomenclature, methods of formation. Chemical reactions of glycerols. B. **Phenols:** Nomenclature, structure and bonding. Preparations of phenols, Physical properties and acidic character, comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ions. Reactions of phenols- Electrophillic aromatic substitution, acylation and carboxylation. Mechanism of Fries rearrangement, Claisen rearrangement, Gatermann synthesis, Hauben-Hoesche reaction, Lederer Manasse reaction and Reimer-Teiman reactions.
	अ. ऐल्कोहल वर्गीकरण एवं नामकरणः मोनोहाइड्रिक ऐल्कोहल – नामकरण, बनाने की विधि, एल्डीहाइड, कीटोन, कार्बोक्सिलिक अम्ल एवं एस्टर का अपचयन, हाइड्रोजन बंध, अम्लीय गुण, एल्कोहल की अभिक्रियाऐं। **डाइहाइड्रिक ऐल्कोहल–** नामकरण, बनाने की विधियां, विसिलन, ग्लाइकाल की रासायनिक अभिक्रियाऐं, ऑक्सीकारकीय विचलन [$Pb(OAc)_4$] एवं [HIO_4] एवं पिनाकॉल– पिनाकोलोन पुर्नविन्यास, **ट्राइहाइड्रिक ऐल्कोहल–** नामकरण एवं बनाने की विधियां, ग्लिसराल की रसायनिक अभिक्रियाऐं। **ब – फीनॉल**

	नामकरण, संरचना एवं आबंधन, बनाने की विधियाँ, भौतिक गुण एवं अम्लीय स्वभाव, फीनाक्साइड आयन का अनुनादी एल्कोहल, स्थायित्व एवं फीनॉल की तुलनात्मक अम्लीय सामर्थ्य, फीनॉल की अभिक्रियाऐं– इलेक्ट्रान स्नेही एरोमेटिक प्रतिस्थापन, ऐसीलीकरण, कार्बोक्सिलिकरण, फ्राइज पुर्नविन्यास, क्लेजन पुर्नविन्यास, गॉटरमान संश्लेषण, हाउबेन–हॉश अभिक्रिया, लेडरर मनासे अभिक्रियां एवं राइमर – टाइमन अभिक्रियाओं की क्रियाविधि।
Unit-III	**Aldehydes and ketones:** Nomenclature, structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using l,3dithianes, synthesis of ketones from nitrilles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig and Mannich reaction. Use of acetals as protecting groups. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizaro reaction, Meerwein Pond of Verley (MPV), Clemmensen, Wolf Kischner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones. An introduction to alfa, beta unsaturated aldehydes and ketones.
	अ. ऐल्डिहाइड्स एवं कीटोन्स : नामकरण, कार्बोनिल समूह की सरचना, एल्डिहाइड्स एवं कीटोन्स बनाने का संश्लेषण, एसिड क्लोराइड, 1, 3–डाइथायन्स, नाइट्राइल एव कार्बोक्सिलिक अम्ल के विशेष संदर्भ में। भौतिक गुण, कार्बोनिल समूह की नाभिक स्नेहीयोगात्मक अभिक्रियाओं की क्रियाविधि–बेन्जाइन, ऐल्डोल संघनन, पर्किन एवं नोवेन जल संघनन को प्रमुखता देते हुए। अमोनिया एवं उसके व्युत्पन्नों के साथ संघनन क्रियाऐ और विटिग, मॉनिश अभिक्रिया, एसिटल का रक्षात्मक समहू के रूप में प्रयोग, ऐल्डिहाइड्स का ऑक्सीकरण, कीटोन्स का बेयर –विलिगर ऑक्सीकरण, केनिजारो अभिक्रिया, मीरवीन–पोण्डॉर्फ –वर्ले, क्लेमेन्सन, वुल्फ किश्नर अपचयन, $LiAlH_4$ एवं $NaBH_4$ अपचयन। इनोलीकृत कीटोन्स का हैलोजनीकरण, α, β असंतृप्त एल्डीहाईड एवं कीटोन का परिचय।
Unit-IV	**A Carboxylic Acids:** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, Effects of substituent on acid strength. Preparation of carboxylic acids and reactions of carboxytlic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids, hydroxy acids (Malic, Tartaric and citric acids). Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids-Methods of formation and effect of heat and dehydrating agents. **B** Ether: Nomenclature and methods of their formation. Physical properties and chemical reactions. Cleavage and auto oxidation, Ziesels method.
	कार्बोक्सिलिक अम्ल: नामकरण, सरचना एव आबधन, भौतिक गुण, कार्बोक्सिलिक अम्लो की अम्लीयता, अम्ल की प्रबलता पर प्रतिस्थापियों का प्रभाव, कार्बोक्सिलिक अम्लों के बनाने की विधियॉ, रासायनिक अभिक्रियाएँ, हैल–वोल्हार्ड–जैलिन्सकी अभिक्रिया, ऐसिड क्लोराइडों एस्टर एवं एमाइड का संश्लेषण, कार्बोक्सिलिक अम्लों का अपचयन, विकार्बोक्सिलीकरण की क्रियाविधि। हैलोअम्ल, हाइड्राक्सी अम्ल (मौलिक, टार्टरिक एवं साईट्रिक अम्ल) बनाने की विधियॉ एवं रसायननिक अभिक्रियाऐं असंतृप्त मोनोकार्बोक्सिलिक अम्लो के बनाने की विधियॉ का प्रभाव एव निर्जलीकारक अभिकर्मक। ईथर – नामकरण एवं बनाने की विधियॉ, भौतिक गुण एवं रसायनिक अभिक्रियायें, विघटन और स्व ऑक्सीकरण, जीसल विधि।
Unit-V	**Organic compounds of Nitrogen:** Preparation of nitro alkanes and nitro arenes. Chemical reactions of nitro-alkanes. Mechanism of nucleophilic substitution in nitro arenes and their reductions in neutral acidic and alkaline

	media Halonitroarenes; reactivity, structure and nomenclature of amines, physical properties, stereochemistry of amines, separation of mixture primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase transfer catalyst. Preparation of alkyl and aryl amine (reduction of nitro compounds, nitrilles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalmide reaction, Hoffmann-Bromide reaction. Reactions of Amines. Electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acids. Synthetic transformations of aryl diazonium salts, Azo coupling.
	नाइट्रोजन के कार्बनिक यौगिक: नाइट्रोएल्केन तथा नाइट्रोऐरीन्स के बनाने के विधि। नाइट्रोऐल्केन की रासायनिक अभिक्रियाऐं। नाइट्रोएरिन में नाभिकस्नेही प्रतिस्थापना अभिक्रियाओं की क्रियाविधि तथा अम्लीय, उदासीन एवं क्षारीय माध्यम में अपचयन। हेलोनाइट्रोऐरीन्स: क्रियाशीलता, एमीन के नामकरण तथा संरचना। ऐमीन के भौतिक गुण तथा त्रिविम रसायन। प्राथमिक, द्वितीयक एवं तृतीयक ऐमीन के मिश्रण का पृथक्करण। एमीनों की क्षारकता पर संरचना का प्रभाव। प्रावस्था रूपांतर उत्प्रेरकों के रूप मे ऐमीन लवण। एल्काईल तथा ऐराइल ऐमीन के बनाने की विधि। (नाईट्रो एवं नाइट्रिल यौगिकों का अपचयन) ऐल्डीहाइड एवं कीटोनिक यौगिकों का अपचयनी ऐमीनीकरण, ग्रबियल थैलिमाइड अभिक्रिया, हॉफमेन ब्रोमाइड अभिक्रिया। ऐमीन की अभिक्रियाऐं, ऐरिल ऐमीन में इलेक्ट्रान स्नेही एरोमेटिक प्रतिस्थापना, ऐमीन की नाइट्रस अम्ल से अभिक्रिया। ऐरिल डाइजोनियम लवण के संश्लेषिक रूपांतरण, एजो युग्मन।

Part C: Learning Resources

Organic Chemistry, Morrison and Boyd, Prentice Hall.
Organic Chemistry , L G Wade Jr , Prentice Hall
Fundamentals of Organic Chemistry , Solomon ,John Wiley
Organic Chemistry, Vol.I ,II,III, S.M.Mukherji, S.P.Singh and R.P. Kapoor
Organic Chemistry, F A Carey McGraw Hills Inc.
Introduction to Organic Chemistry Streitwiesser , Healthcock and Kosover, MacMillan
Vogel's Qualitative and Quantitative Analysis , Vol I,II,III ,ELBS
Advanced Organic Chemistry , I.L. Finar ,ELBS
Basic concepts of Analytical Chemistry, S.M. Khopker,New Age International Publishers
Analytical Chemistry, R. M. Verma , CBS Publication
Analytical Chemistry , Skoog and west Wiley International
Essentials of Physical Chemistry , B.S.Bahl , Arun Bahl and G.D. Tuli, S Chand and Company Limited
Atomic Structure and Molecular Spectroscopy , Mans Chanda , New Age International Publishers
Molecular Spectroscopy , Sukumar , MJP Publishers .
Organic Chemistry, Mac Murrey ,Pearson Education

Class: B.Sc. II Year

Subject Chemistry

Paper- Practical

Max Marks: 50 **Time:6 Hrs**

Inorganic Chemistry **12 Marks**

(i) Analysis of inorganic mixture containing five radicals with at least on interfering radical
(ii) Determination of acetic acid in commercial vinegar using NaOH
(iii) Redox titrations
(iv) Estimation of hardness of water by EDTA.

Physical Chemistry

(i) Determination of transition temperature of given substance by thermometric and diatometric method.

(ii) To determine the enthalpy of neutralization of strong acid and strong base.

(iii) Verification of Beer's- Lambert law.

(iv) To study the phase diagram of two component system by cooling curve method.

(v) To determine the strength of HCl with NaOH using potentiometer.

Organic Chemistry (Any two) **12 Marks**

(i) Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

(ii) Use of Paper chromatography / Thin layer chromatography: determination of Rf values, separation and identification of organic compounds.
a. Separation of green leaf pigments (spinach leave may be used)
b. Separation of dyes

Viva voce 06 Marks
Record 08 Marks

कक्षा : बी.एस–सी. द्वितीय
विषय – रसायनशास्त्र
पेपर – प्रायोगिक रसायन

अधिकतम अंक : 50 समय– 06 घंटे

अकार्बनिक रसायन 12 अंक

1. अकार्बनिक मिश्रण का विश्लेषण जिसमें पांच मूलक हो तथा कम से कम एक बाधाकारी मूलक हो।
2. NaOH का उपयोग करते हुए सिरके में एसिटिक अम्ल का निर्धारण।
3. रैडॉक्स अनुमापन
4. EDTA द्वारा जल की कठोरता का निर्धारण

भौतिक रसायन 12 अंक

1. उष्मामिति तथा डायलोमट्रिक विधि द्वारा दिये हुए पदार्थ का संक्रमण ताप ज्ञात करना।
2. प्रबल अम्ल/प्रबल क्षार के लिये उदासीनीकरण उष्मा ज्ञात करना।
3. बीयर–लेम्बर्ट नियम का सत्यापन।
4. शीतलन वक्र विधि द्वारा दो घटकीय तंत्र के प्रावस्था आरेख का अध्ययन।
5. विभवमापी द्वारा NaOH की सहायता से HCl की सांद्रता ज्ञात करना।

कार्बनिक रसायन :

1. क्रियात्मक समूह द्वारा कार्बनिक यौगिक की पहचान गलनांक का निर्धारण तथा उपयुक्त व्युत्पन्नों का निर्माण। 12 अंक
2. पेपर क्रोमेटोग्राफी/महीन परत क्रोमेटोग्राफी Rf मान का निर्धारण व कार्बनिक पदार्थो की पृथक्करण एवं पहचान।

अ. हरी पत्ती रंजक का पृथक्करण (पालक पत्ती का उपयोग किया जा सकता है)
ब. रंजकों का पृथक्करण।

वाईवा – 06 अंक
रेकॉर्ड – 08 अंक

Part A: Introduction for code: 305-I

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Chemistry
Syllabus Session – 2021-2022

Class – B.Sc. – IIIrd YEAR	
Title of the Paper : Physical Chemistry	**Paper Code: 305-I**
Course Objective	
In deep knowledge of various spectroscopy and it application and photo chemical processes.	
Course Learning Outcomes	
CO1	The students will be able to apply the postulates and concept of quantum mechanics to various natural phenomena taking place in this universe. This will motivate the students to correlate quantum mechanics with molecular orbitals theory.
CO2	Study of interaction of microwave and IR radiations helps to understand the structure of molecules.
CO3	The students can explore the chemical composition and structure of various novel molecules.
CO4	Learner can get acquainted with photochemical processes and their role in various biological process.
CO5	Knowledge of this topic helps to correlate these physical properties (optical activity and dipole moment) with structure of molecules.

Part B: Content of the course:

Unit	Syllabus
Unit-I	A. **Elementary Quantum Mechanics:** Black-body radiation. Planck's radiation law. photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. Compton effect. de-Broglie hypothesis, the Heisenberg's uncertainty principle. Sinusoidal wave equation. Hamiltonian operator. Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one-dimensional box. **B. Molecular orbital theory:** Basic ideas-criteria for forming M.O. from A.O., construction of M.O.'s by LCAO-H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ. σ*, π. π* orbitals and their characters. Hybrid orbitals- sp, sp^2, sp^3: calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H_2^+ ion, comparison of M.O. and V.B. models
	अ. प्रारंभिक क्वाण्टम यांत्रिकी – कृष्णिका विकिरण, फ्लांक का विकिरण नियम, प्रकाश वैद्युत प्रभाव, ठोसों की उष्माधारिता, बोर का हाइड्रोजन परमाणु मॉडल (व्युत्पत्ती नहीं) एवं इसके दोष। कॉम्पटन प्रभाव। डी–बोगली की परिकल्पना, हाईजेनबर्ग, का अनिश्चितता का सिद्धांत, ज्यावक्रीय तरंग समीकरण, हेमिल्टोनियन प्रचालक, श्रोडिंजर तरंग समीकरण एवं इसका महत्व, तरंग फलन की भौतिक व्याख्या, क्वाण्टम यांत्रिकी के अभिगृहित, एक–विमीय कोष्ठ में कण। आण्विक कक्षक सिद्धांत : आधारभूत सिद्धांत, परमाण्विक कक्षकों से आण्विक कक्षक बनने का आधार, परमाण्विक कक्षक के रेखीय संयोजन LCAO से H_2^+ आयन के आण्विक कक्षक का निर्माण, तरंग फलन से उर्जा स्तर की गणना, आबंधी एवं प्रति आबंधी तरंग फलन का भौतिक चित्रण, σ. σ*, π. π* कक्षक की अवधारणा एवं उनके गुणधर्म, sp, sp^2, sp3 संकरण कक्षक, इस संकरित कक्षकों में प्रदत्त परमाण्विक कक्षकों के नियतांकों की गणना। H_2^+ के संयोजकता बंध के माडल का परिचय। आण्विक कक्षक एवं संयोजकता बंध माडल की तुलना।
Unit-II	**Spectroscopy:**

	Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom. **Rotational Spectrum:** Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotopic effect. **Vibrational Spectrum :** Infra-red spectrum : Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of an harmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.
	स्पेक्ट्रोस्कॉपी परिचय: विद्युत चुम्बकीय विकिरण, स्पेक्ट्रम के परिक्षेत्र, विभिन्न स्पेक्ट्रोमापी के आधारभूत लक्षण, बोर्न ओपनहाइमर सन्निकटन का कथन, स्वतंत्रता की कोटि **घूर्णन स्पेक्ट्रम** : द्विपरमाणवीय अणु, दृढ़ घूर्णक के उर्जा स्तर, (अर्ध–चिरप्रतिष्ठित सिद्धांत) वरण नियम, स्पेक्ट्रल तीव्रता, समष्टि बंटन प्रयुक्त करते हुए वितरण (मैक्सवेल–बोल्टजमैन वितरण), आबंध लम्बाई का निर्धारण, अदृढ़ घूर्णक का गुणात्मक विवरण, समस्थानिक प्रभाव। **कम्पन स्पेक्ट्रम:** अवरक्त स्पेक्ट्रमः सरल आर्वतीय कंपन के उर्जा स्तर, वरण नियम, विशुद्ध कम्पन स्पेक्ट्रम, तीव्रता, बल स्थिरांक का निर्धारण, बल स्थिरांक एवं आबंध उर्जाओं में गुणात्मक संबंध। स्पेक्ट्रम पर अनावर्तीय गति तथा समस्थानिक का प्रभाव, विभिन्न क्रियात्मक समूहों की कंपन आवृत्तियों की जानकारी।
Unit-III	**Raman Spectrum:** Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules. **Electronic Spectrum:** Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of σ, π and η M.O. their energy levels and the respective transition. **UV Spectroscopy:** Electronic excitation, elementary idea of instrument used. Application to organic molecules. Woodward- Fieser rule for determining λ_{max} of dienes, polyenes and α, β unsaturated carbonyl compounds
	अ. रमन स्पेक्ट्रम: ध्रुवणीयता की परिकल्पना, द्विपरमाणवीय अणुओं के लिये विशुद्ध घूर्णन एवं विशुद्ध कम्पन रमन स्पेक्ट्रम, वरण नियम। **इलेक्ट्रनिक स्पेक्ट्रम:** आबंधन एवं प्रतिबंधन आणविक कक्षकों हेतु स्थितिज उर्जा वक्रों की परिकल्पना, वरण नियमों का गुणात्मक विवरण एवं फ्रेक कांडन सिद्धांत, आबंध कक्षक सिद्धांत एवं आण्विम कक्षक सिद्धांत का गुणात्मक विवरण और उनके उर्जा स्तर तथा तत्संबंधी संक्रमण। **पराबैंगनी स्पेक्ट्रामिकी:** इलेक्टॉनिक उत्तेजन, प्रयुक्त उपकरण के संबंध में प्रारंभिक जानकारी, कार्बनिक यौगिकों की संरचना ज्ञात करने के अनुप्रयोग, डाईन्स, पॉलीईन्स तथा **α,β** असंतृप्त कार्बोनिल यौगिकों के **λ_{max}** के निर्धारण के लिये बुडवर्ड– फिशर नियम।
Unit-IV	**Photochemistry** Law of photochemistry: Grothus-Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radioactive processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions energy transfer processes (simple examples.) Photochemical reactions of simple organic compounds. Norrish type I and II reactions.

	प्रकाश–रसायन प्रकाश रसायन के नियम : ग्रोथस–ड्रेपर नियम–स्टार्क–आइन्सटीन नियम, उत्तेजित अवस्थाओं में होने वाली विभिन्न क्रिया–विधियों को दर्शाते हुए जैबलोन्सकी आरेख, प्रतिदीप्ति का गुणात्मक विवरण, स्फुरदीप्ति, अविकरणीय क्रिया–विधियों (अन्तरपरिवर्तन, अन्तरनिकाय लांघन), क्वाण्टम दक्षता, प्रकाशग्राही अभिक्रियाएँ, ऊर्जा स्थानान्तरण क्रिया–विधियाँ (सरल उदाहरण) कार्बनिक योगिको की प्रकाश रसायनिक अभिक्रियाएं,नॉरिश I तथा II अभिक्रियाएं
Unit-V	**Physical Properties and Molecular Structure:** Optical activity. Polarisation (Clausius - Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment measurement of dipole moment, temperature method and refractive method, dipole moment and structure of molecules, magnetic properties –para-magnetism , diamagnetism and ferromagnetism
	भौतिक गुण तथा अणु संरचना: ध्रुवण–घूर्णता, ध्रुवण–(क्लॉसियम–मोसोटी समीकरण) विद्युत क्षेत्र में द्विध्रुवीय अभिविन्यास, द्विध्रुवीय आघूर्ण, प्रेरित द्विध्रुव आघूर्ण, अपवर्तन विधि तथा ताप विधि द्वारा द्विध्रुवीय आघूर्ण मापन, द्विध्रुव आघूर्ण तथा अणुओं की संरचना, चुम्बकीय गुण– अनुचुम्बकीय, पराचुम्बकीय तथा लौह चुम्कबत्व।

Part C: Learning Resources:

Physical Chemistry – Puri , Sharma and Pathania – Vikas publications, New Delhi
Physical Chemistry – G M Barrow , International Student Edition McGraw Hills
The Elements of physical Chemistry , PW Atkins , Oxford University Press
Physical Chemistry – R A Alberty , Willey Eastern Limited
Physical Chemistry Through Problems , S K Dogra and S Dogra , Wiley Eastern

Part A: Introduction for code: 305-II

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Chemistry	
Syllabus Session – 2021-2022	
Class – B.Sc. – IIIrd YEAR	
Title of the Paper : Inorganic Chemistry	**Paper Code: 305-II**
Course Objective	
To provide the students, the knowledge of inorganic polymers, Pearson's principle new theories of metal – ligand bonding, stability of complexes, magnetic and spectroscopic properties and elementary knowledge of organometallic chemistry and bioinorganic chemistry.	
Course Learning Outcomes	
After successful completion of course students will be able to	
C01	a) To reframe their knowledge about acids and bases into hard and soft acid and bases. b) The role plays of inorganic polymers.
C02	To develop the concept of different theories of metal ligand bonding and to develop the concept of stability.
C03	To create the concept of magnetic properties.
C04	To correlate the electronic spectra with structure of complexes.
C05	a) The role play of essential and trace elements in biological system. b) To Illustrate the metal nitrosyl complexes.

Part B: Content of the course

Unit	Syllabus
Unit-I	**1. Hard and Soft Acids and Bases (HSAB)** Introduction. Classification of hard and soft acid-base. Hard and soft acid-base concept of Pearson, Applicatic of hard-soft acid base theory, Symbosis, acid-base strength, hardness and softness; Theoretical basis of hardne and softness, electronic theory, π-bonding theory, and Dragowayland theory, electronegativity, hardness ai softness, limitations of hard soft acid-base concept. **2. Silicones and Phosphazenes:** Introduction: silicones-methods of preparation, classification, properties and application (uses Phosphazenes (Phosphonitrilic chloride)-Methods of preparation and properties; Structure triphosphazenes. Some other phasphazenes and uses of phosphazenes.
	1. कठोर तथा मृदु अम्ल क्षारक परिचयात्मक, कठोर एवं मृदु अम्ल–क्षारक वर्गीकरण, पीयरसन की HSAB धारणा, कठोर–मृदु अम्ल क्षारक सिद्धांत के उपयोग, सहजीवता, अम्ल–क्षार प्रबलता तथा कठोरता एवं मृदुता, कठोरता एवं

	मृदुता के सिद्धांत इलेक्ट्रॉनिक तथा π–बंध एवं ड्रेगोवेलेंड सिद्धांत, विद्युत ऋणात्मकता और कठोरत एवं मृदुता, HSAB धारणा की सीमायें एवं अभ्यासार्थ प्रश्न। 2. सीलिकॉन्स एवं फास्फाजीन परिचयात्मक सिलीकॉन्स बनाने की विधियॉं, वर्गीकरण, गुण एवं उपयोग फॉस्फोजीन बनाने की विधियां, गुण त्रिफॉस्फाजीन्स $(NPCl_2)_3$ की संरचना, उपयोग एवं अभ्यासार्थ प्रश्न।
Unit-II	**1. Metal Ligand Bonding in Transition Metal Complexes.** Introduction, limitations of valence bond theory, crystal field theory, crystal field splitting of d-orbitals, d-orbit splitting and stabilization energy in octahedral, tetrahedral and square planar complexes; factors affecting tl crystal field parameters. Applications of crystal field theory and limitations of crystal field theory. **2. Thermodynamic and Kinetic Aspects of stability of Metal complexes:** Introduction; Thermodynamic aspects of metal complexes-factors affecting thermodynamic stability complexes, kinetic aspects of metal complexes, substitutions reactions of square planer complexes ar factors affecting the rate of substitution reactions in square planar complexes.
	1. संक्रमण धातु संकुलों में धातु लिगण्ड बंधन सयोंजकता बंध सिद्धांत की सीमायें, क्रिस्टल क्षेत्र सिद्धांत, d- कक्षकों का क्रिस्टल क्षे विपाटन–अष्टफलकीय, चतुष्फलकीय एवं समतल वर्गीकार संकुलों में d- कक्षकोंका विपाट इलेक्ट्रानों का वितरण एवं क्रिस्टल स्थायीकरण उर्जा, संकुलो द्वारा ज्यामितीय प्रबंधन, अष्टफलकी तथा समचतुष्फलकीय ज्यामिति की तुलना, क्रिस्टल क्षेत्र मापको (पेरामीटर) को प्रभावित करने वा कारक, क्रिस्टल क्षेत्र सिद्धांत के अनुप्रयोग, क्रिस्टल क्षेत्र सिद्धांत की सीमायें एवं अभ्यासार्थ प्रश्न। 2. धातु संकुलोंकी उष्मागतिकी एवं बलगतिकी अवधारणा परिचयात्मक, धातु संकलों की उष्मागतिकी अवधारणा, बंध उर्जा, स्थायित्व एवं स्थायित्व नियतांक, उष्मागतिकी स्थायि को प्रभावित करने वाले कारक। धातु संकलों की बलगतिकी अवधारणा, वर्ग समतलीय संकलों मं प्रतिस्थापना क्रिया वर्ग समतलीय संकुलों में प्रतिस्थाना अभिक्रिया दर को प्रभावित करने वाले कारक एवं अभ्यासार्थ प्रश्न।
Unit-III	**Magnetic Properties of Transition Metal Complexes.** Introduction: Types of magnetic behavior, diamagnetism. Paramagnetism. Ferromagnetism. Anliferromagnetism. Ferrimagnetis. Origin and calculation of magnetism. Methods of determining magnetic susceptibility-Guoy, Bhatnagar Mathur. Quincke's, Curie and Nuclear magnetic Resonance method. Magnetic moment; L-S coupling, Determination of ground state term symbol. Correlation of μ_s and μ_{eff} values. Orbital contribution to magnetic moments and application of magnetic moment data for 3d-metal complexes.
	संक्रमण धातु संकुलों के चुम्बकीय गुण परिचयात्मक, चुम्बकीय व्यवहार के प्रकार, चुम्बकत्व का उद्गम एवं गणना, चुम्बकीय सुग्राहिता को मापने की विधियां, चुम्बकीय आघूर्ण मूल अवस्था तथा उत्तेजित अवस्था का उर्जापद निर्धारण, L-S युग्मन, μ_s तथा μ_{eff} में संबंध तथा मानों में सहसंबंध, चुम्बकीय आघूर्ण में कक्षक योगदान, 3d धातु संकुलों के लिए चुम्बकीय आघूर्ण , आघूर्ण आंकडों की उपयागिता एवं अभ्यासार्थ प्रश्न।
Unit-IV	**Electronic Spectra of Transition Metal Complex** Introduction; Type of electronic transition. Selection rules for d-d transitions; sprctroscopic ground state Notations, Spectroscopic states and spectroscopic ground states in complexes; Spectrochemical series; Org energy level diagram-Uses in octahedral and tetrahedral complexes having d^1 to d^9 states: Electronic spectrum $[Ti(H_2O)_6]^{3+}$ complex ion.complexes with aromatic systems Synthesis, structure and bonding in metal olef complexes, aklyne complexes, cyclopenta dienyl, complexes, coordinative unsaturation, oxidative additi reactions, insertion reaction, fluxional molecules and their characterization compounds with metal- metal bon and metal atoms clusters.

	संक्रमण धातु संकुलों के इलेक्ट्रॉनिक स्पेक्ट्रारू परिचयात्मक, इलेक्ट्रानिक संक्रमण एवं उसके प्रकार, संक्रमण के लिए वरण नियम चयन, नियम का भंग होना, स्पेक्ट्रोस्कॉपीक मूल अवस्थाऐं, संकुलों में स्पेक्ट्रोस्कॉपिक अवस्थायें एवं स्पेक्ट्रोस्कॉपिक मूल अवस्थायें, रासायनिक वर्णक्रम श्रेणी, आर्गेल उर्जा स्तर चित्र (d^1 से d^9) संकुल आयन की इलेक्ट्रॉनिक वर्णक्रम विवेचना $[Ti(H_2O)_6]^{3+}$ का इलेक्ट्रॉनिक स्पेक्ट्रम एवं अभ्यासार्थ प्रश्न। एरोमेटिक तंत्रों सहित संकुल– संश्लेषण धातु ओलीफिन संकलों में संरचना एवं बंधन, साइकोपेन्टाडायनिल संकुल, उप सहसंयोजी असंतृप्तता, ऑक्सीकरण योगात्मक अभिकियाएं, प्रविष्टि अभिकियोंए, संगणन अणु के अभिलक्षण, धातु–धातु बंध एवं धातु – परमाणु समूह के यौगिक।
Unit-V	**Bio-Inorganic Chemistry** Introduction; Essential and trace elements in biological processes. Biological function of the bio-element Availability of bio-metals and bio-non-metals: Metalloporphyrins. Haemoglobin structure and biologic function. Myoglobin-mechanism of oxygen transfer through haemoglobin and myoglobin. Biological role alkali and alkaline earth metal ions with special reference to Ca^{2+}, Nitrogen fixation. Metal ions in biological systems and their role in Ion transport across the membranes.(molecular mechanisr oxygen-uptake proteins, cyclochromes and ferreodoxins.
	जैव– अकार्बनिक रसायन– परिचयात्मक जैविक प्रक्रियाओ में आवश्यक एवं सूक्ष्म तत्व, जैव तत्वों के जैविक कार्य, जैव धातु प्र जैव धातुओं की उपलब्धता, धातु पॉर्फिरिन्स–हीमोग्लोबिन एवं मायोग्लोबिन, क्षार तथा क्षारीय मृ धातु आयनों का जैविक महत्व, पोटेशियम, सोडियम तथा कैल्शियम के संदर्भ में, नाइट्रोज स्थिरीकरण एवं अभयासार्थ प्रश्न। जैविक तंत्र में धातु आयन एवं झिल्ली के आर–पार आयन भूमिका (आणविक कियाविधि), ऑक्सीजप – तेज प्रोटीन, साइक्लोक्रोम्स एवं फेरोडाक्सीस।

Part C: Learning Resources:

Inorganic Chemistry – J D Lee , John Wiley
Inorganic Chemistry – Cotton and Wilkinson ,John Wiley
Inorganic Chemistry – Huheey , Harper Collins Pub.USA
Inorganic Polymer – G R Chhatwal , Himalaya Publication
Synthesis and Characterization of Some Novel Nitrosyl Complexes – R. C. Maurya , Pioneer Publication
मध्यप्रदेश हिंदी ग्रंथ अकादमी भोपाल द्वारा प्रकाशित रसायन विज्ञान की पाठ्यपुस्तक ।
मध्यप्रदेश हिंदी ग्रंथ अकादमी भोपाल द्वारा प्रकाशित प्रयोगिक रसायन की पाठ्यपुस्तक ।
Spectroscopy of Organic Compound - P.S.Kalsi , New Age International (p) Limited
Advanced Organic Chemistry – Jerry March ,National Print ,O Pack Noida
Fundamental concepts of Inorganic Chemistry – Esmarch, S Gilreath , McGraw Hill

Part A: Introduction for code: 305-III

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Chemistry
Syllabus Session – 2021-2022
Class – B.Sc. IIIrd YEAR
Title of the Paper : Organic Chemistry Paper Code: 305-III

Course Objective	
To develope student abilities and skills to acquire expertise over synthesis for chemical industries.	
Course Learning Outcomes	
CO1	Students will be able to develop interpretation of different spectroscopy e.g. NMR, UV and IR spectroscopy.
CO2	To write chemical behavior and reactivity of categorized organometallic compounds.
CO3	Carbohydrates, one of the four major classes of biomolecules are aldehyde or ketone compounds with multiple hydroxyl groups. After interacting with this learner will be able to correlate structure and properties of carbohydrates.
CO4	To develop and modify the knowledge about Amino acid, peptide, proton and Nucleic.
CO5	To analyse heterocyclic compounds in different manner i.e. Nomenclature, classification, preparation and chemical reactions.

Part B: Content of the course

Unit	Syllabus	Periods
Unit-I	**Spectroscopy:** **Nuclear Magnetic Resonance Spectroscopy:** Proton Magnetic Resonance (1HNMR) Spectroscopy, Nuclear shielding and dis-shielding, chemical shift and molecular structure, spin-spin coupling and coupling constant, region of signals, Explanation of PMR spectra of simple organic molecules like ethyl bromide, ethanol, acetaldehyde, 1,1,2 tribromo ethane, ethylacetate, toluene and acetophenone. Applications of UV, IR and PMR spectroscopy for simple organic compounds.	
	स्पेक्ट्रमिकी– नाभिकीय चुम्बकीय अनुनाद स्पेक्ट्रमिकी प्रोटोन चुम्बकीय अनुनाद (1HNMR) स्पेक्ट्रमिकी, नाभिकीय परिरक्षण एवं विपरिरक्षण, रासायनिक विस्थापन एवं आण्विक संरचना, स्पिन–स्पिन युग्मन एवं युग्मन स्थिरांक, सिग्नल का क्षेत्र, सरल कार्बनिक यौगिकों के PMR स्पेक्ट्रा की व्याख्या, जैसे–इथाइल ब्रोमाइड, एथेनाल, एसीटैल्डिहाइड, 1,1,2–टाई, ब्रोमोएथेन, इथाइलएसीटेट, टॉल्वीन एवं ऐसिटोफीनॉन। UV, IR तथा PMR स्पेक्ट्रमिकी तकनीकी का उपयोग करते हुये सरल कार्बनिक यौगिकों की संरचना का निर्धारण।	
Unit-II	**(A) Organo-Metallic compounds:-** Organomagnesium compounds- Grignard reagent, preparations, structure and chemical reactions. Organozinc compounds-Preparations and chemical reactions. Organolithium compounds- Preparations and chemical reactions. **(B) Organo sulphur compounds:** Nomenclature, structural characteristics. Thiol, thio-ether, sulphonic acid, sulphonamide and sulphaguanidine-methods of preparations and chemical reactions. **(C)** Preparation and properties of polymers, organic Polymers-polyethylene, polystyrene, polyvinyl chloride, Teflon, nylon, terylene, synthetic and natural rubber.	
	(अ) कार्ब–धात्विक यौगिक – कार्बमैग्नीशियम यौगिक: ग्रिग्नार्ड अभिकर्मक– विरचन, संरचना एवं रासायनिक अभिक्रियाऐं। कार्बजिंक यौगिक – विरचन एवं रसायनिक अभिक्रियाऐं। कार्बलीथियम यौगिक – विरचन एवं रसायनिक अभिक्रियाऐं। (ब) कार्बसल्फर यौगिक– नामकरण, संरचनात्मक लक्षण, थायोल, थायोईथर, सल्फोनिक अम्ल, सल्फोनामाइड एवं सल्फा ग्वानिडीन के विरचन की विधियां एवं रासायनिक अभिक्रियाऐं। (स) बहुलक के बनाने की विधि एवं उनके गुण, कार्बनिक बहुलक – पॉलीइथिलिन, पॉलीस्टीरिन, पॉली विनाइल क्लोराइड, टेफलॉन, नाइलान,	

	टेरेलिन कृत्रिम एवं प्राकृतिक रबर।
Unit-III	(A) **Carbohydrates :-** Classification and nomenclature. Monosaccharides, mechanism of osazone formation, inter conversion of glucose into fructose. Ascending and descending series in aldose. Configuration of monosaccharides. Stereo isomers of erythro and threo sugars. Conversion of glucose into mannose. Glycosides, determination of the size of the ring of monosaccharides. Ring structure of D(+) glucose, Mechanism of mutarotation. Structure of ribose and deoxyribose. Disaccharides- introductory idea of maltose, sucrose and lactose(Excluding structures). Polysaccharides-introductory idea of starch and cellulose (Excluding structures) **(B) Fat,Oil and Detergents:** Natural fat, edible and industrial oil of plant origin. Normal fatty acids, glycerides. Hydrogenation of unsaturated oil, saponification value, iodine value and acid value. Synthetic Detergents:-Alkyl and aryl sulphonate.
	अ. कार्बोहाइड्रेट्स – वर्गीकरण एवं नामकरण, मोनोसैकेराइड, ओसाजोन विरचन की क्रियाविधि, ग्लूकोज तथा फ्रक्टोज का अंतरूपांतरण, एल्डोसो में श्रृंखला आरोहण व अवरोहण, मोनेसैकेराइडो का अभिविन्यास, एरिथ्रो एवं थ्रियो अप्रतिबिम्बी त्रिविम समावयवी, ग्लूकोज का मैनोस में रूपांतरण, ग्लाइकोसाइड, मोनोसैकेराइड के वलय के आकार का निर्धारण, D(+) ग्लूकोज की वलय संरचना, परिवर्तित ध्रुवण घूर्णन की क्रियाविधि, राइबोस एवं डीऑक्सी राइबोस की संरचना, डाइसैकेराइड (माल्टोस, सुक्रोज एवं लैक्टोस) एवं पॉलीसैकेराइड (स्टार्च एवं सैल्युलोस) का परिचयतात्मक अध्ययन (संरचना निर्धारण छोड़कर) (ब) वसा, तेल एवं अपमार्जक :– प्राकृतिक वसा, वानस्पतिक उद्भव के खाद्य एवं औद्योगिक तेल, सामान्य वसीय अम्ल , ग्लिसाराइड, असंतृप्त तेलों का हाइड्रोजिनीकरण, साबुनीकरण मान, आयोडीन मान, अम्ल मान, साबुन, सांश्लेषिक अपमार्पक, एल्किल एवं ऐरिल संल्फोनेट।
Unit-IV	**Amino Acid, Peptide, Protein and nucleic acid.** Classification of amino acids, structure and stereo chemistry. Acid base behavior, Isoelectric point and electrophoresis. Preparations and chemical reactions of alpha amino acids. Nomenclature and structure of peptide and proteins. Classifications of proteins, determination of peptide structure, end group analysis, selective hydrolysis of peptides, peptide synthesis, solid phase peptide synthesis. Determination of proteins, Nucleic Acid: Constitution of nucleic acids, ribonucleoside and ribonucleotide. Double helix structure of DNA.
	एमीनों अम्ल, पैप्टाइड, प्रोटीन एवं न्युक्लिक अम्ल एमीनों अम्ल का वर्गीकरण, संरचना एवं त्रिविम रसायन, अम्ल–क्षारकीय व्यवहार, समविभव बिंदु एवं वैद्युत कण संचलन, α–ऐमीनों अम्ल का विरचन एवं अभिक्रियाऐं। पेप्टाइड एवं प्रोटीन की संरचना एवं नामकरण, प्रोटीन का वर्गीकरण, प्रेप्टाइड संरचना का निर्धारण, अंत्य समूह विश्लेषण, पेप्टाइड का वर्णात्मक जल–अपघटन,चिरप्रतिष्ठित पेप्टाइड संश्लेषण, ठोस प्रावस्था पैप्टाइड संश्लेषण, प्रोटीन विकृतिकरण। न्युक्लिक अम्ल–परिचयात्मक अध्ययन, न्युक्लिक अम्ल का संघटन, राइबोन्युक्लियोसाइड एवं राइबोन्युक्लियोटाइड, DNA की द्विकुंडली संरचना।
Unit-V	A- Synthetic dyes: Colour and constitution (electronic concept). Classification of dyes-Methyl orange, Congored, Malachite green, crystal violet, phenolphthalein, Fluoroscein, Alizarine and indigo-Chemical study and synthesis. B- Pericyclic reactions: Classification and examples Wood ward Hoffmann rules, electrocyclic reactions, cyclo addition reaction (2, 2 and 4, 2) and sigmatropic shift (1,3,3,3 and 1,5) FMO approach.
	(अ) सश्लेषित रंजक :– रंग एवं संघटन (इलेक्ट्रॉनिक अवधारणा), रंजकों का वर्गीकरण – मेथिल ऑरेंज, कॉगो रेड,

	मैलाकाइट ग्रीन, क्रिस्टल वायलेट, फीनॉल्फ्थैलिन, फ्लुओरसीन, ऐलिजारीन एवं इंडिगो का रासायनिक अध्ययन एवं संश्लेषण। (ब) पेरासाईक्लिक अभिक्रियाएं :– वर्गीकरण एवं उदाहरण, वुडवर्ड हॉफमेन का नियम, विद्युत चक्रीय अभिक्रियाएं, चक्रीय योगात्मक अभिक्रिया, (2,2 एवं 4,2) एवं सिगमोट्रापिक शिफ्ट (1,3,3,3 एवं 1,5) FMO दृष्टिकोण।

Part C: Learning Resources:

Organic Chemistry, Vol.I ,II,III, S.M.Mukherji, S.P.Singh and R.P. Kapoor
Organic Chemistry, F A Carey McGraw Hills Inc.
Introduction to Organic Chemistry Streitwiesser , Healthcock and Kosover, MacMillan
Vogel's Qualitative and Quantitative Analysis , Vol I,II,III ,ELBS
Advanced Organic Chemistry , I.L. Finar ,ELBS
Basic concepts of Analytical Chemistry, S.M. Khopker,New Age International Publishers
Analytical Chemistry, R. M. Verma , CBS Publication
Analytical Chemistry , Skoog and west Wiley International
Essentials of Physical Chemistry , B.S.Bahl , Arun Bahl and G.D. Tuli, S Chand and Company Limited
Atomic Structure and Molecular Spectroscopy , Mans Chanda , New Age International Publishers
Molecular Spectroscopy , Sukumar , MJP Publishers .
Organic Chemistry, Mac Murrey ,Pearson Education

Class: B.Sc. III Year
Subject : Chemistry
Paper : Practical

Max Marks: 50 **Time: 06 Hrs**

Inorganic Chemistry **12 Marks**

i) Gravimetric Analysis
Barium as Barium sulphate, Copper as cuprous thiocynate

ii) Complex compound preparation
   a. Potassium Chlorochromate (IV)
   b. Tetramine copper (II) sulphate monohydrate
   c. Hexamminenickel Chloride, Identification of cations and anions in different samples, effluent of water.
   d. Water analysis, to determine dissolved oxygen in water samples in ppm.

Physical Chemistry **12 Marks**

i) To determine the velocity constant (specific reaction rate) of hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature

ii) Determination of partition coefficient of iodine between carbon tetra chloride and water

iii) Job's method

iv) pH metric titration, conductometric titrations

Organic Chemistry

1. Binary mixture analysis containing two solids:
   Separation, identitfication and preparation of derivatives
2. Preparation
   a) Acetylation b) Benzolylation c) Meta dinitro benzene d) Picric Acid

Viva –voce : 06 Marks
Record : 08 Marks

कक्षा – बी.एस–सी. तृतीय वर्ष
विषय– रसायनशास्त्र
पेपर – प्रायोगिक रसायन

अधिकतम अंक : 50 समय : 04 घण्टे

अकार्बनिक रसायन 12 अंक

1. भारात्मक विश्लेषणः बेरियम का बेरियम सल्फेट के रूप में आकलन करना, कॉपर का क्युप्रस थायोसायनेट के रूप में
2. संकुल यौगिक निर्माण
   अ. पोटेशियम क्लोरोक्रोमेट
   ब. टेट्राऐम्मीन कॉपर (II) सल्फेट मोनोहाइड्रेट
   स. हैक्साएमीन निकल क्लोराइड
3. निसारी जल का विश्लेषण, विभिन्न नमूनों में धनायन एवं ऋणायनों का निर्धारण
4. जल विश्लेषण, जल के नमूनें में घुलित ऑक्सीजन का पी.पी.एम. में निर्धारण

भौतिक रसायन 12 अंक

1. मिथाईल/इथाइल एसिटेट का हाइड्रोजन आयन उत्प्रेरण से जल अपघटन क्रिया की वेग स्थिरांक या (विशिष्ट क्रिया दर) कमरे के तापमान पर ज्ञात करना।
2. आयोडीन का वितरण गुणांक जल एवं कार्बन टेट्राक्लोराइड तंत्र के लिये ज्ञात करना।
3. जॉब्स विधि।
4. pH मितीय अनुमापन, चालकता मितीय अनुमापन।

कार्बनिक रसायन 12 अंक

1. दो ठोस युक्त द्विघटकीय मिश्रणः पृथक्करण पहचान एवं व्युत्पन्न निर्माण।
2. विरचन।
   अ. एसिटीलीकरण
   ब. बेंजायलीकरण
   स. मेटा डाई नाइट्रो बेंजीन
   द. पिक्रिक अम्ल

मौखिक – 06 अंक।
रिकार्ड – 08 अंक।

Year 2020-21

M.Sc. I & II Semester

Course Name – Chemistry

Program Code – P003

Subject Code – CH-13, CH-23

(Physical Chemistry)

Objectives:-

P003	1. To elucidate the use of chemical kinetics in understanding the reaction mechanism and to apply. The theories and concepts of it for homogeneous& heterogeneous catalyzed reactions.
P003	2. To know the application of classical thermodynamics in the evaluation of microscopic properties.
P003	3. To know the structure of the electrode surface & the application of electrode process.
P003	4. To have a good foundation in the physical & mathematical aspects of quantum mechanics.

Course Outcome:-

P003	1. Upon successful completion of this course, students will be able to apply the postulates of quantum mechanics detectsthe structure of periodic table.
P003	2. It explains the origin of electronic vibrations, rotational, vibronic and vibration-rotation spectra.
P003	3. Students learn to predict the point of group of a mole, explain the implications of molecular symmetry in spectroscopy.

Paper-III

MCH-403: PHYSICAL CHEMISTRY I

Hrs : 10 Hrs **M.M. 75**

Unit-I

Introduction to Exact Quantum Mechanical Results

Schrodinger equation and the postulates of quantum mechanics.Discussion of solutions of the Schrodinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom.

Unit-II **10 hrs**

Approximate Methods

The variation theorem, linear variation principle.Perturbation theory (First order and nondegenerate).Applications of variation method and perturbation theory to the Helium atom.

Molecular Orbital Theory

Huckel theory of conjugated systems bond and charge density calculations.Applications to ethylene, butadiene, cyclopropenyl radical, cyclobutadiene.Introduction to extended Huckel Theory.

UNIT- III **10 hrs**

Angular Momentum

Ordinary angular momentum, generalized angular momentum, Eigenfunctions for angular momentum, Eigenvalues of angular momentum operator using ladder operators addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

Unit-IV **15 hrs**

Classical Thermodynamics

Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies.Partial molar free energy, partial molar volume and partial molar heat content and their significance.Determinations of these quantities.Concept of fugacity and determination of fugacity. Non-ideal systems : Excess functions for non-ideal solutions. Activity, activity coefficient, Debye Huckel theory for activity coefficient of electrolytic solutions; determination of activity and activity coefficients; ionic strength. Application of phase rule to three component systems; second order phase transitions.

Unit-V **15 hrs**

Statistical Thermodynamics

Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and micro-canonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions-translation, rotational, vibrational and electronic partition functions, Calculation of thermodynamic properties in terms of partition. Application of partition functions. Fermi-Dirac Statistics, distribution law and applications to metal. Bose-Einstein statistics distribution Law and application to helium.

Books Suggested

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistyry, A.K. Chandra, Tata Mc Graw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Coulson's Valence, R.Mc Ween y, ELBS.
5. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
6. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan.
7. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum.
8. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum.
9. Introduction to Polymer Science, V.R Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
10. Introduction to Quantum Chemistry-R.K. Prasad, New Age Publication.

Paper-III

MCH-408:

PHYSICAL CHEMISTRY II

Hrs: 18 **M.M. 75**

Unit-I

Chemical Dynamics

Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dyamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogenbromine and hydrogen-chlorine reactions) and homogenous catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method, dynamics of unimolecular reactions (Lindemann Hinshelwood and Rice-Ramsperger-Kassel- Marcus (RRKM) theories for unimolecular reactions).

Unit-II **15 Hrs**

Surface Chemistry

Adsorption

Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon).

Micelles

Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solublization, micro emulsion, reverse micelles.

Unit-III **10 Hrs**

Macromolecules

Polymer-definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimension of various chain structures.

Unit-IV **10 Hrs**

Non Equilibrium Theromodynamics

Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electrokinetic phenomena, diffusion, electric conduction.

Unit-V **15 Hrs**

Electrochemistry

Electrochemistry of solutions.Debye-Huckel-Onsager treatment and its extension, ion solvent interactions.Debye-Huckel-Jerum mode.Thermodynamics of electrified interface equations.Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination.Structure of electrified interfaces. Overpotentials, exchange current density, derivation of Butler Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces-theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface.Polarography theory, Ilkovic equation; half wave potential and its significance.

Books Suggested

11. Physical Chemistry, P.W. Atkins, ELBS.
12. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.
13. Quantum Chemistry, IraN. Levine, Prentice Hall.
14. Coulson's Valence, R.Mc Ween y, ELBS.
15. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
16. Kineties and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan.
17. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum.
18. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum.
19. Introduction to Polymer Science, V.R Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.

Year 2020-21

M.Sc. III Semester

Course Name – Chemistry

Program Code – P003

Subject Code – CH-32

(Photo Chemistry)

Objectives:-

P003	1. To explain the concept of photo chemistry and study Beer-Lamberts Law.
P003	2. To describe and explain photochemical and photo physical process using Jablonski-diagram, their quantum field.

Course Outcome:-

P003	1. After completing the course they should be able to explain theory and practice of common photochemical & photo physical methods
P003	2. Describe the interaction of excited states with their surroundings and apply theoretical methods for treating excited states.
P003	3. Describe photo inducedprocesses in semiconductors and explain how there can be used for photo physicalenergy conversion.
P003	4. Explain theory and application of photo catalysis and explain the environmental impact of atmospheric photochemistry.
P003	5. They should know the importance of singlet molecular oxygen in photochemical reactions & in synthesis of some biologically active compounds.
P003	6. Describe and distinguish between radioactiveand non-radioactive transitions with the help of Jablonski-diagram

Class	**M.Sc.**
Semester /	**III**
Subject /	**Chemistry**
Title of Subject Group	**PHOTOCHEMISTRY**
Paper No. /	**II (Code- MCH-502)**
Compulsory /	**Compulsory**
Max. Marks V	75

Particulars

Hrs : 50

Unit-1	**Photochemical Reactions**10 Hrs. Photochemistry an Introduction, Laws of Photochemistry, Role of photochemistry, Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, Photosensitizer, actinometry.
Unit-2	**Determination of Reaction Mechanism**10 Hrs Classification, rate constants and life times of reactive energy state, determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions-photodissociation, Photoreduction, Photoaddition, Photoisomerisation, Photooxidation, gas-phase photolysis.
Unit-3	**Photochemistry of Alkenes**10 Hrs Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes. **Photochemistry of Aromatic Compounds** Isomerisations, additions and substitutions.
Unit-4	**Photochemistry of Carbonyl Compounds**10 Hrs Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, β, ϒ unsaturated and α, β unsaturated compounds, cyclohexadienones. Intermolecular cyloaddition reactions-dimerisations and oxetane formation.

Unit-5	**Miscellaneous Photochemical Reactions**10 Hrs Photo-Fries reactions of annilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen and its reactions. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision. Photography, Photochromism, Photoimaging

Books Suggested

1. Fundamentals of photochemistry, K.K. Rothagi-Mukheriji, Wiley-Eastern.
2. Essentials of Molecular Photochemistry, A Gilbert and J. Baggott, Blackwell Scientific Publication.
3. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
4. Introductory Photochemistry, A. Cox and T. Camp, McGraw Hill.
5. Photochemistry, R.P. Kundall and A. Gilbert. Thomson Nelson.
6. Organic Photochemistry, J. Coxon and B.Halton, Cambridge University Press.

Year 2020-21

M.Sc. III Semester

Course Name – Chemistry

Program Code – P003

Subject Code – CH-33

(Environmental Chemistry)

Objectives:-

P003	1. The main aim of the course is to equip students with the knowledge of the chemical properties of elements and compounds as well as about the chemical reaction essential for the emergence and existence of the cycling and accumulation of pollutants in the environment.

Course Outcome:-

P003	1. Upon successful completion of the course the student will be able to demonstrate knowledge of chemical & biochemical principles of fundamental environmental processes in air, water & soil.
P003	2. Recognize different types of toxic substances and responses and analyzetoxicological information.
P003	3. Apply basic chemical concepts to analyze chemical processes involved in different environmental problem.
P003	4. Describe water purification and waste treatment processes
P003	5. Describe causes and effects of environmental pollution by energy industry and discuss some mitigation strategies.
P003	6. Explain energy crises and different aspects of sustainability.
P003	7. Discuss local & global environmental issues based on the knowledge gained throughout the course.

Class	**M.Sc.**
Semester	**III**
Subject	**Chemistry**
Title of Subject Group	**ENVIRONMENTAL CHEMISTRY**
Paper No.	**III (Code- MCH-503)**
Compulsory	**Compulsory**
Max. Marks V	**75**

Particulars

60 Hrs

Unit-1	**(a) 1. Atmosphere** **15 Hrs** Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. Temperature inversion. Calculation of Global mean temperature of the atmosphere. Pressure variation in atmosphere and scale height. Biogeochemical cycles of carbon, nitrogen, sulphur, phosphorus, oxygen. Residence times. **2. Atmospheric Chemistry** Sources of trace atmospheric constituents : nitrogen oxides, sulphurdioxide and other sulphur compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons. **(b) Tropospheric Photochemistry** Mechanism of Photochemical decomposition of NO_2 and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO_2 and NO_2. Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.
Unit-2	**(a) Air Pollution** **15 Hrs** Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health. **Stratospheric Ozone Depletion** Mechanism of Ozone formation, Mechanism of catalytic ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology.

	Control Strategies. **Urban Air Pollution** Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies. **(b) Acid Rain** Definition, Acid rain precursors and their aqueous and gas phase atmospheric oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO_2 and NO_2. Acid rain control strategies. **Green House Effect** Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences.
Unit-3	**Aquatic Chemistry and Water Pollution** **10 Hrs** Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Aerobic and anaerobic reactions of organic sulphur and nitrogen compounds in water acid-base chemistry of fresh water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.
Unit-4	**Environmental Toxicology** **15 Hrs** **Toxic heavy metals :** Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects. **Toxic Organic Compound :**Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects. **Polychlorinated biphenyls :**Properties, use and environmental continuation and effects. **Polynuclear Aromatic Hydrocarbons :** Source, structures and effect as pollutants.
Unit-5	**a) Soil and Environmental Disasters** **05 Hrs** Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic and metals. Methods of re-mediation of soil. Bhopal gas tragedy, Chernobyl, three mile island, Minimtata Disease, Sevoso (Italy), London smog. **b)** Disaster Management: Elements of disaster management, control of leakage of gas cylinder containing toxic gases such as chlorine.

Books Suggested

1. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
2. Chemistry of Atmospheres, R.P. Wayne, Oxford.
3. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
4. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
5. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.
6. Industrial hazards & plant safety, Sanjoy Banerjee- Taylor & Francis.
7. Factories Act with M.P. Factories rules- Law Publishers.

Co

S

Objectives:-

P003	1. Polymer permeates energy aspects of daily life and it is difficult to imagine society without synthetic and natural polymers.

Course Outcome:-

P003	1. At the end of the course students will be able to understand different kinds of polymers & their properties.
P003	2. Concept of molecular weight and distribution
P003	3. Variation of properties of polymers by crystalinity and glass transition temp.
P003	4. Process of polymer degradation.
P003	5. Behavior of polymer solution at different concentration
P003	6. Different techniques of polymerization of polymers kinetics, mechanism of methodology used of control molecular weight of polymers.

Class	M.Sc.
Semester	III
Subject	Chemistry
Title of Subject Group	Polymers
Paper No	OPT-2 **(Code- MCH-505)**
Compulsory	Optional
Max. Marks	75

Particulars

60 Hrs

Unit-1	**Basics** **12 Hrs** Importance of polymers. Basic concepts: Monomers, repeat units, degree of polymerization Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition/radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.
Unit-2	**Polymer Characterization** **12 Hrs** Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution.The practical significance of molecular weight.Measurement of molecular-weights.End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.
Unit-3	**Analysis and testing of polymers12 Hrs** Chemical analysis of polymers, spectroscopic methods, X-ray diffraction study. Microscopy. Thermal analysis and physical testing-tensile strength. fatigue, impact, tear resistance, Hardness and abrasion resistance.
Unit-4	**Inorganic Polymers** **12 Hrs** A general survey and scope of Inorganic Polymers, special characteristics, classification, homo and hetero atomic polymers. Structure, Properties and Applications of a. Polymers based on boron-borazines, boranes and carboranes. b. Polymers based on Silicon-silicone's, polymetalloxanes and polymetallosiloxanes, silazanes.

Unit-5	**Structure, Properties and Application of Polymers12 Hrs** a. Polymers based on Phosphorous-Phosphazenes, Polyphosphates b. Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds. c. Co-ordination and metal chelate polymers.

Book Suggested

1. Inorganic Chemistry, J.E. Huheey, Harper Row.
2. Developments in Inorganic polymer Chemistry, M.F. Lappert and G.J. Leigh.
3. Inorganic polymers- N.H. Ray.
4. Inorganic polymers, Graham and Stone.
5. Inorganic Rings and Cages : D.A. Armitage.
6. Textbook of Polymers Science, F.W. Billmeyer Jr. Wiley.
7. Contemporary Polymer Chemistry, H.R. Al cock and F.W. Lambe, Prentice Hall.

Year 2020-21

M.Sc. III Semester

Course Name – Chemistry

Program Code – P003

SubjectCode – CH-34-B

(Organotransition Metal Chemistry)

Objectives:-

P003	1. Organometallic compounds are industrial chemical reactions as well as in the reactions, where target molecules include polymers and pharmaceutical

Course Outcome:-

P003	1. Learning outcome has a good overview of the fundamental principles of organotransition metal. Chemistry and know how chemical properties are affected by metals and ligands.
P003	2. Upon successful completion students will have the knowledge & skills to explain the synthesis structure , bonding ,properties and reactivity of main group reagent , organolithiuon reagent , organophosphorous compounds
P003	3. To learn organotransition metal chemistry and cluster chemistry
P003	4. The theoretical components of the course will aim to develop skills in the handling of air sensitive compounds

Class	**M.Sc.**
Semester	**III**
Subject	**Chemistry**
Title of Subject Group	**Organotransition Metal Chemistry**
Paper No	**Opt-I (MCH 504)**
Compulsory	**Optional**
Max. Marks	75

Particulars / fooj.k

60 Hrs

Unit - 1 Alkyls and Aryls of Transition Metals **15 Hrs**

Types, routes of synthesis, stability and decomposition pathways organocopper in organic synthesis.

Compounds of Transition Metal-Carbon Multiple Bonds

Alkylidenes, alkylidynes, low valent carbenes and carbynes-synthesis, nature of bond, structural characteristics, nucleophilic and electrophilic reactions on the ligands, role in organic synthesis.

Unit - 2 Transition Metal π-Complexes **15 Hrs**

Transition metal π -Complexes with unsaturated organic molecules, alkenes, alkynes, allyl, diene, dienyl, arene and trienyl complexes, preparation, properties, nature of bonding and structural features. Important reactions relating to nucleophilic and electrophilic attack on ligands and to organic synthesis.

Unit - 3 Transition metal compounds with bonds to hydrogen, boron, silicon : **10 Hrs**

Transition metal compounds with bonds to hydrogen, boron, silicon

Unit - 4 Homogeneous Catalysis
12Hrs

Stoichiometric reactions for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerization of olefins, catalytic reactions involving carbon monoxide such as hydrocarbonylation of olefins (oxoreaction), explanation reactions, activation of C-H bond.

Unit - 5 Fluxional Organometallic Compounds **08 Hrs**

Fluxionality and dynamic equilibrium in compounds such as η-2 olefine, η-3allyl and dienyl complexes.

Suggested Readings:

1. Principles and Application of Organotransition Metal Chemistry, J.P. Collman, L.S. Hegsdus,

J.R. Norton and R.G. Finke, University Science Books.

2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree. John Wiley.

3. Metallo-organic Chemistry, A.J. Pearson, Wiley.

4. Organometallic Chemistry, R.C. Mehrotra and A. Singh New Age International

Year 2020-21

M.Sc. III Semester

Course Name – Chemistry

Program Code – P003

Subject Code – OE-HC

(Health Chemistry)

Objectives:-

P003	1. To enable the students about the role of chemistry in food.
P003	2. To learn about the biomolecules.
P003	3. To improve the knowledge on the chemistry in common diseases.

Course Outcome:-

P003	1. After completing this program the students will learn how to present common diseases through taking precautionary measures.
P003	2. The students will learn about proper dietary habits and remain healthy.
P003	3. Learn the chemical composition of medicines which are given to family members.

(Open Elective Paper)
HEALTH CHEMISTRY

M.M.: 75

UNIT-I : Health

Definition: Food, Food Pyramid- Health- Hygiene- mal-, under – and over- nutrition, their causes and remedies, sanitation, Carbohydrates- Classification, Biological functions, Protein- Classification, Biological functions, vitamins- Classification, Biological functions.

UNIT-II: Drugs

Drugs- Types of drugs- depressant, anticonvulsant, narcotics, antipyretics, antibiotics, antiseptics, analgesics, muscle relaxants and cardiovascular and vasodepressants, Steroids.

UNIT-III: Body fluids

Blood volume, groups, coagulation, blood pressure, anemia, blood sugar, heamoglobin- chemistry of respiration- urine-electrolyte balance.

UNIT-IV: Enzymes, Hormones, Digestion

Types of enzymes and enzyme action, Characters of hormones- action, examples of essential hormones- digestion in mouth, stomach, intestine and pancreas- mineral metabolism.

UNIT-V: Common Diseases

Toxicants in food- cancer-types and causes- common diseases- Jaundice, vomiting, fever, rickets, scurvy, beriberi, pellagra, night blindness, ulcer, gout, goiter, diabetes, anemia and their causes,

Books Recommended

1. Jayashree Ghosh, A Text book of Pharmaceutical Chemistry, S. Chand and Co. Ltd, 1999. UNITS II and V
2. Alex V Ramani, Food Chemistry, MJP Publishers, Chennai, 2009 UNIT I
3. Deb A C, Fundamentals of Biochemistry, New Central Book Agency, Calcutta, 1994. UNIT III
4. Satake M and Mido Y, Chemistry for Health Science, Discovery Publishing House, New Delhi, 2003 UNIT I and III
5. Ashutosh Kar, Medicinal Chemistry, Wiley Easterns Limited, New Delhi, 1993 UNIT II & IV

Year 2020-21

M.Sc. IV Semester

Course Name – Chemistry

Program Code – P003

Subject Code – CH-42

(Solid-State)

Objectives:-

P003	1. To provide an introduction to the concept underlying solid state chemistry
P003	2. To illustrate the mid-range of materials and physical properties that currently available.

Course Outcome:-

P003	1. On completion of the course the students should be able to describe the principles concerning solid state structure.
P003	2. The students should be able to describe experimental procedures and co- precipitation as a precursor to solid state reactions.
P003	3. To describe different types of crystal defects and Non-Stoichiometry.
P003	4. To describe electrically conducting solids and new super conductors.
P003	5. They learn type of liquid crystals and various theories of liquid crystals.

Class	M.Sc.
Semester	IV
Subject	Chemistry
Title of Subject Group	**SOLID STATE CHEMISTRY**
Paper No.	**II (Code- MCH-512)**
Compulsory	Compulsory
Max. Marks	75

Particulars

Hrs; 60 Hrs

Unit-1	**Solid State Reactions**	**10 Hrs**
	General principles, experimental procedure, co-precipitation as a precursory to solid state reactions, kinetics of solid state reactions.	
Unit-2	**CrystalDefects and Non-Stoichiometry**	**12 Hrs**
	Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky detects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects.	
Unit-3	**Electronic Properties and Band Theory**	**18 Hrs**
	Metals insulators and semiconductors, electronic structure of solids band theory band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties-Application of optical and electron microscopy. Magnetic Properties-Classification of materials : Effect of temperature calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.	
Unit-4	**Organic Solids**	**10 Hrs**
	Electrically conducting solids. organic charge transfer complex, organic metals, new superconductors.	

Unit-5	**Liquid Crystals**: **10 Hrs** Types of liquid crystals: Nematic, Smectic, Ferroelectric, Antiferroelectric, Various theories of LC, Liquid crystal display, New materials.

Books Suggested.

1. Solid state chemistry and its applications, A.R. West. Peenum.
2. Principles of the Solid State, H.V. Keer, Wiley Eastern.
3. Solid State Chemistry, N.B. Hannay.
4. Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern.
5.

Year 2020-21

M.Sc. IV Semester

Course Name – Chemistry

Program Code – P003

Subject Code – CH-43

(Biochemistry)

Objectives:-

P003	1. To know the application of co-ordination compounds in living systems.
P003	2. To understand the chemistry of biomolecules.
P003	3. To understand the importance of metabolism of substrates.
P003	4. To know the interpretation of data emanating from a clinical test tube.
P003	5. To understand the basic principles of protein and polysaccharide structure.

Course Outcome:-

P003	1. Describe the mechanism of enzyme action and identify the classes of enzymes and factors affecting action.
P003	2. Describe the catabolic reaction of carbohydrates, lipids and amino acids.
P003	3. Identify the class and functions of secondary metabolites.

Class	M.Sc.
Semester	IV
Subject	Chemistry
Title of Subject Group	**BIOCHEMISTRY**
Paper No.	**III (Code- MCH-513)**
Compulsory	Compulsory
Max. Marks	75

Particulars / fooj.k

Hrs: 60 Hrs

Unit-1	**Metal Ions in Biological Systems** **12 Hrs** Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K+/Na+ pump. **Bioenergetics and ATP Cycle.** DNA polymerisation, glucose storage, metal complexes in transmission of energy; chlorophyll's, photosystem I and photosystem II in cleavage of water. **Transport and Storage of Dioxygen** Heam proteins and oxygen uptake structure and function of haemoglobin's, mygolobin, haemocyanms and hemerythrin, model synthetic complexes of iron, cobalt and copper.
Unit-2	**Electron Transfer in Biology** **10 Hrs** Structure and function of metal of proteins in electron transport processes cytochrome's and ion-sulphure proteins, synthetic models. **Nitrogen fixation** Biological nitrogen fixation, and its mechanism, nitrogenase, Chemical nitrogen fixation. **Kinds of Reactions Catalysed by Enzymes** Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in Isomerisations reactions, b-Cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.
Unit-3	**Enzymes** **14 Hrs**

	Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshalnd's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michael's-Menten and Lineweaver Burk plots, reversible and irreversible inhibition. **Mechanism of Enzyme Action** Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chemotrypsin, ribonuclease, lysozyme and carboxypeptidase.
Unit-4	**Co-Enzyme Chemistry** **12 Hrs** Cofactors as derived from vitamines, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors. **Enzyme Models** Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality Biometric chemistry, crown ether, cryptates. Cyclodextrins, cyclodextrion-based enzyme models, clixarenes, ionospheres, micelles synthetic enzymes or synzymes. **Biotechnological Applications of Enzymes** large-scale prodcution and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from cron starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.
Unit-5	**Biological Cell and its Constituents** **12 Hrs** Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coils transition. **Bioenergetics** Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP. **Biopolymer Interactions** Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of bidning processes in biological systems. Hydrogen ion titration curves. **Cell Membrane and Transport of Ions** Structure and functions of cell membrane, ion transport through cell membrane, irreversible

	thermodynamic treatment of membrane transport. Nerve conduction.

Book Suggested

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, 1. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
3. Inorganic biochemistry vol. I and II ed. G.L. Eichhorn, Elsever.
4. Progress in Inorganic Chemistry, Vol 18 and 38 ed J.J. Lippard, Wiley.
5. Bioorganic Chemistry : A chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer Verlag.
6. Understanding Enzymes, Trevor Palmer, Prentice Hall.
7. Enzyme Chemistry : Impact and applications, Ed. Collin J suckling, chemistry.
8. Enzyme Mechanisms Ed. M.I. Page and A Williams, Royal Society of Chemistry.
9. Fundamentals of Enzymology, N.C. Price and L. Stevens. Oxford University Press.
10. Immobilized Enzymes : An Introduction and Applications in Biotechnology, Michael ID. Trevan, Hohn Wiley.
11. Enzymatic Reaction Mechanisms. C. Walsh. W.H. Freeman.
12. Enzyme Structure and Mechanism, A Fersht, W.H. Freeman
13. Biochemistry : The Chemical Reactions of Living Cells, D.E. Metzler, Academic Press.

Year 2020-21

M.Sc. IV Semester

Course Name – Chemistry

Program Code – P003

Subject Code – CH-44-A

(Analytical Chemistry)

Objectives:-

P003	1. Analytical chemistry is the branch of science that provides knowledge of compound separation,identification and quantification that can be useful for measuring by availability of drugs.
P003	2. Purifying drugs during synthesis and identifying drugs metabolic pathways.
P003	3. It plays important role as drug manufacturing process control in industry and environmental monitoring.

Course Outcome:-

P003	1. The student will be able to explain the fundamentals of analytical chemistry and steps of characteristics analysis.
P003	2. Express the role of analytical chemistry in science.
P003	3. Compares qualitative and quantitative analysis methods.
P003	4. Will be able to evaluate the analytical data in terms of statistics such as mean, median, precision, accuracy, absolute error, relative error and the error sources.
P003	5. To learn safety in the analytical lab.
P003	6. Role of analytical chemistry in food analysis, water pollution and analysis of soil & fuel, clinical chemistry and drug analysis.

Class	M.Sc.
Semester	IV
Subject	Chemistry
Title of Subject Group	Applied **Analytical Chemistry**
Paper No.	**OPT-1 (Code- MCH-516)**
Compulsory	Optional
Max. Marks	75

Particulars / fooj.

Hrs: 60 Hrs

Unit-1	**(A) Introduction** **14 Hrs** Role of analytical chemistry Classification of analytical methods classical and instrumental. Types of instrumental analysis. Selecting an analytical method. Neatness and cleanliness. Laboratory operations and practices. Analytical balance. Techniques of weighing, errors. Volumetric glassware cleaning and calibration of glassware. Sample preparation-dissolution and decompositions. Gravimetric techniques. Selecting and handling of reagents. Laboratory notebooks. **(B)** Safety in the analytical laboratory. **(C) Errors and Evaluation** Definition of terms, mean and median. Precision-standard deviation, relative standard deviation. Accuracy-absolute error, relative error. Types of error in experimental data determinate (systematic), indeterminate (or random) and gross. Sources of error and the effects upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data-indeterminate errors. The uses of statistics.
Unit-2	**Food analysis** **10 Hrs** Moisture, ash, crude protein, fat crude fiber, carbohydrates, calcium, potassium, sodium and phosphate. Food adulteration-common adulterants in food, contamination of foods stuffs. Microscopic examination of foods for adulterants. Pesticide analysis in food products. Extraction and purification of sample. HPLC. Gas chromatography for organophosphates. Thin-layer chromatography for identification of chlorinated pesticides in food products.
Unit-3	**Analysis of Water Pollution** **12 Hrs** Origin of Waste water, types, water pollutants and their effects. Sources of water pollution-domestic, industrial, agricultural soil and radioactive wastes as sources of pollution. Objectives of analysis-parameter for analysis-colour, turbidity, total solids, conductivity, acidity, alakalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen, Heavy

	metal pollution-public health significance of cadmium, chromium, copper, lead, zinc, managanese, mercurry and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems. Measurements of DO, BOD, and COD. Pesticides as waterpollutants and analysis. Water pollution laws and standards.
Unit-4	**Analysis of soil and Fuel** **12 Hrs** (a) Analysis of Soil, moisture pH total nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts. Fuel analysis : liquid and gas. Ultimate and proximate analysis-heating values-grading of coal. Liquid fuels-flash point, aniline point, octane number and carbon residue. Gaseous fuels-producer gas and water gas, calorific value.
Unit-5	**Analysis of Body Fluids and Drugs12 Hrs** (a) **Clinical Chemistry** : Composition of blood-collection and preservation of samples. Clinical analysis. Serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphatase Immunoassay: principles of radio immunoassay (RIA) and its applications. The blood gas analysis, trace elements in the body (b) **Drug analysis**: Narcotics and dangerous drug. Classification of drugs. Screening by gas and thin-layer chromatography and spectrophotometeric measurements.

Suggested Readings:

1. Analytical Chemistry, G.D. Christian, J.Wicy.
2. Fundamentals o analytical Chemistry. D.A. Skoog. D.M. West and F.J. Hooler, W.B. Saunders.
3. Analytical Chemistry-Principles. J.H. Kennedy. W.B. Saunders.
4. Analytical Chemistry-Principles and Techniques. LG. Hargis. Prentice Hall.
5. Principles of Instrumental analysis D.A. Skoog and J.L. Loary, W.B. Saunders.
6. Principles of Instrumental Analysis D.A. Skoog W.B. Saunders.
7. Quantitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
8. Environmental Solution, S.M. Khopkar, Wiley Eastern.
9. Basic Concepts of Analysis Chemistry, S.M. Khopkar, Wiley Eastern.
10. Handbook of Instrumental Techniques for Analytical Chemistry, F. Settle, Prentice Hall

Year 2020-21

M.Sc. IV Semester

Course Name – Chemistry

Program Code – P003

Subject Code – CH-44-B

(Medicinal Chemistry)

Objectives:-

P003	1. Medicinal chemistry is stimulating field as it links many scientific disciplines and allows for collaboration with other scientists in researching & developing new drugs.
P003	2. Medicinal chemistry applies their chemistry training to the process of synthesizing new pharmaceutical.
P003	3. Major contributions to health care have been made by medicinal chemistry.
P003	4. The development of new drugs involves chemical analysis and synthesis of new compounds.

Course Outcome:-

P003	1. Chemistry is the fundamental of medicine & there for it is most useful application for the mankind.
P003	2. After the successful completion of the course students will be able to explain gross morphology structure and function of various organs of the human body.
P003	3. To understand the chemistry of drugs with respect to their pharmacological activity.
P003	4. Well aquatinted with the synthesis of some important class of drugs.

Class	M.Sc.
Semester	IV
Subject	Chemistry
Title of Subject Group	**Medicinal Chemistry**
Paper No.	**OPT-2 (Code- MCH-518)**
Compulsory	Optional
Max. Marks	75

Particulars

Hrs: 60 Hrs

Unit-1	**Structure and activity :** Prodrugn and soft drug **12 Hrs** Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design, stpes involved in design process. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. Fundamental of QSAR, Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis, physicochemical properties.
Unit-2	**Pharmacodynamics:** **12 Hrs** Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides-sulphacetanalide, sulphapyridine, sulphaizine, sulphaguanidine, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.
Unit-3	**Antibiotics and antibacterials** **12 Hrs** Introduction, Antibioticβ-Lactam type - Penicillins, Cephalosporins, Antitubercular – Streptomycin, Broad spectrum antibiotics – Tetracyclines, Anticancer - Dactinomycin (Actinomycin D), ethambutol, anti coagulants- classification, mode of action, therapeutic uses.
Unit-4	**Antifungal –** **12 Hrs** polyenes, Antibacterial – Ciprofloxacin, Norfloxacin, Antiviral – classification, mode of action, therapeutic uses, Acyclovir, **Antimalarials**: Chemotherapy of malaria. SAR. Chloroquine, pamaquin, Chloroguanide and

	Mefloquine	
Unit-5	**Non-steroidal Anti-inflammatory Drugs:** Diclofenac Sodium, Ibuprofen and Netopam **Antihistaminic and antiasthmatic agents :** Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate. Anti ulcer drugs - classification, mode of action, therapeutic uses.	**12 Hrs**

Books recommended

1. Introduction to medicinal chemistry, A. Gringuage, Wiley-VCH.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorge.
3. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age Internaitonal.
4. Burger's Medicianl Chemistry and Drug Discovery, Vol-I (Chapter 9 and Chapter 14), Ed. M.E.Wolff, John Wiley.
5. Goodman and Gilman's Pharmacoloical Basis of Therapeutics, Mc GRaw-Hill.
6. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press.
7. Strategies for Organic Drug synthesis and Design, D.Lednicer, John Wiley.
8. Principles of Medicinal Chemistry W.O.Foye
9. Medicinal Chemistry; The Role of organic chemist in Drug Research, S.M. Roberts and B.J. Pricer.

Program Code – P003

(M.Sc. I, II, III, IV Semester)

Objectives of Master's degree programme in chemistry:-

P003	1. To impart knowledge in fundamental aspects of all branches of chemistry.
P003	2. To acquire deep knowledge in the study of physical, chemical, electrochemical and magnetic properties structure elucidation using various techniques and applications of various organic and inorganic materials.

Course Outcome:-

P003	1. To acquire basic knowledge in the specialized areas of chemistry.
P003	2. To train the students in various quantitative and qualitative analysis.
P003	3. The masters in chemistry will extend your depth and breadth of knowledge in all branches of chemistry suitable for a professional chemist capable of conducting research.

SEMESTER I Paper-I

MCH-401: INORGANIC CHEMISTRY I

Hrs: 60 **M.M. 75**

Unit-I **12 hrs**

Stereochemistry and Bonding in Main Group Compounds :

(A) VSEPR, Walsh diagram (triatomic and penta-atomic molecules), **dπ - pπ** bond

(B) Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.

Unit-II **08 hrs**

Metal-Ligand Equilibrium in Solution

(A) Stepwise and overall formation constants and their interaction, trends in stepwise constant.

(B) Factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand.

(C) Chelate effect and its thermodynamic origin, determination of binary formation constants by potentiometry and spectrophotometry.

Unit-III **20 hrs**

Reaction Mechanism of Transition Metal Complexes

(A) Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution.

(B) Acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand bond cleavage.

(C) Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction.

Unit-IV **15 hrs**

(A) Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

Metal-Ligand bonding

(B) Crystal field theory and Limitation of crystal field theory, molecular orbital theory for bonding in octahedral, tetrahedral and square planar complexes.

(C) π-bonding and molecular orbital theory.

Unit-V **05 hrs**

A - HSAB Theory :

i) Classification of acids and bases as hard and soft; HSAB principle.

ii) Theoretical basis of hardness and softness; Lewis-acid base reactivity approximation; donor and acceptor numbers.

iii) E and C equation; applications of HSAB concept.

B General principles involved in Qualitative and quantitative analysis.

Books Suggested :

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetiochemistry, R.l. Carlin, Springer Verlag.

6. Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J. A. Mc Cleverty,Pergamon.
7. Inorganic Qualitative analysis by Vogel.
8. Inorganic quantitative analysis by Vogel

SEMESTER I

Paper-II

MCH-402: ORGANIC CHEMISTRY I

60 Hrs **M.M. 75**

Unit-I

Nature of Bonding in Organic Molecules

Delocalized chemical bonding-conjugation, cross conjugation, resonance hyperconjugation; bonding in fullerences, tautomerism. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons. Huckel's rule, Energy level of π-molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO approach. Bonds weaker than covalent, compounds, crown-ether complexes, cryptands, inclusion compounds, catenanes and rotaxanes.

Unit-II **15 Hrs**

Stereochemistry

Elements of symmetry, chirality, molecules with more than one chiral center, threo and ertythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), Chirality due to helical shape. Stereochemistry of compounds containing nitrogen, sulphur and phosphorus.

Unit III **05 Hrs**

Conformational analysis and linear free energy relationship

Conformational analysis of cycloalkanes, decalines, effect of conformation on reactivity, conformation of sugars. Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes. The Hammett equation and linear free energy relationship, sub stituents and reaction constants, Taft equation.

Unit-IV **12 Hrs**

Reaction Mechanism : Structure and Reactivity

Types of mechanism, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects

Unit-V **15 Hrs**

Aliphatic Nucleophilic Substitution

The SN_1, SN_2 mixed SN_1 and SN_2 and SET mechanism. The neighboring group mechanism, neighboring group participation by σ and π bonds, anchimeric assistance. Classical and nonclassical carbocations, phenomium ions, norbornyl systems, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations. The SNi mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.

Book Suggested

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
6. Modern Organic Reactions, H.O. House, Benjamin.
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professionsl.
8. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh,Macmillan.
9. Pericyclic Reactions, S.M. Mukherji, Macmillan, India

10. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International.
11. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age International.

Paper-III

MCH-403: PHYSICAL CHEMISTRY I

Hrs : 10 Hrs **M.M. 75**

Unit-I

Introduction to Exact Quantum Mechanical Results

Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom.

Unit-II **10 hrs**

Approximate Methods

The variation theorem, linear variation principle. Perturbation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the Helium atom.

Molecular Orbital Theory

Huckel theory of conjugated systems bond and charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical, cyclobutadiene. Introduction to extended Huckel Theory.

UNIT- III **10 hrs**

Angular Momentum

Ordinary angular momentum, generalized angular momentum, Eigen functions for angular momentum, Eigen values of angular momentum operator using ladder operators addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

Unit-IV **15 hrs**

Classical Thermodynamics

Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity. Non-ideal systems : Excess functions for non-ideal solutions. Activity, activity coefficient, Debye Huckel theory for activity coefficient of electrolytic solutions; determination of activity and activity coefficients; ionic strength. Application of phase rule to three component systems; second order phase transitions.

Unit-V **15 hrs**

Statistical Thermodynamics

Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and micro-canonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions-translation, rotational, vibrational and electronic partition functions, Calculation of thermodynamic properties in terms of partition. Application of partition functions. Fermi-Dirac Statistics, distribution law and applications to metal. Bose-Einstein statistics distribution Law and application to helium.

Books Suggested

10. Physical Chemistry, P.W. Atkins, ELBS.
11. Introduction to Quantum Chemistyry, A.K. Chandra, Tata Mc Graw Hill.

12. Quantum Chemistry, Ira N. Levine, Prentice Hall.
13.Coulson's Valence, R.Mc Ween y, ELBS.
14. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
15. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan.
16.Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum.
17.Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum.
18.Introduction to Polymer Science, V.R Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
10. Introduction to Quantum Chemistry-R.K. Prasad, New Age Publication.

Paper-IV

MCH-404: Group Theory & Spectroscopy-I

Hrs: 45 **M.M. 75**

Unit-I

Symmetry and Group theory in Chemistry

Symmetry elements and symmetry operation, definition of group, subgroup. Conjugacy relation and classes. Point symmetry group. Schonfilies symbols, representations of groups by matrices (representation for the C_n, C_{nv}, C_{nh}, D_{nh} group to be worked out explicitly). Character of a representation. The great orthogonality theorem (without proof) and its importance. Multiplication table of C2v and C3v point group. Character tables and their use; in spectroscopy. Derivation of character table for C_{2v} and C_{3v} point group Symmetry aspects of molecular vibrations of H_20 molecule.

Unit-II **10 hrs**

Microwave Spectroscopy

Basic Concept: Classification of molecules, rigid rotor model, Bond of length of diatomic molecule, calculation of bond length of diatomic molecule, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field, applications.

Unit-Ill **10 hrs**

Infrared-Spectroscopy

Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy. P.Q.R. branches, Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal ligand vibrations, normal co-ordinate analysis.

Unit-IV **05 hrs**

Raman Spectroscopy

Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent anti stokes Raman spectroscopy (CARS).

Unit-V **10 hrs**

Electronic-Spectroscopy

(A) Molecular Spectroscopy

Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radiative and nonradative decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra.

(B) Photoelectron Spectroscopy

Basic principles; photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA. Auger electron spectroscopy-basic idea.

Books suggested

1. Modern Spectroscopy, J.M. Hollas, John Viley.

2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Chemical Applications of Group Theory, F.A. Cotton.
6. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
7. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
8. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBHOxford.
9. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
10. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, Harper & Row.

M.Sc. I sem

PRACTICAL

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Hrs: 90hrs/sem

Inorganic Chemistry

Quantitative Analysis	25
Chromatography	05
Preparation	05
Record	07
Viva Voce	08

Quantitative Analysis

a) Separation and determination of two metal ions Cu-Ni, Ni-Zn, Cu-Fe, Cu-Ba etc. involving and volumetric and gravimetric methods.

b) Volumetric analysis: Different types of titrations.

Chromatography Separation of cations and anions by Paper Chromatography and TLC

Preparations

Preparation of selected inorganic compounds and their studies by I.R. electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds.

1. $VO(acac)_2$
2. $TiO(C_9H_8NO)_2\ H_2O$
3. $Na[Cr(NH_3)_2(SCN)_4]$
4. $Ni(acac)_2$
5. $K_3[Fe(C_2O_4)_3]$
6. Prussian Blue, Turnbull's Blue.
7. Oxalate Complexes of Copper-II
8. Pyridine complexes

Organic Chemistry

Qualitative Analysis	24
Organic Synthesis	12
Record	06
Viva Voce	08

Qualitative Analysis

Separation, purification and identification of compounds of ternary mixture (three solids, one liquid and one solid) using TLC and columns chromatography, chemical tests. IR spectra to be used for functional group identification.

Organic Synthesis

Acetylation, Nitration, Halogenations, Oxidation , Reduction, Polymerization

Physical Chemistry

Experiment no. 01	18 marks
Experiment no. 02	18 marks
Record	06
Viva Voce	08

Error Analysis and Statistical Data Analysis

(a) Errors, types of errors, minimization of errors, distribution curves precision, accuracy and combination; statistical treatment for error analysis, student's test,

null hypothesis, rejection criteria. F & Q test; linear regression analysis, curve fitting. Calibration of volumetric apparatus, burette, piette and standard flask.

(b) Adsorption Experiment.

Phase Equilibria

i. Determination of congruent composition and temperature of a binary system (e.g. diphenylamine-benzophenone system).

ii. Determination of glass transition temperature of a given salt (e.g., CaC_{12}) conductometrically.

iii. To construct the phase diagram for three component system (e.g. chloroform-acetic acid-water).

Chemical Kinetics

i. Determination of the effect of (a) Change of temperature (b) Change of concentration of reactant and catalyst and (c) Ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reaction.

ii. Determination of the velocity constant of hydrolysis of an ester/ionic reaction in micellar media.

iii. Determination of the velocity constant for the oxidation of iodide ions by hydrogen peroxides. Study the kinetics as an iodine clock reaction.

Solution

i. Determination of molecular weight of non-volatile electrolyte by cryoscopic method and to determine the activity coefficient of an electrolyte.

ii. Determination of the degree of dissociation of weak electrolyte and to study the deviation from ideal behavior that occurs with a strong electrolyte.

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
4. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
5. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
6. Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
9. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
10. Experimental

SEMESTER- II

Paper-I

MCH-406: INORGANIC CHEMISTRY II

60 Hrs **M.M. 75**

Unit-I **15 Hrs**

Electronic Spectral Studies of Transition Metal Complexes :

Spectroscopic ground states, correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1 to d^9 states), Selection rule for electronic spectroscopy. Intensity of various types of electronic transitions. Calculations of lODq, B and β parameters, charge transfer spectra.

Unit-II **10 Hrs**

Magnetic Properties of Transition Metal Complexes

Anomalous magnetic moments, Quenching of Orbital contribution. Orbital contribution to magnetic moment, magnetic exchange coupling and spin crossover.

Unit-III **15 Hrs**

Metal π-Complexes

Metal carbonyl, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding structure and important reaction of transition metal nitrosyl, dinitrogen and dioxgen complexes; tertiary phosphine as ligand.

Unit-IV **05 Hrs**

Metal Clusters

Higher boranes, carboranes, metalloboranes and metallo-carboranes compounds with metal metal multiple bonds.

Unit-V **15 Hrs**

Optical Rotatory Dispersion and Circular Dichroism

Linearly and circularly polarized lights; optical rotatory power and circular birefringence, elipticity and circular dichroism; ORD and Cotton effect, Faraday and Kerr effects; Assignment of electronic transitions; applications of ORD and CD for the determination of (i) absolute configuration of complexes and (ii) isomerism due to non-planarity of chelate rings.

Books Suggested :

7. Advanced Inorganic Chemistry, F. A. Cotton and Wilkinson, John Wiley.
8. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
9. Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon.
10. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
11. Magnetiochemistry, R.l. Carlin, Springer Verlag.
12. Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty,Pergamon.

SEMESTER- II

Paper-II

MCH-407:

ORGANIC CHEMISTRY II

Hrs: 60 Hrs **M.M. 75**

Unit-I **10 Hrs**

Aromatic Electrophilic Substitution

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reaction, Gatterman-Koch reaction.

Aromatic Nucleophilic Substitution

The SN_{Ar} SN_1, benzyne and $S_{RN}1$ mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile. The Von Richter. Sommelet-Hauser and Smiles rearrangements.

Unit-II **08 Hrs**

Free Radical Reactions

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboyxlic acids, autooxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

Unit III **07 Hrs**

Addition Reactions

Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio-and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bounds, hydrogenation of aromatic rings. Hydroboration, Michael reaction, sharpless asymmetric epoxidation.

Unit-IV **12 Hrs**

Addition to Carbon-Hetero Multiple bonds

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to saturated and unsaturated carbonyl compounds. Witting reaction. Mechanism of condensation reactions involving enolates-Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

Elimination Reactions

The E_1, E_2 and E_1 cb mechanisms. Orientation of double bond. Effects of substrate structures, attacking base, the leaving group and the medium on reactivity. Mechanism and orientation in pyrolytic elimination.

Unit-V **05 Hrs**

Pericyclic Reactions

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of periycyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions-conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions-antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheleotrpic reactions. Sigmatropic rearrangements suprafacial and antarafacial shifts of H, sigmatropic rearrangement involving carbon moieties, 3,3- and 5,5 sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements. Fluxional tautomerism. Ene reaction.

Book Suggested

12. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
13. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.
14. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
15. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
16. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
17. Modern Organic Reactions, H.O. House, Benjamin.
18. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic &* Professionsl.
19. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
20. Pericyelic Reactions, S.M. Mukherji, Macmillan, India
21. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International.
22. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age International.

Paper-III

MCH-408:

PHYSICAL CHEMISTRY II

Hrs: 18 **M.M. 75**

Unit-I

Chemical Dynamics

Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dyamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogenbromine and hydrogen-chlorine reactions) and homogenous catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method, dynamics of unimolecular reactions (Lindemann Hinshelwood and Rice-Ramsperger-Kassel- Marcus (RRKM) theories for unimolecular reactions).

Unit-II **15 Hrs**

Surface Chemistry

Adsorption

Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon).

Micelles

Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solublization, micro emulsion, reverse micelles.

Unit-Ill **10 Hrs**

Macromolecules

Polymer-definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimension of various chain structures.

Unit-IV **10 Hrs**

Non Equilibrium Theromodynamics

Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium

stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electrokinetic phenomena, diffusion, electric conduction.

Unit-V **15 Hrs**

Electrochemistry

Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination. Structure of electrified interfaces. Overpotentials, exchange current density, derivation of Butler Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces-theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface. Polarography theory, Ilkovic equation; half wave potential and its significance.

Books Suggested

20. Physical Chemistry, P.W. Atkins, ELBS.
21. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.
22. Quantum Chemistry, IraN. Levine, Prentice Hall.
23. Coulson's Valence, R.Mc Ween y, ELBS.
24. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
25. Kineties and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan.
26. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum.
27. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum.
28. Introduction to Polymer Science, V.R Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.

Paper-IV

MCH-409: Spectroscopy II and Diffraction Methods

45 Hrs **M.M. 75**

Unit-I **10Hrs**

Nuclear Magnetic Resonance Spectroscopy

Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant "j" Classification (AXB, AMX, ABC, A2B2 etc.). Spin decoupling; basic ideas about instrument, NMR studies of nuclei other than proton- ^{13}C, ^{19}F and ^{31}P. FT NMR, advantages of FT NMR.

Unit II **08 Hrs**

Nuclear Quadrupole Resonance Spectroscopy

Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting, Applications.

Unit-Ill **09 Hrs**

Electron Spin Resonance Spectroscopy

Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and Mc Connell relationship, measurement techniques, applications.

Unit-IV **10 Hrs**

X-ray Diffraction

Bragg condition, Miller indices, Laue Method, Bragg method, Debye Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern, Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules.

Unit-V **10 Hrs**

Electron Diffraction

Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces.

Neutron Diffraction Scattering of neutrons by solids measurement techniques, Elucidation of structure of magnetically ordered unit cells.

Books suggested

11. Modern Spectroscopy, J.M. Hollas, John Viley.
12. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
13. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
14. Physical Methods in Chemistry, R.S. Drago, Saunders College.
15. Chemical Applications of Group Theory, F.A. Cotton.
16. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
17. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
18. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBHOxford.
19. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
20. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, harper & Row.

PRACTICAL

M.Sc. II sem

Practical Syllabus (Duration: 6-8 hrs in each branch)

Total 270 Hrs.: 90 hrs/sem (Inorg+ Org+ Phy)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

Qualitative Analysis (7 radicals)	21
Chromatography	07
Preparation	07
Record	07
Viva Voce	08

Qualitative Analysis:

Qualitative analysis with rare elements, interfering radicals, typical combination (total 07 radicals).

Chromatography Separation of cation and anions by Ion exchange / TLC & paper chromatography.

Chromatographic analysis of plant pigments with column chromatography.

Preparations

Preparation of selected inorganic compounds and their studies by I.R. electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds.

1. $[Co(NH_3)_6]$ $[Co(N0_2)_6]$
2. cis-$[Co(trien)\ (N0_2)_2]C1.H_20$
3. $Hg[Co(SCN)_4]$
4. $[Co(Py)_2Cl_2]$
5. $[Ni(NH_3)_6]Cl_2$
6. $Ni(dmg)_2$
7. $[Cu(NH_3)_4]S0_4H_20$
8. $[Cu_3[CS\ NH_2]_2\ S0_4\ 2H_20$
9. K_3 $[Cr\ (SCN)_6]_4\ H_20$
10. Cis ions and optical isomers of complexes.
11. Cis- $K[Cr(C_2O_4)_2(H_2O)_2]$
12. Ferrioxalate etc

Organic Chemistry

Organic Synthesis	12
Quantitative Analysis	24
Record	06
Viva Voce	08

Organic Synthesis

(A) Synthesis involving name reaction:

(i) Aldol condensation
(ii) Cannizzaro reaction
(iii) Sandmeyer reaction
(iv) Diel's Alder reaction
(v) Knoevenagel reaction

(B) Synthesis of dyes:

(i) Phenolphthalein
(ii) Fluoroscein
(iii) Diazotization followed by coupling

Quantitative Analysis

(i) Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method.
(ii) Estimation of amines/phenols using bromate bromide solution/or acetylation method.
(iii) Saponification value, iodine value and acid values of an oil or fat.

Physical Chemistry

Experiment no. 01	- 18 marks
Experiment no. 02	- 18 marks
Record	- 06
Viva Voce	- 08

Conductometry

i. Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.
ii. Determination of solubility and solubility product of sparingly soluble salts (e.g. PbS04, BaS04) conductometrically.
iii. Determination of the strength of strong and weak acid in a given mixture conductometrically.
iv. To study of the effect of solvent on the conductance of AgN03/acetic acid and to determine the degree of dissociation and equilibirum constant in different solvents and in their mixtures (DMSO, DMF, dioxane, acetone, water) and to test the validity of Debye-Huckel-Onsager theory.
v. Determination of the activity coefficient of zinc ions in the solution of 0.002 M zinc sulphate using Debye Huckel's limiting law.

Potentiometry/pH metry

1. Determination of strengths of halides in a mixture potentiometrically.
2. Determination of the strength of strong and weak acids in a given mixture using a potentiometer/pH meter.
3. Determination of temperature dependence of EMF of a cell.
4. Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometrically.
5. Acid-base titration in a non-aqueous media using a pH meter.

Polarimetry

1. Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.
2. Enzyme kinetics-inversion of sucrose.

Books Suggested

(i) Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
(ii) Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice
(iii) Hall.
(iv) Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
(v) Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
(vi) Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
(vii) Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward
(viii) Arnold.
(ix) Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
(x) Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
(xi) Findley's Practical Physical chemistry, B.P. Levitt, Longman.
(xii) Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.

Class / d{kk % M.Sc.

Semester / lsesLVj % III

Subject / fo"k; % Chemistry

Title of Subject Group % **APPLICATION OF SPECTROSCOPY-I**

fo"k; lewg dk 'kh"kZd %

Paper No. / i'ui= de kd

Compulsory / vfuok;; ;k Optional / odfYid vfuok; % Compulsory

Max. Marks vf/kdre vd % 75

Particulars

	Semester III
Unit - 1	**Electronic Spectroscopy:** 10 Hrs Electronic spectroscopy- Application of electronic spectral studies: d^1-d^9, d^2-d^8, d^3-d^7, d^4-d^6, d^5 systems in octahedral, tetrahedral and square planar symmetries taking suitable examples. Spectroscopic groundstates, splitting of spectral terms, selection rules: spin multiplicity and Laporte Forbidden Rule, Orgel Diagrams calculation of spectral parameters: Racah parameter, B, nephelauxatic ratio β and C.
Unit - 2	**Vibrational Spectroscopy** 10 Hrs Symmetry and shapes of AB_2, AB_3, AB_4, AB_5 and AB_6, mode of bonding of ambidentate ligands, nitrosyl, ethylenediamine and diketonato complexes, application of resonance, Raman spectroscopy and its applications.
Unit - 3	**Nuclear Magnetic Resonance Spectroscopy-I** 15 Hrs General introduction and definition, chemical shift, spin-spin interaction, shielding and deshielding mechanism, measurement of chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto),
Unit - 4	**Nuclear Magnetic Resonance Spectroscopy-II** 15 Hrs Chemical exchange, effect of deuteration, Complex spin spin interaction

	between two, three, four and five nuclei (I order spectra) Stereochemistry, hindered rotation, Karplus curve-variation of coupling constant with disordered angle. NMR shift reagents, solvent effects. nuclear overhauser effect (NOE).
Unit - 5	**Mössbauer Spectroscopy** 10 Hrs Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and Sn^{+4} compounds, nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.

Suggested Readings:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
3. Infrared and Raman Spectral: Inorganic and Coordination Compounds K. Nakamoto, Wiley.
4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.
5. Transition Metal Chemistry ed. R.L. Carlin vol. 3 dekker.
6. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, .V. Parish, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G.J. Martin, Heyden.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler adn T.C. Morrill, John Wiley.
10. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Application of Spectroscopy of Organic Compounds, J.R. Dyer Prentice Hall.
12. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.
13. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Lof

Class / d{kk	% M.Sc.
Semester / lsesLVj	% III
Subject / fo"k;	% Chemistry
Title of Subject Group	% PHOTOCHEMISTRY
fo"k; lewg dk 'kh"kZd	%
Paper No. / i'ui=k dekd	% II (Code- MCH-502)
Compulsory / vfuok; ;k Optional / odfYid vfuok;	% Compulsory
Max. Marks vf/kdre vad	% 75

Particulars / fooj.k

Hrs : 50

Unit-1	**Photochemical Reactions**	10 Hrs.
	Photochemistry an Introduction, Laws of Photochemistry, Role of photochemistry, Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, Photosensitizer, actinometry.	
Unit-2	**Determination of Reaction Mechanism**	10 Hrs
	Classification, rate constants and life times of reactive energy state, determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions-photodissociation, Photoreduction, Photoaddition, Photoisomerisation, Photooxidation, gas-phase photolysis.	
Unit-3	**Photochemistry of Alkenes**	10 Hrs
	Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes. **Photochemistry of Aromatic Compounds** Isomerisations, additions and substitutions.	
Unit-4	**Photochemistry of Carbonyl Compounds**	10 Hrs
	Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, β, ϒ unsaturated and α, β unsaturated compounds, cyclohexadienones. Intermolecular cyloaddition reactions-dimerisations and oxetane formation.	
Unit-5	**Miscellaneous Photochemical Reactions**	10 Hrs
	Photo-Fries reactions of annilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen and its reactions. Photochemical formation of smog. Photodegradation of	

	polymers. Photochemistry of vision. Photography, Photochromism, Photoimaging

Books Suggested

7. Fundamentals of photochemistry, K.K. Rothagi-Mukheriji, Wiley-Eastern.
8. Essentials of Molecular Photochemistry, A Gilbert and J. Baggott, Blackwell Scientific Publication.
9. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
10. Introductory Photochemistry, A. Cox and T. Camp, McGraw Hill.
11. Photochemistry, R.P. Kundall and A. Gilbert. Thomson Nelson.
12. Organic Photochemistry, J. Coxon and B.Halton, Cambridge University Press.

Class / d{kk	% M.Sc.
Semester / lseLVj	% III
Subject / fo"k;	% Chemistry
Title of Subject Group	% ENVIRONMENTAL CHEMISTRY
fo"k; lewg dk 'kh"kd	%
Paper No. / i'ui= dekad	% III (Code- MCH-503)
Compulsory / vfuok; ;k Optional / odfYid vfuok;	% Compulsory
Max. Marks vf/kdre vad	% 75

Particulars / fooj.k

60 Hrs

Unit-1	**(c) 1. Atmosphere** **15 Hrs** Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. Temperature inversion. Calculation of Global mean temperature of the atmosphere. Pressure variation in atmosphere and scale height. Biogeochemical cycles of carbon, nitrogen, sulphur, phosphorus, oxygen. Residence times. **3. Atmospheric Chemistry** Sources of trace atmospheric constituents : nitrogen oxides, sulphurdioxide and other sulphur compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons. **(d) Tropospheric Photochemistry** Mechanism of Photochemical decomposition of NO_2 and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO_2 and NO_2. Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.
Unit-2	**(c) Air Pollution** **15 Hrs** Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health. **Stratospheric Ozone Depletion** Mechanism of Ozone formation, Mechanism of catalytic ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies. **Urban Air Pollution**

	Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies. **(d) Acid Rain** Definition, Acid rain precursors and their aqueous and gas phase atmospheric oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO_2 and NO_2. Acid rain control strategies. **Green House Effect** Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences.
Unit-3	**Aquatic Chemistry and Water Pollution** **10 Hrs** Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Aerobic and anaerobic reactions of organic sulphur and nitrogen compounds in water acid-base chemistry of fresh water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.
Unit-4	**Environmental Toxicology** **15 Hrs** **Toxic heavy metals :** Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects. **Toxic Organic Compound :** Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects. **Polychlorinated biphenyls :** Properties, use and environmental continuation and effects. **Polynuclear Aromatic Hydrocarbons :** Source, structures and effect as pollutants.
Unit-5	**c) Soil and Environmental Disasters** **05 Hrs** Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic and metals. Methods of re-mediation of soil. Bhopal gas tragedy, Chernobyl, three mile island, Minimtata Disease, Sevoso (Italy), London smog. **d)** Disaster Management: Elements of disaster management, control of leakage of gas cylinder containing toxic gases such as chlorine.

Books Suggested

8. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
9. Chemistry of Atmospheres, R.P. Wayne, Oxford.
10. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
11. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
12. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.
13. Industrial hazards & plant safety, Sanjoy Banerjee- Taylor & Francis.
14. Factories Act with M.P. Factories rules- Law Publishers.

OPTIONAL PAPERS

Out of the five optional papers following one paper each of marks 100 (75+25) are selected.

Optional Papers

OPT-1	MCH-505 Polymers
OPT-2	MCH-504 Organotransition Metal Chemistry
OPT-3	Natural Products
OPT-4	Hetrocyclic Chemistry

Open Elective Paper

Health Chemistry

Class / d{kk	¼ M.Sc.
Semester / lseLVj	¼ III
Subject / fo"k;	¼ Chemistry
Title of Subject Group	% Polymers
Paper No. / i'ui= dekd	¼ OPT-2 **(Code- MCH-505)**
Compulsory / vfuok; ;k Optional / odfYid vfuok;	¼ Optional
Max. Marks	% 75

Particulars / fooj.k

60 Hrs

Unit-1	**Basics** **12 Hrs** Importance of polymers. Basic concepts: Monomers, repeat units, degree of polymerization Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition/radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.
Unit-2	**Polymer Characterization** **12 Hrs** Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular-weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.
Unit-3	**Analysis and testing of polymers** **12 Hrs** Chemical analysis of polymers, spectroscopic methods, X-ray diffraction study. Microscopy. Thermal analysis and physical testing-tensile strength. fatigue, impact, tear resistance, Hardness and abrasion resistance.
Unit-4	**Inorganic Polymers** **12 Hrs** A general survey and scope of Inorganic Polymers, special characteristics, classification, homo and hetero atomic polymers. Structure, Properties and Applications of c. Polymers based on boron-borazines, boranes and carboranes. d. Polymers based on Silicon-silicone's, polymetalloxanes and polymetallosiloxanes, silazanes.
Unit-5	**Structure, Properties and Application of Polymers** **12 Hrs** d. Polymers based on Phosphorous-Phosphazenes, Polyphosphates e. Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds. f. Co-ordination and metal chelate polymers.

Book Suggested

8. Inorganic Chemistry, J.E. Huheey, Harper Row.
9. Developments in Inorganic polymer Chemistry, M.F. Lappert and G.J. Leigh.
10. Inorganic polymers- N.H. Ray.
11. Inorganic polymers, Graham and Stone.
12. Inorganic Rings and Cages : D.A. Armitage.
13. Textbook of Polymers Science, F.W. Billmeyer Jr. Wiley.
14. Contemporary Polymer Chemistry, H.R. Al cock and F.W. Lambe, Prentice Hall.

Natural Products (Optional Paper)

M.M.: 75

Unit I

Terpenoids and Carotenoids

Calcifications, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules : Citral, Geraniol a-Terpeneol, Menthol, Farnesol, Zingiberence, Santonin, Phytol, Abietic acid and b-Carotene.

Unit II

Alkaloids

Definition, nomenclature and physiological action, occurrence, isolation, general methods, of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry, synthesis and biosynthesis of the following : Ephedrine , (+)- Coniine, Nicotine, Atropine, Quinine and Morphine.

Unit III

Steroids

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, Isolation, Structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone, Biosynthesis of Steroids.

Unit IV

Plant Pigments

Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin Quercetin, Myrcetin, Quercetin 3-glucoside, Vitexin, Diadzein, Aureusin, Cyanidin-7arabinoside, Cyanidin, Hirsutidin, Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway.

Prophyrins

Structure and synthesis of Haemoglobin and Chlorophyll.

Unit V

Prostaglandis

Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGF2a.

Pyrethroids and Rotenones

Synthesis and reactions of Pyrethroids and Rotenones. (For structure elucidation, emphasis is to be placed on the use of spectral parameters wherever possible).

Books Suggested

1. Natural Products : Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthrope adn J.B. Harbome, Longman, Esses.
2. Organic Chemistry : Vol. 2 1L. Finar, ELBS
3. Stereoselective Synthesis : A Practical Approach, M. Norgradi, VCH.
4. Rodd's Chemistry of Carbon Compounds, Ed. S. Coffey, Elsevier.
5. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston. harwood Academic Publishers.
6. Introduction to Flavonoids, B.A. Bohm. Harwood Academic Publishers.
7. New Trends in Natural Product chemistry, Ataaur Rahman and M.L. Choudhary, Harwood Academic Publishers.
8. Insecticides of Natural Origin, Sukh Dev, Harwood Academic Publishers.

Class / d{kk	¼ M.Sc.
Semester / lsesLVj	¼ III
Subject / fo"k;	¼ **Chemistry**
Title of Subject Group **fo"k; leg dk 'kh"kd**	% **Heterocyclic Chemistry** ¼
Paper No. / i'ui= dekd	¼ OPT-3 **(Code- MCH-506)**
Compulsory / vfuok; ;k **Optional / odfYid vfuok;**	¼ **Optional**
Max. Marks vf/kdre vad	¼ 75

Particulars / fooj.k

60 Hrs

Unit-1	**Nomenclature of Heterocycles** **12 Hrs** Replacement and systematic nomenclature (HantzsMCH-Widman system) for monocyclic fused and bridged heterocycles. **Aromatic Heterocycles** General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in 1H NMR-spectra. Empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.
Unit-2	**Non-aromatic Heterocycles** **12 Hrs** Strain-bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Atereo-electronic effects anomeric and related effects, Attractive interactions-hydrogen bonding and intermolecular nucleophilic electrophilic interactions. Heterocyclic synthesis-princples of heterocyclic synthesis involing cyclization reactions and cycloaddition reactions.
Unit-3	**Small Ring Heterocycles** **12 Hrs** Three-membered and four-membered heterocycles-synthesis and reactions of azirodines, oxiranes, thiranes, azetidines, oxetanes and thietanes. **Benzo-Fused Five-Membered Heterocycles** Synthesis and reactions including medicinal applications of benzopyrroles, bezofurans and benzothiophenes.
Unit-4	**Meso-ionic Heterocycles** **12 Hrs** General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications.

	Six-Membered Heterocycles with one Heteroatom Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium & thiopyrylium salts and phridones. Synthesis and reactions of quionlizinium and benzopyrylium salts, coumarins and chromones.
Unit-5	**12 Hrs** Six Membered Heterocycles with Two or More Heteroatoms: Synthesis and reactions of diazones, triazines, tetrazines and thiazines. Seven-and Large-Membered Heterocycles: Synthesis and reactions of azepines, oxepines, thiepines, diazepines, thiazepines, azocines, diazocines, dioxocines and dithiocines. **Heterocyclic Systems Containing P, As, Sb and B** Heterocyclic rings containing phosphorus : Introduction, nomenclature, synthesis and characteristics of 5- and 6-membered ring systemsphosphorinaes, phosphorines, phospholanes and phospholes. Heterocyclic rings containing As and Sb : Introduction, synthesis and characteristics of 5- and 6-membered ring system. Heterocyclic rings containing B : Introduction, synthesis reactivity and spectral characteristics of 3- 5- and 6- membered ring system.

Book Suggested

1. Heterocyclic Chemistry Vol. 1-3, R.R. Gupta, M. Kumar and V.Gupta, Springer Verlag.
2. The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.
3. Heterocyclic chemistry J.A. Joule, K. Mills and g.F. Smith, Chapman and Hall.
4. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scietific Techinal.
5. Contemporary Hetrocyclic Chemistry, G,.R. Newkome and W.W. Paudler, Wiley-Inter Science.
6. An Introductiion to the Heterocyclic Compounds, R.M. Acheson, Johnwiely.
7. Comprehensive Heterocyclic Chemistry, A.R. Katrizky and C.W. Rees, eds. Pergamon Press.

Class / d{kk	% M.Sc.
Semester / lseLVj	% III
Subject / fo"k;	% Chemistry
Title of Subject Group fo"k; leg dk 'kh"kd	% Organotransition Metal Chemistry %
Paper No. / i'ui= dekd	% Opt-I (MCH 504)
Compulsory / vfuok; ;k **Optional / odfYid vfuok;**	% Optional
Max. Marks vf/kdre vd	% 75

Particulars / fooj.k

60 Hrs

Unit - 1 Alkyls and Aryls of Transition Metals **15 Hrs**

Types, routes of synthesis, stability and decomposition pathways organocopper in organic synthesis.

Compounds of Transition Metal-Carbon Multiple Bonds

Alkylidenes, alkylidynes, low valent carbenes and carbynes-synthesis, nature of bond, structural characteristics, nucleophilic and electrophilic reactions on the ligands, role in organic synthesis.

Unit - 2 Transition Metal π-Complexes **15 Hrs**

Transition metal π -Complexes with unsaturated organic molecules, alkenes, alkynes, allyl, diene, dienyl, arene and trienyl complexes, preparation, properties, nature of bonding and structural features. Important reactions relating to nucleophilic and electrophilic attack on ligands and to organic synthesis.

Unit - 3 Transition metal compounds with bonds to hydrogen, boron, silicon : **10 Hrs**

Transition metal compounds with bonds to hydrogen, boron, silicon

Unit - 4 Homogeneous Catalysis

12Hrs

Stoichiometric reactions for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerization of olefins, catalytic reactions involving carbon monoxide such as hydrocarbonylation of olefins (oxoreaction), explanation reactions, activation of C-H bond.

Unit - 5 Fluxional Organometallic Compounds **08 Hrs**

Fluxionality and dynamic equilibrium in compounds such as η-2 olefine, η-3 allyl and dienyl complexes.

Suggested Readings:

1. Principles and Application of Organotransition Metal Chemistry, J.P. Collman, L.S. Hegsdus,

J.R. Norton and R.G. Finke, University Science Books.

2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree. John Wiley.

3. Metallo-organic Chemistry, A.J. Pearson, Wiley.

4. Organometallic Chemistry, R.C. Mehrotra and A. Singh New Age International

(Open Elective Paper)

HEALTH CHEMISTRY

M.M.: 75

UNIT-I : Health

Definition: Food, Food Pyramid- Health- Hygiene- mal-, under – and over- nutrition, their causes and remedies, sanitation, Carbohydrates- Classification, Biological functions, Protein- Classification, Biological functions, vitamins- Classification, Biological functions.

UNIT-II: Drugs

Drugs- Types of drugs- depressant, anticonvulsant, narcotics, antipyretics, antibiotics, antiseptics, analgesics, muscle relaxants and cardiovascular and vasodepressants, Steroids.

UNIT-III: Body fluids

Blood volume, groups, coagulation, blood pressure, anemia, blood sugar, heamoglobin- chemistry of respiration- urine-electrolyte balance.

UNIT-IV: Enzymes, Hormones, Digestion

Types of enzymes and enzyme action, Characters of hormones- action, examples of essential hormones- digestion in mouth, stomach, intestine and pancreas- mineral metabolism.

UNIT-V: Common Diseases

Toxicants in food- cancer-types and causes- common diseases- Jaundice, vomiting, fever, rickets, scurvy, beriberi, pellagra, night blindness, ulcer, gout, goiter, diabetes, anemia and their causes,

Books Recommended

6. Jayashree Ghosh, A Text book of Pharmaceutical Chemistry, S. Chand and Co. Ltd, 1999. UNITS II and V
7. Alex V Ramani, Food Chemistry, MJP Publishers, Chennai, 2009 UNIT I
8. Deb A C, Fundamentals of Biochemistry, New Central Book Agency, Calcutta, 1994. UNIT III
9. Satake M and Mido Y, Chemistry for Health Science, Discovery Publishing House, New Delhi, 2003 UNIT I and III
10. Ashutosh Kar, Medicinal Chemistry, Wiley Easterns Limited, New Delhi, 1993 UNIT II & IV

M.Sc. Semester III

Chemistry

PRACTICALS

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

Quantitative determinations of a three component mixture	18
Chromatographic Separations	18
Record	06
Viva Voice	08
Total	**50**

Quantitative determinations of a three component mixture:
One Volumetrically and two gravimetrically

a. Cu^{+2}, Ni^{+2}, Zn^{+2} etc.
b. Cu^{+2}, Ni^{+2}, Ag^{+1} etc.

Quantitative separation of three compounds.

Chromatographic Separations of 4 ions:

a. Cadmium and zinc
b. Zinc and magnesium.
c. Thin-layer/paper chromatography-separation of nickel, manganese, cobalt and zinc ion, Cu, Fe, Ni, Co by paper chromatography. Determination of Rf values.
d. Separation of cations and anions by Column Chromatography.

Organic Chemistry

Multi-step Synthesis of Organic Compounds	18
Paper Chromatography	18
Record	06

Viva Voice	08
Total	**50**

Multi-step Synthesis of Organic Compounds

The exercise should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

Aniline → p-Nitroaniline: Aniline → p-Bromoaniline: Phthalic acid → Anthranilic acid: Pinacol-pinacolone rearrangement (Benzophenone → Benzpinacol → Benzpinacolone): Benzoin → Benzilic acid (Benzoin →Benzil → Benzilic acid): Benzopinacol rearrangmenet (Hydrazobenzene → Benzidine) .

Paper Chromatography and TLC

Quantitative Estimation (Titrietric method) :

(i) Estimation of glucose, glycine & ascorbic acid from vitamin – C tablet.
(ii) Determination of DO, COD & BOD of water sample.
(iii) Paper Chromatography and TLC

Physical Chemistry

Experiment no. 01	**18**
Experiment no. 02	**18**
Record	**06**
Viva Voice	**08**
Total	**50**

Spectroscopy

i. Determination of stoichiometry and stability constant of Ferricisothicoyanate complex ion in solution.
ii. Determination of rate constant of alkaline bleaching of Malachite green and effect of ionic strength on the rate of reaction.

Chemical Kinetics (any three):

ii. Determination of rate constant and formation constant of an intermediate complex in the reaction of Ce(IV) and Hypophosphorous acid at ambient temperature.
iii. Determination of energy and enthalpy of activation in the reaction of $KMnO_4$ and benzyl alcohol in acid medium.
iv. Determination of energy of activation of and entropy of activation from a single kinetic run.
v. Kinetics of an enzyme / micellar catalyzed reaction.
vi. Kinetics of decomposition of complex formed between sodium sulphide and sodium Nitroprusside spectrophotometrically.
vii. Flowing clock reactions (Ref : Experiments in Physical Chemistry by Showmaker)
viii. Determination of the primary salt effect on the kinetics of ionic reaction and testing of the Bronsted relationship.
ix. Oscillatory reaction.

Thermodynamics:

i. Determination of partial molar volume of solute (e.g. KCl, MgSO4, NaCl and other available salt) in solvent in a binary mixture.

Potentiometry/pH metry:

i. Determination of activity and activity coefficient of electrolytes.
ii. Determination of the dissociation constant of acetic acid in DMSO. DMF.
iii. Determination of the dissociation constant of monobasic/dibasic acid
iv. Determination of thermodynamic constants, ΔG, ΔS, and ΔH for the reaction $Zn + H_2SO_4 \rightarrow ZnSO_4 + 2\ H$ by e.m.f. method.
v. Determination of the valency of mercurous ions potentiometrically.

Books Suggested

1. Inorganic Experimens, J. Derek Woolings, VCH.
2. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
3. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
4. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. Curlin.

Class / d{kk	% M.Sc.
Semester / lsesLVj	% IV
Subject / fo"k;	% Chemistry
Title of Subject Group	% APPLICATION OF SPECTROSCOPY-II
fo"k; lewg dk 'kh"kZd	%
Paper No. / i'ui= dekd	% I (Code- MCH-511)
Compulsory / vfuok; ;k Optional / odfYid vfuok;	% Compulsory
Max. Marks vf/kdre vad	% 75

Unit-1	**Ultraviolet and Visible spectroscopy** **12 Hrs** Various electronic transitions (185-800 nm) Beer-Lambert law, Effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Fieser Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic compounds. Steric effect in biphenyls.
Unit-2	**Infrared Spectroscopy** **12 Hrs** Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and fermi resonance.
Unit - 3	**Nuclear Magnetic Resonance of Paramagnetic Substances in Solution 12 Hrs** The contact and Pseudo contact shifts, factors affecting nuclear relaxation, some applications including biochemical systems, an overview of NMR of metal nuclide with emphasis on ^{195}Pt and ^{119}Sn NMR.
Unit-4	**Carbon-13 NMR Spectroscopy** **12 Hrs** General considerations, chemical shift (aliphatic olefinic, alkyne, aromatic, heteroaromatic and carboynl carbon), coupling constants. Two dimension NMR

	spectroscopy-COSY, NOESY, DEPT, HMBC and HMQC techniques.
Unit-5	**Mass Spectrometry** **12 Hrs** Introduction ion production E1, C1 FD, ESI and FAB, factors affecting fragmentation, ion analysis, ion abundance Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak. Me Lafferty rearrangement. Nitrogen rule. High resolution mass spectrometry. Structure elucidation of simple molecules using UV – Visible, IR, NMR and mass spectral techniques.

Suggested Readings:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
3. Infrared and Raman Spectral : Inorganic and Coordination Compounds K. Nakamoto, Wiley.
4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.
5. Transition Metal Chemistry ed. R.L. Carlin vol. 3 dekker.
6. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, .V. Parish, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G.J. Martin, Heyden.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler adn T.C. Morrill, John Wiley.
10. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Application of Spectroscopy of Organic Compounds, J.R. Dyer Prentice Hall.
12. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.
13. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.

Class / d{kk	¼ M.Sc.
Semester / lsesLVj	¼ IV
Subject / fo"k;	¼ Chemistry
Title of Subject Group	% **SOLID STATE CHEMISTRY**
fo"k; lewg dk 'kh"kZd	¼
Paper No. / i'ui= dekad	¼ **II (Code- MCH-512)**
Compulsory / vfuok; ;k **Optional / odfYid vfuok;**	¼ Compulsory
Max. Marks vf/kdre vad	¼ 75

Particulars / fooj.k

Hrs; 60 Hrs

Unit-1	**Solid State Reactions** **10 Hrs** General principles, experimental procedure, co-precipitation as a precursory to solid state reactions, kinetics of solid state reactions.
Unit-2	**Crystal Defects and Non-Stoichiometry** **12 Hrs** Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky detects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects.
Unit-3	**Electronic Properties and Band Theory** **18 Hrs** Metals insulators and semiconductors, electronic structure of solids band theory band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties-Application of optical and electron microscopy. Magnetic Properties-Classification of materials : Effect of temperature calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.
Unit-4	**Organic Solids** **10 Hrs** Electrically conducting solids. organic charge transfer complex, organic metals, new superconductors.
Unit-5	**Liquid Crystals**: **10 Hrs** Types of liquid crystals: Nematic, Smectic, Ferroelectric, Antiferroelectric, Various theories of LC,

	Liquid crystal display, New materials.

Books Suggested.

6. Solid state chemistry and its applications, A.R. West. Peenum.
7. Principles of the Solid State, H.V. Keer, Wiley Eastern.
8. Solid State Chemistry, N.B. Hannay.
9. Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern.
10.

Class / d{kk	¼ M.Sc.
Semester / lsesLVj	¼ IV
Subject / fo"k;	¼ Chemistry
Title of Subject Group	% **BIOCHEMISTRY**
fo"k; lewg dk 'kh"kd	¼
Paper No. / i'qi= dekd	¼ **III (Code- MCH-513)**
Compulsory / vfuok; ; ;k **Optional / odfYid vfuok;**	¼ Compulsory
Max. Marks vf/kdre vad	¼ 75

Particulars / fooj.k

Hrs: 60 Hrs

Unit-1	**Metal Ions in Biological Systems** **12 Hrs** Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K+/Na+ pump. **Bioenergetics and ATP Cycle.** DNA polymerisation, glucose storage, metal complexes in transmission of energy; chlorophyll's, photosystem I and photosystem II in cleavage of water. **Transport and Storage of Dioxygen** Heam proteins and oxygen uptake structure and function of haemoglobin's, mygolobin, haemocyanms and hemerythrin, model synthetic complexes of iron, cobalt and copper.
Unit-2	**Electron Transfer in Biology** **10 Hrs** Structure and function of metal of proteins in electron transport processes cytochrome's and ion-sulphure proteins, synthetic models. **Nitrogen fixation** Biological nitrogen fixation, and its mechanism, nitrogenase, Chemical nitrogen fixation. **Kinds of Reactions Catalysed by Enzymes** Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in Isomerisations reactions, b-Cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.
Unit-3	**Enzymes** **14 Hrs** Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshalnd's induced fit hypothesis, concept

	and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michael's-Menten and Lineweaver Burk plots, reversible and irreversible inhibition. **Mechanism of Enzyme Action** Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chemotrypsin, ribonuclease, lysozyme and carboxypeptidase.
Unit-4	**Co-Enzyme Chemistry** **12 Hrs** Cofactors as derived from vitamines, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors. **Enzyme Models** Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality Biometric chemistry, crown ether, cryptates. Cyclodextrins, cyclodextrion-based enzyme models, clixarenes, ionospheres, micelles synthetic enzymes or synzymes. **Biotechnological Applications of Enzymes** large-scale prodcution and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from cron starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.
Unit-5	**Biological Cell and its Constituents** **12 Hrs** Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coils transition. **Bioenergetics** Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP. **Biopolymer Interactions** Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of bidning processes in biological systems. Hydrogen ion titration curves. **Cell Membrane and Transport of Ions** Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

Book Suggested

14. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
15. Bioinorganic Chemistry, 1. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
16. Inorganic biochemistry vol. I and II ed. G.L. Eichhorn, Elsever.
17. Progress in Inorganic Chemistry, Vol 18 and 38 ed J.J. Lippard, Wiley.
18. Bioorganic Chemistry : A chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer Verlag.
19. Understanding Enzymes, Trevor Palmer, Prentice Hall.
20. Enzyme Chemistry : Impact and applications, Ed. Collin J suckling, chemistry.
21. Enzyme Mechanisms Ed. M.I. Page and A Williams, Royal Society of Chemistry.
22. Fundamentals of Enzymology, N.C. Price and L. Stevens. Oxford University Press.
23. Immobilized Enzymes : An Introduction and Applications in Biotechnology, Michael ID. Trevan, Hohn Wiley.
24. Enzymatic Reaction Mechanisms. C. Walsh. W.H. Freeman.
25. Enzyme Structure and Mechanism, A Fersht, W.H. Freeman
26. Biochemistry : The Chemical Reactions of Living Cells, D.E. Metzler, Academic Press.

OPTIONAL PAPERS

Out of the three optional papers following one paper each of marks 100 (75+25) are selected.

OPT-1	MCH- 516	Analytical Chemistry
OPT-2	MCH-518	Medicinal Chemistry
OPT-3	MCH-	Organic Synthesis
OPT-4	MCH-	Electrochemistry

Class / d{kk	¼ M.Sc.
Semester / lsesLVj	¼ IV
Subject / fo"k;	¼ Chemistry
Title of Subject Group	% Applied **Analytical Chemistry**
fo"k; lewg dk 'kh"kZd	¼
Paper No. / i'ui= dekd	¼ **OPT-1 (Code- MCH-516)**
Compulsory / vfuok; ;k **Optional / odfYid vfuok;**	¼ Optional
Max. Marks vf/kdre vad	¼ 75

Particulars / fooj.k

Hrs: 60 Hrs

Unit-1	**(D) Introduction** **14 Hrs** Role of analytical chemistry Classification of analytical methods classical and instrumental. Types of instrumental analysis. Selecting an analytical method. Neatness and cleanliness. Laboratory operations and practices. Analytical balance. Techniques of weighing, errors. Volumetric glassware cleaning and calibration of glassware. Sample preparation-dissolution and decompositions. Gravimetric techniques. Selecting and handling of reagents. Laboratory notebooks. **(E) Safety in the analytical laboratory.** **(F) Errors and Evaluation** Definition of terms, mean and median. Precision-standard deviation, relative standard deviation. Accuracy-absolute error, relative error. Types of error in experimental data determinate (systematic), indeterminate (or random) and gross. Sources of error and the effects upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data-indeterminate errors. The uses of statistics.
Unit-2	**Food analysis** **10 Hrs** Moisture, ash, crude protein, fat crude fiber, carbohydrates, calcium, potassium, sodium and phosphate. Food adulteration-common adulterants in food, contamination of foods stuffs. Microscopic examination of foods for adulterants. Pesticide analysis in food products. Extraction and purification of sample. HPLC. Gas chromatography for organophosphates. Thin-layer chromatography for identification of chlorinated pesticides in food products.
Unit-3	**Analysis of Water Pollution** **12 Hrs** Origin of Waste water, types, water pollutants and their effects. Sources of water pollution-domestic, industrial, agricultural soil and radioactive wastes as sources of pollution. Objectives of analysis-parameter for analysis-colour, turbidity, total solids, conductivity, acidity, alakalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen, Heavy metal pollution-public health significance of cadmium, chromium, copper, lead, zinc, managanese, mercurry and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems. Measurements of DO, BOD, and COD. Pesticides as water

	pollutants and analysis. Water pollution laws and standards.
Unit-4	**Analysis of soil and Fuel** **12 Hrs** (a) Analysis of Soil, moisture pH total nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts. Fuel analysis : liquid and gas. Ultimate and proximate analysis-heating values-grading of coal. Liquid fuels-flash point, aniline point, octane number and carbon residue. Gaseous fuels-producer gas and water gas, calorific value.
Unit-5	**Analysis of Body Fluids and Drugs** **12 Hrs** (a) **Clinical Chemistry** : Composition of blood-collection and preservation of samples. Clinical analysis. Serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphatase Immunoassay: principles of radio immunoassay (RIA) and its applications. The blood gas analysis, trace elements in the body (b) **Drug analysis**: Narcotics and dangerous drug. Classification of drugs. Screening by gas and thin-layer chromatography and spectrophotometeric measurements.

Suggested Readings:

11. Analytical Chemistry, G.D. Christian, J.Wicy.
12. Fundamentals o analytical Chemistry. D.A. Skoog. D.M. West and F.J. Hooler, W.B. Saunders.
13. Analytical Chemistry-Principles. J.H. Kennedy. W.B. Saunders.
14. Analytical Chemistry-Principles and Techniques. LG. Hargis. Prentice Hall.
15. Principles of Instrumental analysis D.A. Skoog and J.L. Loary, W.B. Saunders.
16. Principles of Instrumental Analysis D.A. Skoog W.B. Saunders.
17. Quantitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
18. Environmental Solution, S.M. Khopkar, Wiley Eastern.
19. Basic Concepts of Analysis Chemistry, S.M. Khopkar, Wiley Eastern.
20. Handbook of Instrumental Techniques for Analytical Chemistry, F. Settle, Prentice Hall

Class / d{kk	¼ M.Sc.
Semester / lseLVj	¼ IV
Subject / fo"k;	¼ Chemistry
Title of Subject Group	% **Medicinal Chemistry**
fo"k; lewg dk 'kh"kZd	¼
Paper No. / i'ui= dekd	¼ **OPT-2 (Code- MCH-518)**
Compulsory / vfuok; ;k **Optional / odfYid vfuok;**	¼ Optional
Max. Marks vf/kdre vad	¼ 75

Particulars / fooj.k

Hrs: 60 Hrs

Unit-1	**Structure and activity :** Prodrugn and soft drug **12 Hrs** Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design, stpes involved in design process. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. Fundamental of QSAR, Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis, physicochemical properties.
Unit-2	**Pharmacodynamics:** **12 Hrs** Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides-sulphacetanalide, sulphapyridine, sulphaizine, sulphaguanidine, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.
Unit-3	**Antibiotics and antibacterials** **12 Hrs** Introduction, Antibiotic β-Lactam type - Penicillins, Cephalosporins, Antitubercular – Streptomycin, Broad spectrum antibiotics – Tetracyclines, Anticancer - Dactinomycin (Actinomycin D), ethambutol, anti coagulants- classification, mode of action, therapeutic uses.
Unit-4	**Antifungal** – **12 Hrs** polyenes, Antibacterial – Ciprofloxacin, Norfloxacin, Antiviral – classification, mode of action, therapeutic uses, Acyclovir, **Antimalarials**: Chemotherapy of malaria. SAR. Chloroquine, pamaquin, Chloroguanide and Mefloquine
Unit-5	**Non-steroidal Anti-inflammatory Drugs:** **12 Hrs**

	Diclofenac Sodium, Ibuprofen and Netopam **Antihistaminic and antiasthmatic agents :** Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate. Anti ulcer drugs - classification, mode of action, therapeutic uses.

Books recommended

1. Introduction to medicinal chemistry, A. Gringuage, Wiley-VCH.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorge.
3. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age Internaitonal.
4. Burger's Medicianl Chemistry and Drug Discovery, Vol-I (Chapter 9 and Chapter 14), Ed. M.E.Wolff, John Wiley.
5. Goodman and Gilman's Pharmacoloical Basis of Therapeutics, Mc GRaw-Hill.
6. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press.
7. Strategies for Organic Drug synthesis and Design, D.Lednicer, John Wiley.
8. Principles of Medicinal Chemistry W.O.Foye
9. Medicinal Chemistry; The Role of organic chemist in Drug Research, S.M. Roberts and B.J. Pricer.

Organic Synthesis (Optional –III)

Unit I

Disconnection Approach

An introduction to synthons and synthetic equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reaction, amine synthesis.

Unit II

One Group C-C Disconnections

Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic Nitro compounds in organic synthesis.

Two Group C-C Disconnections

Diels-Alder Reaction, 1,3-difunctionalised compounds, a-b- unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds. Micheal addition and Robinson annelation.

Unit III

Oxidation

Introduction, Different oxidative processes. Hydrocarbons-alkenes, aromatic rings, saturated C-H groups (activated and unactivated) Alcohols, diols, aldehyde's, ketones, ketals and carboxylic acids. Amines, hydrazines, and sulphides. Oxidations with ruthenium tetraoxide, iodobenzene diacetate and thallium. (III) Nitrate.

Reduction

Introduction, Different reductive processes. Alkanes, alkenes, alkynes, and aromatic rings. Carbonyl compounds-aldehydes, ketones, acids and their derivatives. Epoxides. Nitro, nitroso, azo and oxime groups. Expoxide, Nitro, Nitroso, azo and oxime groups. Hydrogenolysis.

Unit IV

Organometallic Reagents

Principle, preparations, properties and applications of the following in organic synthesis with mechanistic details. Group I and II metal organic compounds Li, Mg, Hg, Cd, Zn and Ce Compounds.

Unit V

Synthesis of some complex molecules:

Application of the above in the synthesis of following compounds:

Canphor, longifoline, cartisone, reserpine, vitamin D, juvabion, aphidicolin and fredericamycin. A

Books Suggested

1. Designing Organic Synthesis, S. Warren. Wiley.

2. Organic Synthesis-Concept, Methods and Starting Materials, J. Fuhrhop.

3. Some Modern Methods of Organic Synthesis. W. carruthers, Cambridge Univ.

Press.

4. Modern Synthetic Reactions H.O. House, W.A Benjamin.

5. Advanced Organic Chemistry : Reactions, Mechanisms and Structure, J. March.

Wiley.

6. Principles, of Organic Chemistry Part B. F.a. Carey and R.J. Sundberg, Plenum

Press.

Electrochemistry (Optional – IV)

Unit I

1. Conversion and Storage of Electrochemical Energy Present status of energy

consumption : Pollution problem. History of fuel cells, Direct energy conversion by electrochemical means. Maximum intrinsic efficiency of an electrochemical converter. Physical interpretation of the Carnot efficiency factor in electrochemical energy converters. Power outputs. electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells, Hydrogen Air cell, Hydrocarbon air cell, Alkane fuel cell, Phosphoric and fuel cell, direct NaOH fuel cells, applications of fuel cells.

Electrochemical Energy Storage :

Properties of Electrochemical energy storage : Measure of battery performance, Charging and discharging of a battery, Storage Density, Energy Density. Classical Batteries : (i) Lead Acid (ii) Nickel-Cadmium, (iii) Zinc manganese dioxide. Modern Batteries : (i) Zinc-Air (ii) Nickel-Metal Hydride, (iii) Lithium Battery, Future Electricity storers : Storage in (i) Hydrogen, (ii) Alkali Metals, (iii) Non aqueous solutions.

Unit II

Corrosion and Stability of Metals :

Civilization and Surface mechanism of the corrosion of the metals; Thermodynamics and the stability of metals, Potential -pH (or Pourbaix) Diaphragmsl; uses and abuses, Corrosion current and corrosion potential -Evans diagrams. Measurement of corrosion rate : (i) Weight Loss method, (ii) Electrochemical Method.

Inhibiting Corrosion : Cathodic and Anodic Protection. (i) Inhibition by addition of substrates to the electrolyte environment, (ii) by charging the corroding method from external source, anodic Protection, Organic inhibitors, The fuller Story Green inhibitors. **Passivation :** Structure of Passivation films, Mechanism of Passivation, Spontaneous Passivation Nature's, method for stabilizing surfaces.

Unit III

Bioelectrochemistry :

bioelectrodics, Membrane Potentials, Simplistic theory, Modern theory, Electrical conductance in biological organism: Electronic, Protonic electrochemical mechanism of nervous systems, enzymes as electrodes.

Kinetic of Electrode Process :

Essentials of Electrode reaction. Current Density, Overpotential, Tafel Equation, Butler Volmer equation. Standard rate constant (K0) and Transfer coefficient (a), Exchange Current.

Irreversible Electrode processes : Criteria of irreversibility, informatino from irreversible wave.

Unit IV

Methods of determining kinetic parameters for quasi-rversible and irreversible

waves : Koutecky's methods, Meits Israel Method, Gellings method.

Electrocatalysis :

Chemical catalysts and Electrochemical catalysts with special reference to purostates, porphyrin oxides of rare earths. Electrocatalysis in simple redox reactions, in reaction involving adsorbed species. Influence of various parameters.

Unit V

Potential Sweep Method :

Linear sweep Voltammetry, Cyclic Voltammetry, theory and applications. Diagnostic criteria of cyclic voltammetry. Controlled current microelectrode techniques : comparison with controlled potentials methods, chronopotentiometry, theory ad applications.

Bulk Electrolysis Methods :

Controlled potential coulometry, Controlled Coulometry, Electroorganic synthesis and its important applications. Stripping analysis : anodic and Cathodic modes, Pre electrolysis and Stripping steps, applications of Stripping Analysis.

Books Suggested

1. Modern Electrochemistry Vol. I, IIa, Vol. IIB J'OM Bockris and A.K.N. Reddy, Plenum Publication, New York.

2. Polarographic Techniques by L. Meites, Interscience.

3. "Fuel Cells : Thjeir electrochemistry". McGraw Hill Book Company, New York.

4. Modern Polarographic Methods by A.M. Bond, Marcell Dekker.

5. Polarography and allied techniques by K. Zutshi, New age International publicatin. New Delhi.

6. "Electroaalytical Chemistry by Basil H. Vessor & Galen W. ; Wiley Interscience.

7. Electroanalytical Chemistry by Basil H. Vessor & alen w. ; Wiley Interscience.

8. Topics in pure and Applied Chemistry, Ed. S. K. Rangrajan, SAEST Publication,

Karaikudi (India)

Department of Chemistry, Govt. Holkar Science College,

Indore [M.P.]

M.Sc. IV Semester [Optional Paper]

CHEMINFORMATICS

Objective: Objective of this subject is to expose students to understand basic chemical informatics and its application to chemical engineering

Syllabus:

UNIT I- Database Management System

Database Design and their Management: Database concepts. Design of Chemical databases, Data Abstraction; Data Models; Instances and Schemes; E-R Model – Entity and entity sets; Relations and relationship sets; E-R diagrams, Reducing E-R Diagram to tables. Network Data Model: Basic concepts, Hierarchical data Model, Data Security.

UNIT II- Basics of Bioinformatics

Basics of Bioinformatics: Introduction to Bioinformatics; Computers in Biology to understand Biological System; Concept of open resources in Bioinformatics. source; Protein Sequence and Structural Databases; Nucleic acid databases; Genome databases; Specialized Databases; Carbohydrate Databases; Clinically relevant drug-drug interactions databases; Information retrieval from Biological databases: Entrez system.

UNIT III – Introduction of Cheminformatics:

Cheminformatics introduction: Introduction to cheminformatics, History, and Evolution of cheminformatics, Use of cheminformatics, Prospects of cheminformatics,

Cheminformatics tools; Chemical structure representation (SMILES and SMARTS); Chemical Databases: CSD, ACD, WDI, Chembank, PUBCHEM, Chemical Structure file formats; Structural Isomers; Structure visualization.

UNIT IV Drug Designing

Stages of Drug Designing 8 Drug Discovery Pipeline: Strategies to identify possible drug targets, Validation and Druggability of targets, Discovery of Lead compounds, Optimization of Lead compounds to Candidate drugs, Clinical Trials and its applications.

Direct Drug Design

Structure based Drug Design: Molecular Docking- principles and concepts, Representation of molecules, Searching Docking programs: AUTODOCK, GOLD.

Indirect Drug Design

Ligand based Drug Design: Quantitative Structure Activity Relationship (QSAR) – principles and concepts, Statistical Methods used in QSAR analyses, Pharmacophore

Modeling: Criteria for satisfactory pharmacophore model, Basics of Hip Hop and Hypogen Model, Applications of pharamacophore model.

UNIT V

Medical and Pharmacy Informatics: Introduction to pharmacy informatics, Medical Transcription, Role of informatics to enhance the services provided by pharmaceutical care givers. Health Information Systems Architecture, Health Data Management, Medical Coding, Telemedicine and Telehealth, Ethics in medical informatics, Pharmacy systems and automation, Informatics applications in pharmacy, survey and evaluation of on-line resources.

Text Books:

1. Andrew Bender, Jonathan M Goodman, Cheminformatics, Oxford University Press-2007.
2. Gasteiger J. and Engel T., Chemoinformatics, A Text Book, Wiley VCH. Stuart Schreiber, Tarun M. Kapoor, Chemical Biology: From Small Molecules to Systems Biology and Drug Design Chemical Release 2001.
3. Bourne, P.E., and Gu, J. 2009 Structural Bioinformatics (2nd edition), John Wiley & Sons, New York
4. Andreas D. Baxevanis, B. F. Francis Ouellette 2001 Bioinformatics: A Practical Guide to the Analysis of Genes,
5. Mount 2003. Bioinformatics: Sequence and Genome Analysis. CBS
6. Attwood and Parry-Smith 2002. Introduction to Bioinformatics. Pearson
7. Barnes and Gray (ed) 2003. Bioinformatics for Geneticists. Wiley
8. Westhead et al 2003. Bioinformatics Instant Notes. Viva Books

M.Sc. Semester IV

Chemistry

Practical

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry	**Max Marks - 50**
Preparation / Analytical	15
Spectrophotometric Determinations or	
Flame Photometric Determinations	20
Record	05
Viva Voice	10
Total	**50**

(i) Preparation and estimation of anyone component from the following.

Preparation of selected inorganic compounds and their study by IR, electronic spectra, and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds involving vacuum lines. Selection can be made from the following :

1. Sodium amide. Inorg. Synth., 1946, 2, 128.
2. Atomic absorption analysis of Mg and Ca.
3. Synthesis of trichlorodiphenylantimony (V) hydrate. Inorg. Synths., 1985, 23, 194
4. Sodium tetrathionate $Na_2S_4O_6$.
5. Metal complex of dimethyl sulfoxide : $CuCl_2.2DMSO$ J.Chem. Educ., 1982, 59, 57.
6. Synthesis of metal acethylacetonate : Inorg. Synths, 1957, 5, 130, 1963, 1, 183.
7. Cis and Trns $[Co(en)_2Cl_2]^+$.
8. Determination of Cr (III) complex. $[Cr(H_2O)_6]NO_3.3HO$,. Inorg. synths., 1972, 13, 184.
9. Preparation and use of Ferrocene. J. Chem. Edu. 1966, 43, 73; 1976, 53, 730.
10. Preparation of [Co(phenathroline-5,6 quinone)].
11. Synthesis of metal ethelene diamine complexes.

OR

Theortical interpritition of given spectra of the complex. (any two)

Analytical Chemistry Practical

1- Cleaning & calibration of glass wares and instruments.
2- Qulitative identitification of simple ion in food items e.g.
Ca^{2+}, Fe^{2+}, Pb^{2+}, Na^{+}, K^{+}, Mg^{2+}, PO_4^{---} etc. fruits, vegetable and pulses.

3- Adulteration of food items
4- Preparation of soaps and detergents.

Spectrophotometric Determinations / Spectroscopic identification of recorded spectra like IR, NMR, ESR and Mass

a. Manganese/Chromium in steel sample.
b. Nickel by extractive spectrophotometric method.
c. Fluoride/nitrite/phosphate.
d. Copper-Ethylene diamine complex : Slope-ratio method

Flame Photometric Determinations

a. Sodium and potassium when present together.
b. Lithium/calcium/barium/strontium.
c. Cadmium and magnesium in tap water

Organic Chemistry	**Max Marks - 50**
Synthesis of Organic Compounds	14
Spectrophotometric Estimation or isolation	14
Identification of Organic compounds (spectral data)	08
Record	06
Viva Voice	08
Total	**50**

Organic Synthesis (may involve multi- step):

1. Friedel Craft Reaction
2. Beckmann's reaction
3. Synthesis of symmetrical tribromobenzene from aniline.
4. Enzymatic reduction of ethylacetoacetate using Baker;s yeast to yield enantiomeric excess of S- ethyl -3- hydroxybutanoate & determine its potical density.
5. Biosynthesis of ethanol from sucrose.
6. Preparation of soap from fat with isolation of glycerol.

Spectroscopic estimation

1. Amino acids

2. Proteins
3. Carbohydrates
4. Aspirin
5. Caffeine

Isolation

1. Casein from milk
2. Lycopine from tomato
3. Piperine from black pepper
4. Caffeine from tea leaves
5. Lactose from milk
6. Preparation of rose water using steam distillation.

Identification of Organic compound by the analysis of their spectral date (UV, IR, NMR & MS).

Physical Chemistry

Max Marks - 50

Experiment No. 1	**20**
Experiment No. 2	**16**
Record	**06**
Viva Voice	**08**

Spectroscopy

i. Determination of PKa of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media.
ii. Colorimetric determinatation of concentration of $K_2Cr_2O_7$ and $KMnO_4$ in a given mixture by the application of mixture Law.

Thermodynamics

i. Determination of partial molar volume in a binary mixture. i.e. Ethanol in water, formic acid in water, Oxalic acid in given mixture of Ethanol and water and fructose in water.
ii. Determination of the temperature dependence of the solubility of a compound in two solvents having similar interromolecular interactions (benzoic acid in water and in DMSO water mixture and calculate the partial molar heat of solution.

Polarography

i. Identification and estimation of metal ions such as Cd^{+2}, Pb^{+2}, Zn^{+2}, and Ni^{+2} etc. polarographically.
ii. Study of a metal ligand complex polarographically (using Lingane's Method).

pH metry:

i. Determination of Acid and Basic dissociation constant of an amino acid and Isoelectric point of the acid

ii. Measurement of the pH of Buffer solution ($CH_3COOH+CH_3COONa$) using Henderson's equation and hence the pKa

Potentiometry:

i. Potentiometrically titration of Zn (II) by $K_4Fe(CN)_6$ and verification of composition of the complex.
ii. Titration of cobaltous solution with potassium ferricyanide and determination of concentration of cobalt (II).
iii. Determination of formal Redox potential of Ferrous – Ferric system by titrating Ferrous Ammonium Sulphate with $K_2Cr_2O_7$/ $KMnO_4$.

Books Suggested

1. Inorganic Experiments, J. Derek Woolings, VCH.
2. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
3. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
4. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. Curlin.

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Computer Science

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

.GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE INDORE

(CENTER FOR EXCELLENCE)

Academic Year: 2021-2022

Affiliated to Devi Ahilya Vishwavidyalaya, Indore

Syllabus for B.Sc. I Semester

Computer Science

(Faculty of Computer Science)

DEPARTMENT OF COMPUTER SCIENCE

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE INDORE

Semester Syllabus for Undergraduates (Computer Science)

As recommended by Central Board of Studies of Computer Science and Approved by H E the Governor of M.P.

Academic Year: 2021-2022

Class: B.Sc. I Semester (Computer Science) for Regular Student

Govt. Holkar (Model Autonomous) Science College, Indore

Computer Science Department

Syllabus Session Year: 2021-22

Programme :Certificate in Science **Class :B.Sc I Semester**

S.No.	Paper	Paper Title	Paper Code	Theory Max. Marks 100				Practical Max. Marks 100				
				Credits	CCE	Exter. Asses.	Min Marks	Credits	Inter. Asses.	Exter. Asses.	Min. Mark.	Total Credit
1	Core Course	Computer System Architecture	S1-CSC1T	4	40	60	35	2	40	60	35	6
2	Minor	Programming Methodologies & Data Structures	S1-CSC2T	4	40	60	35	2	40	60	35	6
3	Open Elective	Computer System Architecture	S1-CSC3T	4	40	60	35	-	-	-	-	4
4	Open Elective	Multimedia & Animation- I	S1-CSC4T	4	40	60	35	-	-	-	-	4

B.Sc. I Semester Computer Science
S1-06-I : Computer System Architecture
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: B.Sc.**	**Semester: I**	**Session: 2021-22**
Subject: Computer Science			
Course Code: S1-06-I	**Course Title: Computer System Architecture**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Understand the basic structure, operation and characteristics of digital computer. 2. Be able to design simple combinational digital circuits based on given parameters. 3. Familiarity with working of arithmetic and logic unit as well as the concept of pipelining. 4. Know about hierarchical memory system including cache memories and virtual memory. 5. Understand concept and advantages of parallelism, threading, multiprocessors and multicore processors. 6. Know the contributions of Indians in the field of computer architecture and related technologies.		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lectures (in hours per week):		**2 Hrs. per week**	
Total no. of Lectures:		**60 Hrs.**	

Para.	Topics	No. of Lectures
I	**Fundamentals of Digital Electronics:** Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Binary and other Codes, Error Detection Codes. **Basic Computer Organization:** Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory	15

	Reference Instruction, Input - Output & Interrupts, Complete Computer Description & Design of Basic Computer. **Logic Gates**: Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits, simple combinational circuit design problems.	
II	**Circuits**- Adder- Subtractor, Multiplexer, Demultiplexer, Decoders, Encoders Flip-Flops, Registers, Counters. **Instructions** - Instruction formats, Addressing modes, Instruction codes, Machine language, Assembly language. **Register Transfer and Micro operations** - Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro operations Logic Micro-operations, Shift Micro-operations.	**15**
III	**Processor and Control Unit** - Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, Introductory concept of RISC, CISC, advantages and disadvantages of both. **Pipelining** - concept of pipelining, introduction to Pipelined data path and control – Handling Data hazards & Control hazards. **Parallelism** - meaning, types of parallelism, introduction to Instruction level-parallelism, Parallel processing challenges, Applications.	**12**
IV	**Memory and I/O Systems** - Peripheral Devices, I/O Interface, **Data Transfer Schemes** - Program Control, Interrupt, DMA Transfer. I/O Processor. **Memory Hierarchy**, Processor vs. Memory Speed, High-Speed Memories, Main memory, Auxiliary memory, Cache Memory, Associative Memory, Interleaving, Virtual Memory, Memory Management.	**10**
V	**Flynn's classification** - Introduction to SISD, SIMD, MISD, MIMD **Hardware multithreading** - Introduction, types, advantages and applications. **Multicore processors** – Introduction, advantages, difference from multiprocessor. **Indian contribution to the field** - Contributions of reputed scientists of Indian origin - like - Dr. Vinod Dham - Father of Intel Pentium Processor, Dr. Ajay Bhat - Co-Inventor of USB Technology, Dr. Vinod Khosla- co-founder of Sun Microsystems, Dr. Vijay P Bhatkar - architect of India's national initiative in supercomputing, and many others. **Parallel Computing projects of India** - PARAM, ANUPAM, FLOSOLVER, CHIPPS etc. Other relevant contributors and contributions.	**8**
Keywords/tags Digital Electronics, Gates, Circuits, Instruction Formats, Addressing Modes, Parallelism, Pipelining, Memory Hierarchy, Multicore, Multithreading, SISD, SIMD, MISD, MIMD, PARAM, ANUPAM, FLOSOLVER, CHIPPS.		
Part-C: Learning Resources		
Text Books, Reference Books, Other Resources		

Suggested Readings:

- M. Morris Mano, "Computer System Architecture", PHI.
- Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
- William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
- V. Carl Hamacher, "Computer Organization", TMH
- Tannenbaum, "Structured Computer Organization", PHI.

Suggestive digital platform web links :

https://www.youtube.com/watch?v=4TzMyXmzL8M
https://nptel.ac.in/courses/106/106/106106166/ https://nptel.ac.in/courses/106/106/106106134/

Suggested equivalent online courses:

https://nptel.ac.in/courses/106/105/106105163/

Part-D: Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE): **40 Marks** Shall be based on allotted assignments and Class Test. The division of marks is as follows:			**External Assessment:** University Exam **(UE): 60 Marks** **Time: 02:00** Hours	
A. **Submission of Assignment followed by Presentation**			**Section A**: 05 MCQ Questions	05x01 = 05 Marks
B. **Class Test**	**Best Two test marks 20 Marks**	**Best two test Marks 40 Marks**	**Section B:** Five Short Questions (200 Words Each)	05x05 = 25 Marks
Test I (Written Test)	20 Marks			
Test I (Written Test)	20 Marks		**Section C:** Two Long Questions (500 Words Each)	02x15 = 30 Marks
Test III (Quiz/ Seminar/ Assignment)	20 Marks			
Total Internal Assessment (Theory) Marks (A+B)	**40 Marks**		Total External Evaluation (Theory) Marks (A+B+ C)	**60 Marks**

Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.

B.Sc. I Semester Computer Science
S1-06-PI : Computer Architecture Lab
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.Sc.	**Semester: I**	**Session: 2021-2022**
Subject: Computer Science			
Course Code: S1-06-PI	**Course Title: Computer Architecture Lab**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Realization of the basic logic and universal gates. 2. Verify the behavior of logic gates using truth tables. 3. Implement Binary-to-Gray, Gray-to-Binary code conversions 4. Design half and full adder circuit using basic gates. 5. Knowledge of Office Tools.		
Credit value	**Practical- 2 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lab Practical's (in hours per week):		**2 Hrs. per week**	
Total no. of Labs:		**30 Hrs.**	

Para.	**Suggestive list of Practicals**	**No. of Labs.**
	1. To study basic gates (AND, OR, NOT) and verify their truth tables. 2. To study and verify NAND as Universal gate. 3. To study half adder using basic gates and verify its truth table. 4. To study Full Adder using basic gates and verify its truth table. 5. To design and construct RS flip Flop using gates and verifies the truth table. 6. To verify DeMorgan's Theorem. **Office Tools** **Using a Text Editor Tool** 1. Create a document and apply different Editing options.	

2. Create Banner for your college.
3. Design a Greeting Card using Word Art for different festivals.
4. Design your Bio data and use page borders and shading.
5. Create a document and insert header and footer, page title, date, time, apply various page formatting features etc.
6. Implement Mail Merge.
7. Insert a table into a document and try different formatting options for the table.

Using a Spreadsheet Tool

1. Design your class Time Table.
2. Prepare a Mark Sheet of your class result.
3. Prepare a Salary Slip of an employee of an organization.
4. Prepare a bar chart & pie chart for analysis of Election Results.
5. Prepare a generic Bill of a Super Market. 6. Work on the following exercises on a Workbook:
    a. Copy an existing Sheet
    b. Rename the old Sheet
    c. Insert a new Sheet into an existing Workbook
    d. Delete the renamed Sheet.
7. Prepare an Attendance sheet of 10 students for any 6 subjects of your syllabus. Calculate their total attendance, total percentage of attendance of each student & average of attendance.
8. Create a worksheet of Students list of any 4 faculties and perform following database functions on it.
    a. Sort data by Name
    b. Filter data by Class
    c. Subtotal of no. of students by Class.

Using a Presentation Tool

1. Design a presentation of your institute using auto content wizard, design template and blank presentation.
2. Design a presentation illustrating insertion of pictures, Word Art and ClipArt. Design a presentation, learn how to save it in different formats, copying and opening an existing presentation.
3. Design a presentation illustrating insertion of movie, animation and sound.
4. Illustrate use of custom animation and slide transition (using different effects)
5. Design a presentation using charts and tables of the marks obtained in class.

Keywords/tags: Digital Electronics, Logic Gates, AND, OR, NOT, NANAD, NOR, Circuits , DeMorgan's Theorem, Office Tools.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- M. Morris Mano, "Computer System Architecture", PHI.
- Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
- William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
- V. Carl Hamacher, "Computer Organization", TMH
- Tannenbaum, "Structured Computer Organization", PHI.

Suggestive digital platform web links :

https://www.youtube.com/watch?v=4TzMyXmzL8M
https://nptel.ac.in/courses/106/106/106106166/
https://nptel.ac.in/courses/106/106/106106134/

Suggested equivalent online courses:

https://nptel.ac.in/courses/106/105/106105163/

Part-D: Assessment and Evaluation

Internal Assessment (A):	**40 Marks**
Lab Record / Class interaction/ Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours) / Mini Project (Project Demo + Report))	20 Marks
End Semester External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

B.Sc I Semester Computer Science
S1-06-M : Programming Methodologies & Data Structures
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: B.Sc.**	**Semester: I**	**Session: 2021-22**
Subject: Computer Science			
Course Code: S1-06-M	**Course Title: Programming Methodologies & Data Structures**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Minor**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming 5. Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles 6. Have knowledge of complexity of basic operations like insert, delete, and search on these data structures. 7. Possess ability to choose a data structure to suitably model any data used in computer applications. 8. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc. 9. Assess efficiency tradeoffs among different data structure implementations. 10. Implement and know the applications of algorithms for searching and sorting etc. 11. Know the contributions of Indians in the field of programming and data structures		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			

No. of Lectures (in hours per week):	2 Hrs. per week	
Total no. of Lectures:	60 Hrs.	
Para.	**Topics**	**No. of Lectures**
I	**Introduction to Programming** - Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies. **Introduction to C++ Programming** - Basic Program Structure In C++, Data Types, Variables, Constants, Operators and Basic I/O. **Variables** - Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise), Using Comments in programs, Character I/O (getc, getchar, putc, putchar etc.), Formatted and Console I/O (printf(), scanf(, cin, cout), Using Basic Header Files (stdio.h, iostream.h, conio.h etc.) **Simple Expressions in C++** (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions **Conditional Statements**- if construct, switch-case construct **Iterative Statements** while, do-while, and for loops, Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative).	**10**
II	**Functions** Top-Down Design, Pre-defined Functions, Programmer - defined Functions, Local Variables and Global variables, Functions with Default Arguments, Call-By-Value and Call-By-Reference Parameters. **Introduction to Arrays** - Declaration and Referring Arrays, Arrays in Memory, Initializing Arrays. Arrays in Functions, Multi-Dimensional Arrays. **Structures** - Member Accessing, Pointers to Structures, Structures and Functions, Arrays of Structures. **Unions** - Declaration and Initialization. **Strings** - Reading and Writing Strings, Arrays of Strings, String and Function, Strings and Structure, Standard String Library Functions. **File Handling** - Use of files for data input and output, merging and copying files.	**10**
III	**Data Structure** - Basic concepts, Linear and Non-Linear data structures. **Algorithm Specification-** Introduction, Recursive algorithms, Data Abstraction, Performance analysis. **Linked List** - Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations. **Array** - Sparse matrices-array and linked representations. **Stack**- Operations, Array and Linked Implementations, **Applications:** Infix to Postfix Conversion, Postfix Expression Evaluation, and Recursion Implementation. **Queue**- Definition, Operations, Array and Linked Implementations. Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation.	**20**

IV	**Trees** - Representation of Trees, Binary tree, Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations, Binary Tree Traversals, Threaded Binary Trees. **Heap**- Definition, Insertion, Deletion **Search Trees** - Binary Search Trees, AVL Trees- Definition and Examples. **Graphs** - Graph ADT, Graph Representations, Graph Traversals, Searching.	**10**
V	**Hashing**- Introduction, Hash tables, Hash functions, Overflow Handling. **Searching Algorithms** - Linear Search, Binary Search. **Sorting Methods**: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, and Comparison of Sorting Methods. **Indian Contribution to the field :** Innovations in India, origin of Julia Programming Language, Indian Engineers who designed new programming languages, open source languages, Dr. Sartaj Sahni – computer scientist - pioneer of data structures, Other relevant contributors and contributions	**10**

Keywords/tags: Programming, C++, Data Structures, Expressions, Control, File Handling, Arrays, Stack, Queue, Linked List, Tree, Graph, Structure, Union, Hash, Search, Sort, Algorithm

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- Lipschutz: Schaum's outline series Data structures, Tata McGraw-Hill .
- Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015 .
- E. Balguruswamy, "C++" TMH Publication ISBN 0-07-462038-X
- Herbertz Shield, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7
- R. Lafore, 'Object Oriented Programming C++"
- N. Dale and C. Weems, Programming and problem solving with C++: brief edition, Jones & Bartlett Learning.
- Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning.
- Sartaj Sahani, Data Structures, Algorithms and Applications with C++, McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
- D.S. Malik, Data Structure using C++, Second edition, Cengage Learning.
- M. A. Weiss, Data structures and Algorithm Analysis in C, 2nd edition, Pearson.

Suggestive digital platform web links :

https://www.youtube.com/watch?v=BCIS40yzssA
https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en
https://www.youtube.com/watch?v=Umm1ZQ51tZw
https://www.youtube.com/watch?v=AT141CXUMKI&list=PLdo5 W4Nhv31bbKJzrsKfMpo grxuL18LU

Suggested equivalent online courses:

https://nptel.ac.in/courses/106/105/106105151/
https://nptel.ac.in/courses/106/106/106106133/

<table>
<tr><th colspan="5">Part-D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Internal Assessment: Continuous Comprehensive Evaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Test. The division of marks is as follows:</td><td colspan="2">External Assessment: University Exam (UE): 60 Marks
Time: 02:00 Hours</td></tr>
<tr><td>C. Submission of Assignment followed by Presentation</td><td colspan="2"></td><td>Section A: 05 MCQ Questions</td><td>05x01 = 05 Marks</td></tr>
<tr><td>D. Class Test</td><td>Best Two test marks 20 Marks</td><td rowspan="4">Best two test Marks 40 Marks</td><td rowspan="2">Section B: Five Short Questions (200 Words Each)</td><td rowspan="2">05x05 = 25 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td><td rowspan="2">Section C: Two Long Questions (500 Words Each)</td><td rowspan="2">02x15 = 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td></tr>
<tr><td>Total Internal Assessment (Theory) Marks (A+B)</td><td colspan="2">40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+ C)</td><td>60 Marks</td></tr>
<tr><td colspan="5">Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

B.Sc I Semester Computer Science
S1-06-PM : Programming Methodology Lab
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.Sc.	**Semester: I**	**Session: 2021-2022**
Subject: Computer Science			
Course Code: S1-06-PM	**Course Title: Programming Methodology Lab**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Minor**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming. 5. Possess ability to choose a data structure to suitably model any data used in computer applications. 6. Implementation of algorithms for searching and sorting.		
Credit value	**Practical- 2 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lab Practical's (in hours per week):		**2 Hrs. per week**	
Total no. of Labs:		**30 Hrs.**	

	Suggestive list of Practical's	**No. of Labs.**
	Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following: 1. a. To learn elementary techniques involving arithmetic operators and	

mathematical expressions, appropriate use of selection (if, switch, conditional operators) and control structures

b. Learn how to use functions and parameter passing in functions, writing recursive programs.

2. Write a program to swap the contents of two variables.
3. Write a program for finding the roots of a Quadratic Equation.
4. Write a program to find area of a circle, rectangle, square using switch case.
5. Write a program to check whether a given number is even or odd.
6. Write a program to print table of any number.
7. Write a program to print Fibonacci series.
8. Write a program to find factorial of a given number.
9. Write a program to convert decimal (integer) number into equivalent binary number.
10. Write a program to check given string is palindrome or not.
11. Write a program to perform multiplications of two matrices.
12. Write a program to print digits of entered number in reverse order.
13. Write a program to print sum of two matrices.
14. Write a program to print multiplication of two matrices.
15. Write a program to generate even/odd series from 1 to 100.
16. Write a program whether a given number is prime or not.
17. Write a program for call by value and call by reference.
18. Write a program to generate a series 1+1/1!+2/2!+3/3!+--- ---+n/n!
19. Write a program to create a pyramid structure

```
*
* *
* * *
* * * *
```

20. Write a program to create a pyramid structure

```
1
12
123
1234
```

21. Write a program to check entered number is Armstrong or not.
22. Write a program for traversing an Array.
23. Write a program to input N numbers add them and find average.
24. Write a program to find largest element from an array.
25. Write a program for Linear search.
26. Write a program for Binary search.
27. Write a program for Bubble sort.
28. Write a program for Selection sort.

Keywords/tags: Programming, C++, Data Structures, if, else, for, while, do, File Handling, call by value, call by reference, recursion, Arrays, Union, Hash, Linear search, Binary search, Bubble sort, Selection sort.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources
Suggested Readings: • Lipschutz: Schaum's outline series Data structures, Tata McGraw-Hill . • Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015. • E. Balguruswamy, "C++" TMH Publication ISBN 0-07-462038-X • Herbertz Shield, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7 • R. Lafore, 'Object Oriented Programming C++" • N. Dale and C. Weems, Programming and problem solving with C++: brief edition, Jones & Bartlett Learning. • Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning. • Sartaj Sahani, Data Structures, Algorithms and Applications with C++, McGraw Hill. • Robert L. Kruse, "Data Structures and Program Design in C++", Pearson. • D.S. Malik, Data Structure using C++, Second edition, Cengage Learning. • M. A. Weiss, Data structures and Algorithm Analysis in C, 2nd edition, Pearson. **Suggestive digital platform web links :** https://www.youtube.com/watch?v=BCIS40yzssA https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en https://www.youtube.com/watch?v=Umm1ZQ5ltZw https://nptel.ac.in/courses/106/106/106106127/
Suggested equivalent online courses: https://nptel.ac.in/courses/106/105/106105151/ https://nptel.ac.in/courses/106/105/106105171/ https://onlinecourses.swayam2.ac.in/cec 19 mg35/preview

Part-D: Assessment and Evaluation	
Internal Assessment (A):	**40 Marks**
Lab Record / Class interaction/ Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours) / Mini Project (Project Demo + Report))	20 Marks
End Semester External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

B.Sc I Semester Computer Science
S1-06-O-A : Computer System Architecture
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: B.Sc.**	**Semester: I**	**Session: 2021-22**
Subject: Computer Science			
Course Code: S1-06-O-A	**Course Title: Computer System Architecture**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Elective**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Understand the basic structure, operation and characteristics of digital computer. 2. Be able to design simple combinational digital circuits based on given parameters. 3. Familiarity with working of arithmetic and logic unit as well as the concept of pipelining. 4. Know about hierarchical memory system including cache memories and virtual memory. 5. Understand concept and advantages of parallelism, threading, multiprocessors and multicore processors. 6. Know the contributions of Indians in the field of computer architecture and related technologies.		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lectures (in hours per week):		**2 Hrs. per week**	
Total no. of Lectures:		**60 Hrs.**	

Para.	Topics	No. of Lectures
I	**Fundamentals of Digital Electronics:** Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Binary and other Codes, Error Detection Codes: Parity Check.	12

II	**Basic Computer Organization:** Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input - Output & Interrupts, Complete Computer Description & Design of Basic Computer. **Logic Gates**: Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits, simple combinational circuit design problems. **Circuits**- Adder- Subtractor, Multiplexer, Demultiplexer, Decoders, Encoders Flip-Flops, Registers, Counters.	20
III	**Instructions** - Instruction formats, Addressing modes, Machine language, Assembly language. **Flynn's classification** - Introduction to SISD, SIMD, MISD, MIMD	12
IV	**Memory and I/O Systems** - Peripheral Devices, I/O Interface. **Data Transfer Schemes** - Program Control, Interrupt, DMA Transfer. I/O Processor. **Memory Hierarchy**, Processor vs. Memory Speed, High-Speed Memories, Main memory, Auxiliary memory, Cache Memory, Virtual Memory.	12
V	**Indian contribution to the field** - Contributions of reputed scientists of Indian origin - like - Dr. Vinod Dham - Father of Intel Pentium Processor, Dr. Ajay Bhat - Co-Inventor of USB Technology, Dr. Vinod Khosla- co-founder of Sun Microsystems, Dr. Vijay P Bhatkar - architect of India's national initiative in supercomputing, and many others. **Parallel Computing projects of India** - PARAM, ANUPAM, FLOSOLVER, CHIPPS etc. Other relevant contributors and contributions.	04

Keywords/tags: Digital Electronics, Gates, Circuits, Addressing Modes, Memory Hierarchy, Multicore, Multithreading, SISD, SIMD, MISD, MIMD, PARAM, ANUPAM, FLOSOLVER, CHIPPS

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- M. Morris Mano, "Computer System Architecture", PHI.
- Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
- William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
- V. Carl Hamacher, "Computer Organization", TMH
- Tannenbaum, "Structured Computer Organization", PHI.

Suggestive digital platform web links :

https://www.youtube.com/watch?v=4TzMyXmzL8M
https://nptel.ac.in/courses/106/106/106106166/
https://nptel.ac.in/courses/106/106/106106134/

Suggested equivalent online courses:

https://nptel.ac.in/courses/106/105/106105163/

<table>
<tr><th colspan="5">Part-D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Internal Assessment: Continuous Comprehensive Evaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Test. The division of marks is as follows:</td><td colspan="2">External Assessment: University Exam (UE): 60 Marks
Time: 02:00 Hours</td></tr>
<tr><td>A. Submission of Assignment followed by Presentation</td><td colspan="2"></td><td>Section A: 05 MCQ Questions</td><td>05x01 = 05 Marks</td></tr>
<tr><td>B. Class Test</td><td>Best Two test marks 20 Marks</td><td rowspan="4">Best two test Marks 40 Marks</td><td rowspan="2">Section B: Five Short Questions (200 Words Each)</td><td rowspan="2">05x05 = 25 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td><td rowspan="2">Section C: Two Long Questions (500 Words Each)</td><td rowspan="2">02x15 = 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td></tr>
<tr><td>Total Internal Assessment (Theory) Marks (A+B)</td><td colspan="2">40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+ C)</td><td>60 Marks</td></tr>
<tr><td colspan="5">Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

B.Sc I Semester Computer Science
S1-06-O-B : Multimedia & Animation - I
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: B.Sc.**	**Semester: I**	**Session: 2021-22**
Subject: Computer Science			
Course Code: S1-06-O-B	**Course Title: Multimedia & Animation -I**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Elective**		
Pre-requisite (If any):	To study this course, a student must have prior basic knowledge of using computer and internet. This course is **open for all**.		
Course Learning Outcomes (CLO)	**On completion of this course, student will be able to:** 1. Describe the various elements and aspects of multimedia and animation. 2. Understand the role played by various multimedia platforms. 3. Learn to add pictures, graphics, sound and animation to prepare a project. 4. Learn the presentation skills and ideas with creativity by using multimedia tools. 5. Apply tools and techniques to create Text animation.		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lectures (in hours per week):	**2 Hrs. per week**	
Total no. of Lectures:	**60 Hrs.**	
Para.	**Topics**	**No. of Lectures**
I	**Introduction to Multimedia:** What is multimedia, Multimedia and Hypermedia, Components of multimedia-textual, images, graphics, animation, audio and video, Linear and Non-Linear Multimedia, Requirement of Multimedia System: Hardware & Software **Application of Multimedia:** Application of Multimedia and It's future's, Application of multimedia in different industries: Education, Entertainment, Journalism etc. Career in Multimedia Production.	**12**
II	**Virtual Reality:** Virtual Reality as a new technology in Multimedia,	**12**

	Applications of Virtual Reality, Introduction to HMD. **Multimedia Authoring Tools :** Multimedia Authoring, Multimedia Authoring Metaphors, Multimedia Production, Multimedia Presentation and tools, Automatic Authoring, Editing and Authoring Tools. Multimedia Hardware, Compression & Decompression.	
III	**Fonts and Hypertext:** Concept of plain text and formatted text, RTF & HTML Text, Usage of text in Multimedia, Families and faces of fonts, outline fonts, bitmap fonts, International character sets and hypertext, Digital font's techniques. **Graphics:** Graphics in Multimedia, Importance of Graphics in Multimedia, Raster and Vector Graphics, 2D Graphics.	**12**
IV	**Image Fundamental:** Introduction, Attributes of image: Size, Color, Bit Depth, Resolution etc., Image Capturing Methods: Scanner, Digital Camera etc., Image formats, Bitmap and Vector, Color Models, Color palettes, Image Compression and File Formats : GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing, Use of image editing software, Photo, Color Retouching, Image resolution.	**12**
V	**Audio fundamentals:** Sound in Multimedia, Importance of Sound In Multimedia and It's Attribute: tone, intensity, frequency, wavelength, pitch etc. Analog V/S digital Sound, Audio quality, formats and devices, Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, Sound synthesis, Musical Instrument Digital Interface (MIDI), wavetable, Compression and transmission of audio on Internet, Editing and adding sound to multimedia project, Audio software and hardware	**12**

Keywords/tags: Multimedia, Hardware, Software, Images, GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Video, Compression, MIDI, file formats.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- Tay Vaughan, "Multimedia Making It Works", Tata McGraw-Hill.
- Ze-Nian Li and Mark S. Drew "Fundamentals of Multimedia" Pearson Education International.
- Rajneesh Aggarwal & B. B Tiwari, "Multimedia Systems", Excel Publication, New Delhi
- Li & Drew, "Fundamentals of Multimedia", Pearson Education.
- Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill.
- M.Mahalakshmi, "Multimedia", Margham Publications,
- Pakhira, Malay K, "Computer Graphics, Multimedia and Animation", Prentice Hall India Pvt. Ltd.
- Liz Blazer "Animated Storytelling: Simple Steps for Creating Animation and Motion Graphics."
- Andy Beane "3D Animation Essentials" John Wiley.

<table>
<tr><td colspan="5">Suggestive digital platform web links :
• https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=7
• https://onlinecourses.swayam2.ac.in/cec21 cs18/preview
• https://onlinecourses.swayam2.ac.in/nou21_cs04/preview</td></tr>
<tr><td colspan="5">Suggested equivalent online courses:
https://www.classcentral.com/course/swayam-animations-13880</td></tr>
<tr><td colspan="5">Part-D: Assessment and Evaluation</td></tr>
<tr><td colspan="3">Internal Assessment: Continuous Comprehensive Evaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Test. The division of marks is as follows:</td><td colspan="2">External Assessment: University Exam (UE): 60 Marks
Time: 02:00 Hours</td></tr>
<tr><td>C. Submission of Assignment followed by Presentation</td><td colspan="2"></td><td>Section A: 05 MCQ Questions</td><td>05x01 = 05 Marks</td></tr>
<tr><td>D. Class Test</td><td>Best Two test marks 20 Marks</td><td rowspan="4">Best two test Marks 40 Marks</td><td rowspan="2">Section B: Five Short Questions (200 Words Each)</td><td rowspan="2">05x05 = 25 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td><td rowspan="2">Section C: Two Long Questions (500 Words Each)</td><td rowspan="2">02x15 = 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td></tr>
<tr><td>Total Internal Assessment (Theory) Marks (A+B)</td><td colspan="2">40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+ C)</td><td>60 Marks</td></tr>
<tr><td colspan="5">Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE
INDORE
(CENTER FOR EXCELLENCE)

Academic Year: 2021-2022

Affiliated to Devi Ahilya Vishwavidyalaya, Indore

Syllabus for B.Sc. II Semester

Computer Science

(Faculty of Computer Science)

DEPARTMENT OF COMPUTER SCIENCE

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE INDORE

Semester Syllabus for Undergraduates (Computer Science)

As recommended by Central Board of Studies of Computer Science and Approved by H E the Governor of M.P.

Academic Year: 2021-2022

Class: B.Sc. II Semester (Computer Science) for Regular Student

Govt. Holkar (Model Autonomous) Science College, Indore

Computer Science Department

Syllabus Session Year: 2021-22

Programme :Certificate in Science **Class :B.Sc II Semester**

S.No.	Paper	Paper Title	Paper Code	Theory Max. Marks 100				Practical Max. Marks 100				
				Credits	CCE	Exter. Asses.	Min Marks	Credits	Inter. Asses.	Exter. Asses.	Min. Mark.	Total Credit
1	Core Course	Programming Methodologies & Data Structures	S2-CSC1T	4	40	60	35	2	40	60	35	6
2	Minor	Computer System Architecture	S2-CSC2T	4	40	60	35	2	40	60	35	6
3	Open Elective	Programming Methodologies & Data Structures	S2-CSC3T	4	40	60	35	-	-	-	-	4
4	Open Elective	Multimedia & Animation- II	S2-CSC4T	4	40	60	35	-	-	-	-	4

B.Sc II Semester Computer Science
S2-06-I : Programming Methodologies & Data Structures
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: B.Sc.**	**Semester: II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: S2-06-I	**Course Title: Programming Methodologies & Data Structures**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming 5. Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles 6. Have knowledge of complexity of basic operations like insert, delete, and search on these data structures. 7. Possess ability to choose a data structure to suitably model any data used in computer applications. 8. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc. 9. Assess efficiency tradeoffs among different data structure implementations. 10. Implement and know the applications of algorithms for searching and sorting etc. 11. Know the contributions of Indians in the field of programming and data structures		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			

No. of Lectures (in hours per week):	2 Hrs. per week	
Total no. of Lectures:	60 Hrs.	
Para.	**Topics**	**No. of Lectures**
I	**Introduction to Programming** - Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies. **Introduction to C++ Programming** - Basic Program Structure In C++, Data Types, Variables, Constants, Operators and Basic I/O. **Variables** - Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise), Using Comments in programs, Character I/O (getc, getchar, putc, putchar etc.), Formatted and Console I/O (printf(), scanf(, cin, cout), Using Basic Header Files (stdio.h, iostream.h, conio.h etc.). **Simple Expressions in C++** (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions **Conditional Statements**- if construct, switch-case construct. **Iterative Statements** while, do-while, and for loops, Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative).	**10**
II	**Functions** Top-Down Design, Pre-defined Functions, Programmer - defined Functions, Local Variables and Global variables, Functions with Default Arguments, Call-By-Value and Call-By-Reference Parameters. **Introduction to Arrays** - Declaration and Referring Arrays, Arrays in Memory, Initializing Arrays. Arrays in Functions, Multi-Dimensional Arrays. **Structures** - Member Accessing, Pointers to Structures, Structures and Functions, Arrays of Structures. **Unions** - Declaration and Initialization. **Strings** - Reading and Writing Strings, Arrays of Strings, String and Function, Strings and Structure, Standard String Library Functions. **File Handling** - Use of files for data input and output, merging and copying files.	**10**
III	**Data Structure** - Basic concepts, Linear and Non-Linear data structures. **Algorithm Specification-** Introduction, Recursive algorithms, Data Abstraction, Performance analysis. **Linked List** - Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations. **Array** - Sparse matrices-array and linked representations. **Stack**- Operations, Array and Linked Implementations, **Applications:** Infix to Postfix Conversion, Postfix Expression Evaluation, and Recursion Implementation. **Queue**- Definition, Operations, Array and Linked Implementations. Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation.	**20**

IV	**Trees** - Representation of Trees, Binary tree, Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations, Binary Tree Traversals, Threaded Binary Trees. **Heap-** Definition, Insertion, Deletion **Search Trees** - Binary Search Trees, AVL Trees- Definition and Examples. **Graphs** - Graph ADT, Graph Representations, Graph Traversals, Searching.	**10**
V	**Hashing**- Introduction, Hash tables, Hash functions, Overflow Handling. **Searching Algorithms** - Linear Search, Binary Search. **Sorting Methods**: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, and Comparison of Sorting Methods. **Indian Contribution to the field :** Innovations in India, origin of Julia Programming Language, Indian Engineers who designed new programming languages, open source languages, Dr. Sartaj Sahni – computer scientist - pioneer of data structures, Other relevant contributors and contributions	**10**

Keywords/tags: Programming, C++, Data Structures, Expressions, Control, File Handling, Arrays, Stack, Queue, Linked List, Tree, Graph, Structure, Union, Hash, Search, Sort, Algorithm

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- Lipschutz: Schaum's outline series Data structures, Tata McGraw-Hill .
- Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015 .
- E. Balguruswamy, "C++" TMH Publication ISBN 0-07-462038-X
- Herbertz Shield, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7
- R. Lafore, 'Object Oriented Programming C++"
- N. Dale and C. Weems, Programming and problem solving with C++: brief edition, Jones & Bartlett Learning.
- Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning.
- Sartaj Sahani, Data Structures, Algorithms and Applications with C++, McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
- D.S. Malik, Data Structure using C++, Second edition, Cengage Learning.
- M. A. Weiss, Data structures and Algorithm Analysis in C, 2nd edition, Pearson.

Suggestive digital platform web links :

https://www.youtube.com/watch?v=BCIS40yzssA
https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en
https://www.youtube.com/watch?v=Umm1ZQ51tZw
https://www.youtube.com/watch?v=AT141CXUMKI&list=PLdo5 W4Nhv31bbKJzrsKfMpo grxuL18LU

Suggested equivalent online courses:

https://nptel.ac.in/courses/106/105/106105151/
https://nptel.ac.in/courses/106/106/106106133/

<table>
<tr><th colspan="5">Part-D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Internal Assessment: Continuous Comprehensive Evaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Test. The division of marks is as follows:</td><td colspan="2">External Assessment: University Exam (UE): 60 Marks
Time: 02:00 Hours</td></tr>
<tr><td>A. Submission of Assignment followed by Presentation</td><td colspan="2"></td><td>Section A: 05 MCQ Questions</td><td>05x01 = 05 Marks</td></tr>
<tr><td>B. Class Test</td><td>Best Two test marks 20 Marks</td><td rowspan="4">Best two test Marks 40 Marks</td><td rowspan="2">Section B: Five Short Questions (200 Words Each)</td><td rowspan="2">05x05 = 25 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td><td rowspan="2">Section C: Two Long Questions (500 Words Each)</td><td rowspan="2">02x15 = 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td></tr>
<tr><td>Total Internal Assessment (Theory) Marks (A+B)</td><td colspan="2">40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+ C)</td><td>60 Marks</td></tr>
<tr><td colspan="5">Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

B.Sc II Semester Computer Science
S2-06-PI : Programming Methodology Lab
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.Sc.	**Semester: II**	**Session: 2021-2022**
Subject: Computer Science			
Course Code: S2-06-PI	**Course Title: Programming Methodology Lab**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming. 5. Possess ability to choose a data structure to suitably model any data used in computer applications. 6. Implementation of algorithms for searching and sorting.		
Credit value	**Practical- 2 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lab Practical's (in hours per week):		**2 Hrs. per week**
Total no. of Labs:		**30 Hrs.**
	Suggestive list of Practical's	**No. of Labs.**
	Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following: 1. a. To learn elementary techniques involving arithmetic operators and	

mathematical expressions, appropriate use of selection (if, switch, conditional operators) and control structures

b. Learn how to use functions and parameter passing in functions, writing recursive programs.

2. Write a program to swap the contents of two variables.
3. Write a program for finding the roots of a Quadratic Equation.
4. Write a program to find area of a circle, rectangle, square using switch case.
5. Write a program to check whether a given number is even or odd.
6. Write a program to print table of any number.
7. Write a program to print Fibonacci series.
8. Write a program to find factorial of a given number.
9. Write a program to convert decimal (integer) number into equivalent binary number.
10. Write a program to check given string is palindrome or not.
11. Write a program to perform multiplications of two matrices.
12. Write a program to print digits of entered number in reverse order.
13. Write a program to print sum of two matrices.
14. Write a program to print multiplication of two matrices.
15. Write a program to generate even/odd series from 1 to 100.
16. Write a program whether a given number is prime or not.
17. Write a program for call by value and call by reference.
18. Write a program to generate a series 1+1/1!+2/2!+3/3!+--- ---+n/n!
19. Write a program to create a pyramid structure

```
*
* *
* * *
* * * *
```

20. Write a program to create a pyramid structure

```
1
12
123
1234
```

21. Write a program to check entered number is Armstrong or not.
22. Write a program for traversing an Array.
23. Write a program to input N numbers add them and find average.
24. Write a program to find largest element from an array.
25. Write a program for Linear search.
26. Write a program for Binary search.
27. Write a program for Bubble sort.
28. Write a program for Selection sort.

Keywords/tags: Programming, C++, Data Structures, if, else, for, while, do, File Handling, call by value, call by reference, recursion, Arrays, Union, Hash, Linear search, Binary search, Bubble sort, Selection sort.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources	
Suggested Readings: • Lipschutz: Schaum's outline series Data structures, Tata McGraw-Hill . • Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015. • E. Balguruswamy, "C++" TMH Publication ISBN 0-07-462038-X • Herbertz Shield, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7 • R. Lafore, 'Object Oriented Programming C++" • N. Dale and C. Weems, Programming and problem solving with C++: brief edition, Jones & Bartlett Learning. • Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning. • Sartaj Sahani, Data Structures, Algorithms and Applications with C++, McGraw Hill. • Robert L. Kruse, "Data Structures and Program Design in C++", Pearson. • D.S. Malik, Data Structure using C++, Second edition, Cengage Learning. • M. A. Weiss, Data structures and Algorithm Analysis in C, 2nd edition, Pearson. **Suggestive digital platform web links :** https://www.youtube.com/watch?v=BCIS40yzssA https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en https://www.youtube.com/watch?v=Umm1ZQ5ltZw https://nptel.ac.in/courses/106/106/106106127/	
Suggested equivalent online courses: https://nptel.ac.in/courses/106/105/106105151/ https://nptel.ac.in/courses/106/105/106105171/ https://onlinecourses.swayam2.ac.in/cec 19 mg35/preview	
Part-D: Assessment and Evaluation	
Internal Assessment (A):	**40 Marks**
Lab Record / Class interaction/ Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours) / Mini Project (Project Demo + Report))	20 Marks
End Semester External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

B.Sc. II Semester Computer Science
S2-06-M : Computer System Architecture
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: B.Sc.**	**Semester: II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: S2-06-M	**Course Title: Computer System Architecture**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Minor**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Understand the basic structure, operation and characteristics of digital computer. 2. Be able to design simple combinational digital circuits based on given parameters. 3. Familiarity with working of arithmetic and logic unit as well as the concept of pipelining. 4. Know about hierarchical memory system including cache memories and virtual memory. 5. Understand concept and advantages of parallelism, threading, multiprocessors and multicore processors. 6. Know the contributions of Indians in the field of computer architecture and related technologies.		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lectures (in hours per week):		**2 Hrs. per week**	
Total no. of Lectures:		**60 Hrs.**	

Para.	Topics	No. of Lectures
I	**Fundamentals of Digital Electronics:** Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Binary and other Codes, Error Detection Codes. **Basic Computer Organization:** Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory	15

	Reference Instruction, Input - Output & Interrupts, Complete Computer Description & Design of Basic Computer. **Logic Gates**: Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits, simple combinational circuit design problems.	
II	**Circuits**- Adder- Subtractor, Multiplexer, Demultiplexer, Decoders, Encoders Flip-Flops, Registers, Counters. **Instructions** - Instruction formats, Addressing modes, Instruction codes, Machine language, Assembly language. **Register Transfer and Micro operations** - Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro operations Logic Micro-operations, Shift Micro-operations.	**15**
III	**Processor and Control Unit** - Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, Introductory concept of RISC, CISC, advantages and disadvantages of both. **Pipelining** - concept of pipelining, introduction to Pipelined data path and control – Handling Data hazards & Control hazards. **Parallelism** - meaning, types of parallelism, introduction to Instruction level-parallelism, Parallel processing challenges, Applications.	**12**
IV	**Memory and I/O Systems** - Peripheral Devices, I/O Interface, **Data Transfer Schemes** - Program Control, Interrupt, DMA Transfer. I/O Processor. **Memory Hierarchy**, Processor vs. Memory Speed, High-Speed Memories, Main memory, Auxiliary memory, Cache Memory, Associative Memory, Interleaving, Virtual Memory, Memory Management.	**10**
V	**Flynn's classification** - Introduction to SISD, SIMD, MISD, MIMD **Hardware multithreading** - Introduction, types, advantages and applications. **Multicore processors** – Introduction, advantages, difference from multiprocessor. **Indian contribution to the field** - Contributions of reputed scientists of Indian origin - like - Dr. Vinod Dham - Father of Intel Pentium Processor, Dr. Ajay Bhat - Co-Inventor of USB Technology, Dr. Vinod Khosla- co-founder of Sun Microsystems, Dr. Vijay P Bhatkar - architect of India's national initiative in supercomputing, and many others. **Parallel Computing projects of India** - PARAM, ANUPAM, FLOSOLVER, CHIPPS etc. Other relevant contributors and contributions.	**8**
Keywords/tags Digital Electronics, Gates, Circuits, Instruction Formats, Addressing Modes, Parallelism, Pipelining, Memory Hierarchy, Multicore, Multithreading, SISD, SIMD, MISD, MIMD, PARAM, ANUPAM, FLOSOLVER, CHIPPS.		
Part-C: Learning Resources		
Text Books, Reference Books, Other Resources		

Suggested Readings:

- M. Morris Mano, "Computer System Architecture", PHI.
- Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
- William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
- V. Carl Hamacher, "Computer Organization", TMH
- Tannenbaum, "Structured Computer Organization", PHI.

Suggestive digital platform web links :

https://www.youtube.com/watch?v=4TzMyXmzL8M
https://nptel.ac.in/courses/106/106/106106166/ https://nptel.ac.in/courses/106/106/106106134/

Suggested equivalent online courses:

https://nptel.ac.in/courses/106/105/106105163/

Part-D: Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE): **40 Marks** Shall be based on allotted assignments and Class Test. The division of marks is as follows:			**External Assessment:** University Exam **(UE): 60 Marks** **Time: 02:00** Hours	
C. **Submission of Assignment followed by Presentation**			**Section A**: 05 MCQ Questions	05x01 = 05 Marks
D. **Class Test**	**Best Two test marks 20 Marks**	**Best two test Marks 40 Marks**	**Section B:** Five Short Questions (200 Words Each)	05x05 = 25 Marks
Test I (Written Test)	20 Marks			
Test I (Written Test)	20 Marks		**Section C:** Two Long Questions (500 Words Each)	02x15 = 30 Marks
Test III (Quiz/ Seminar/ Assignment)	20 Marks			
Total Internal Assessment (Theory) Marks (A+B)	**40 Marks**		Total External Evaluation (Theory) Marks (A+B+ C)	**60 Marks**

Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.

B.Sc. II Semester Computer Science
S2-06-PM : Computer Architecture Lab
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.Sc.	**Semester: II**	**Session: 2021-2022**
Subject: Computer Science			
Course Code: S2-06-PM	**Course Title: Computer Architecture Lab**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Minor**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Realization of the basic logic and universal gates. 2. Verify the behavior of logic gates using truth tables. 3. Implement Binary-to-Gray, Gray-to-Binary code conversions 4. Design half and full adder circuit using basic gates. 5. Knowledge of Office Tools.		
Credit value	**Practical- 2 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lab Practical's (in hours per week):	**2 Hrs. per week**	
Total no. of Labs:	**30 Hrs.**	
	Suggestive list of Practicals	**No. of Labs.**
	1. To study basic gates (AND, OR, NOT) and verify their truth tables. 2. To study and verify NAND as Universal gate. 3. To study half adder using basic gates and verify its truth table. 4. To study Full Adder using basic gates and verify its truth table. 5. To design and construct RS flip Flop using gates and verifies the truth table. 6. To verify DeMorgan's Theorem. **Office Tools** **Using a Text Editor Tool** 1. Create a document and apply different Editing options.	

2. Create Banner for your college.
3. Design a Greeting Card using Word Art for different festivals.
4. Design your Bio data and use page borders and shading.
5. Create a document and insert header and footer, page title, date, time, apply various page formatting features etc.
6. Implement Mail Merge.
7. Insert a table into a document and try different formatting options for the table.

Using a Spreadsheet Tool

1. Design your class Time Table.
2. Prepare a Mark Sheet of your class result.
3. Prepare a Salary Slip of an employee of an organization.
4. Prepare a bar chart & pie chart for analysis of Election Results.
5. Prepare a generic Bill of a Super Market. 6. Work on the following exercises on a Workbook:
    a. Copy an existing Sheet
    b. Rename the old Sheet
    c. Insert a new Sheet into an existing Workbook
    d. Delete the renamed Sheet.
7. Prepare an Attendance sheet of 10 students for any 6 subjects of your syllabus. Calculate their total attendance, total percentage of attendance of each student & average of attendance.
8. Create a worksheet of Students list of any 4 faculties and perform following database functions on it.
    a. Sort data by Name
    b. Filter data by Class
    c. Subtotal of no. of students by Class.

Using a Presentation Tool

1. Design a presentation of your institute using auto content wizard, design template and blank presentation.
2. Design a presentation illustrating insertion of pictures, Word Art and ClipArt. Design a presentation, learn how to save it in different formats, copying and opening an existing presentation.
3. Design a presentation illustrating insertion of movie, animation and sound.
4. Illustrate use of custom animation and slide transition (using different effects)
5. Design a presentation using charts and tables of the marks obtained in class.

Keywords/tags: Digital Electronics, Logic Gates, AND, OR, NOT, NANAD, NOR, Circuits , DeMorgan's Theorem, Office Tools.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- M. Morris Mano, "Computer System Architecture", PHI.
- Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
- William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
- V. Carl Hamacher, "Computer Organization", TMH
- Tannenbaum, "Structured Computer Organization", PHI.

Suggestive digital platform web links :

https://www.youtube.com/watch?v=4TzMyXmzL8M
https://nptel.ac.in/courses/106/106/106106166/
https://nptel.ac.in/courses/106/106/106106134/

Suggested equivalent online courses:

https://nptel.ac.in/courses/106/105/106105163/

Part-D: Assessment and Evaluation

Internal Assessment (A):	**40 Marks**
Lab Record / Class interaction/ Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours) / Mini Project (Project Demo + Report))	20 Marks
End Semester External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

B.Sc II Semester Computer Science
S2-06-O-A : Programming Methodologies & Data Structures
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: B.Sc.**	**Semester: II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: S2-06-O-A	**Course Title: Programming Methodologies & Data Structures**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Elective**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming 5. Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles 6. Possess ability to choose a data structure to suitably model any data used in computer applications. 7. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc. 8. Assess efficiency tradeoffs among different data structure implementations.		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lectures (in hours per week):		**2 Hrs. per week**	
Total no. of Lectures:		**60 Hrs.**	

Para.	**Topics**	**No. of Lectures**

I	**Introduction to Programming** - Program Concept, Algorithms, Flowcharts, Types of Programming Methodologies. **Introduction to C++ Programming** - Basic Program Structure In C++, Tokens in C++, **Conditional Statements**- if construct, switch-case construct.	10
II	**Iterative Statements** while, do-while, and for loops, Use of break and continue in Loops. **Functions:** Introduction, Pre-defined & User- defined Functions, Local Variables and Global variables, Call-By-Value and Call-By-Reference Parameters, Recursion.	10
III	**Introduction to Arrays** - Declaration and Referring Arrays, Arrays in Memory, Initializing Arrays, Arrays in Functions, Multi-Dimensional Arrays. **Structures** - Member Accessing, Pointers to Structures, Structures and Functions, Arrays of Structures.	12
IV	**Data Structure** - Basic concepts, Linear and Non-Linear data structures. **Linked List** - Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Singly linked lists, Doubly Linked Lists- Operations. **Stack**- Definition, Operations, Array and Linked Implementations, Applications of Stack. **Queue**- Definition, Operations, Array and Linked Implementations. Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Introduction.	14
V	**Trees** - Introduction, Binary tree, Properties of Binary Trees, Binary Tree Representations- Array and Linked Representations, Binary Tree Traversals. **Search Trees** - Binary Search Trees, AVL Trees- Definition and Examples. **Graphs** - Graph ADT, Graph Representations, Graph Traversals, Searching. **Indian Contribution to the field** : Innovations in India, origin of Julia Programming Language, Indian Engineers who designed new programming languages, open source languages, Dr. Sartaj Sahni – computer scientist - pioneer of data structures, Other relevant contributors and contributions	14

Keywords/tags: Programming, C++, Data Structures, Expressions, Control, Arrays, Stack, Queue, Linked List, Tree, Structure, Algorithm, Flowchart

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- Lipschutz: Schaum's outline series Data structures, Tata McGraw-Hill .
- Problem Solving and Program Design in C, J. R. Hanly and E. B. Koffman, Pearson, 2015 .
- E. Balguruswamy, "C++" TMH Publication ISBN 0-07-462038-X
- Herbertz Shield, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7
- R. Lafore, 'Object Oriented Programming C++"
- N. Dale and C. Weems, Programming and problem solving with C++: brief edition, Jones & Bartlett Learning.

- Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning.
- Sartaj Sahani, Data Structures, Algorithms and Applications with C++, McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
- D.S. Malik, Data Structure using C++, Second edition, Cengage Learning.
- M. A. Weiss, Data structures and Algorithm Analysis in C, 2nd edition, Pearson.

Suggestive digital platform web links :

https://www.youtube.com/watch?v=BCIS40yzssA
https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en
https://www.youtube.com/watch?v=Umm1ZQ51tZw
https://www.youtube.com/watch?v=AT141CXUMKI&list=PLdo5 W4Nhv31bbKJzrsKfMpo grxuL18LU

Suggested equivalent online courses:

https://nptel.ac.in/courses/106/105/106105151/
https://nptel.ac.in/courses/106/106/106106133/

Part-D: Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE): **40 Marks** Shall be based on allotted assignments and Class Test. The division of marks is as follows:			**External Assessment:** University Exam **(UE): 60 Marks** **Time: 02:00** Hours	
A. **Submission of Assignment followed by Presentation**			**Section A**: 05 MCQ Questions	05x01 = 05 Marks
B. **Class Test**	**Best Two test marks 20 Marks**	**Best two test Marks 40 Marks**	**Section B:** Five Short Questions (200 Words Each)	05x05 = 25 Marks
Test I (Written Test)	20 Marks			
Test I (Written Test)	20 Marks		**Section C:** Two Long Questions (500 Words Each)	02x15 = 30 Marks
Test III (Quiz/ Seminar/ Assignment)	20 Marks			
Total Internal Assessment (Theory) Marks (A+B)	**40 Marks**		Total External Evaluation (Theory) Marks (A+B+ C)	**60 Marks**

Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.

B.Sc II Semester Computer Science
S2-06-O-B : Multimedia & Animation - II
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: B.Sc.**	**Semester: II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: S2-06-O-B	**Course Title: Multimedia & Animation : II**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Elective**		
Pre-requisite (If any):	To study this course, a student must have prior basic knowledge of using computer and internet. This course is **open for all**.		
Course Learning Outcomes (CLO)	**On completion of this course, student will be able to:** 1. Describe the various elements and aspects of multimedia and animation. 2. Understand the role played by various multimedia platforms. 3. Learn to add pictures, graphics, sound and animation to prepare a project. 4. Learn the presentation skills and ideas with creativity by using multimedia tools. 5. Apply tools and techniques to create basic 2D and 3D animation.		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lectures (in hours per week):	**2 Hrs. per week**	
Total no. of Lectures:	**60 Hrs.**	
Para.	**Topics**	**No. of Lectures**
I	**Video Fundamental:** Video basics, Formats, how video works, Types of video signals - component, composite and S-video, Analog video, Digital video, Broadcast Video Standards (NTSC, PAL), Video Recording and Tape formats, Shooting and editing Video, Video compression and File formats (JPEG, MPEG), Video software and hardware.	**12**
II	**Animation:** Introduction and definition of animation, Principles, Types and uses, Methods and Techniques of animation, Basic animation, Text and image	**12**

	animation, Time line construction and management, Masking Motion and shape Tweening, Morphing, Onion skinning, Animation File Formats, Keyframe animation, Working with symbols and Animation Software.	
III	**Basic 2D and 3D animation**: Overview of 2D animation and its features, Drawing tools, types of panels, transformation, property panel, working with objects, group, bitmap, Controlling Movie clips with code, Working with Dynamic Text fields and Input Text Fields, Loading external content and other movies, Dynamic preloaders, Interactivity with code, Difference between 2D and 3D animation, Tweening and motion along a path, Controlling movie playback, Text and hyperlink, adding sound and movie. Introduction to 3D animation and its basic concepts, and its applications.	**12**
IV	**CorelDraw**: Introduction to Corel Draw, Usages and Advantages, Introduction to user interface, Introduction to tool panel and workspaces, Introduction of various size and formats of panels and layouts, file layouts and layout properties, Objects and Using color profiles.	**12**
V	**CorelDraw Tools:** Text tools and text properties, Creating Vector graphics by using editing tools, Importing Image and Graphics in Corel draw layout, Creating Shapes and editing shapes, Drawing curves and editing curves, Creating special text effects, Creating Special Object effects, Using Color effects.	**12**

Keywords/tags: Video, Compression, Animation, Tweening, Morphing, controlling movie clips, transformation, 2D, 3D, Corel Draw, file formats.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- Tay Vaughan, "Multimedia Making It Works", Tata McGraw-Hill.
- Ze-Nian Li and Mark S. Drew "Fundamentals of Multimedia" Pearson Education International.
- Rajneesh Aggarwal & B. B Tiwari, "Multimedia Systems", Excel Publication, New Delhi
- Li & Drew, "Fundamentals of Multimedia", Pearson Education.
- Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill.
- M.Mahalakshmi, "Multimedia", Margham Publications,
- Pakhira, Malay K, "Computer Graphics, Multimedia and Animation", Prentice Hall India Pvt. Ltd.
- Liz Blazer "Animated Storytelling: Simple Steps for Creating Animation and Motion Graphics."
- Andy Beane "3D Animation Essentials" John Wiley.
- Lp Editorial Board ,"Learn Corel Draw 11" BPB Publication.
- Gray David Bouton, " Corel Draw the official Guide", Corel Press

Suggestive digital platform web links :

- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=7

<table>
<tr><td colspan="5">

- https://onlinecourses.swayam2.ac.in/cec21 cs18/preview
- https://onlinecourses.swayam2.ac.in/nou21_cs04/preview

</td></tr>
<tr><td colspan="5">Suggested equivalent online courses:
https://www.classcentral.com/course/swayam-animations-13880</td></tr>
<tr><td colspan="5">Part-D: Assessment and Evaluation</td></tr>
<tr><td colspan="3">Internal Assessment: Continuous Comprehensive Evaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Test. The division of marks is as follows:</td><td colspan="2">External Assessment: University Exam (UE): 60 Marks
Time: 02:00 Hours</td></tr>
<tr><td>C. Submission of Assignment followed by Presentation</td><td colspan="2"></td><td>Section A: 05 MCQ Questions</td><td>05x01 = 05 Marks</td></tr>
<tr><td>D. Class Test</td><td>Best Two test marks 20 Marks</td><td rowspan="4">Best two test Marks 40 Marks</td><td rowspan="2">Section B: Five Short Questions (200 Words Each)</td><td rowspan="2">05x05 = 25 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td><td rowspan="2">Section C: Two Long Questions (500 Words Each)</td><td rowspan="2">02x15 = 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td></tr>
<tr><td>Total Internal Assessment (Theory) Marks (A+B)</td><td colspan="2">40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+ C)</td><td>60 Marks</td></tr>
<tr><td colspan="5">Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE
INDORE
(CENTER FOR EXCELLENCE)

Academic Year: 2021-2022

Affiliated to Devi Ahilya Vishwavidyalaya, Indore

Syllabus for B.Sc. (Yearly)

Computer Science

(Faculty of Computer Science)

DEPARTMENT OF COMPUTER SCIENCE

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE INDORE

Yearly Syllabus for Undergraduates (Computer Science)

As recommended by Central Board of Studies of Computer Science and Approved by H E the Governor of M.P.

Academic Year: 2021-2022

Class: B.Sc. II year (Computer Science) for Regular Student

Govt. Holkar (Model Autonomous) Science College, Indore									
Computer Science Department									
Syllabus: Session Year 2021-22									
Programme :B.Sc.								Class :B.Sc. IIYEAR	
Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Min. Mark	CCE	Min. Mark	Total Minimum	Maximum	Minimum
Paper -1	Object Oriented Programming Concept using C++	206-I	40	28	10	3	33	50	17
Paper -2	Data structures	206-II	40		10	3			

Remark :

I. Each theory paper will contain five objective type question of 1 mark.
Five descriptive answer type question of 7 marks.

B.Sc. II year Computer Science
Paper-I : Object Oriented Programming Concept using C++
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: B.Sc.**	**year: II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: 206-I	**Course Title:** Object Oriented Programming Concept using C++		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Introduction to C++, key concepts of object oriented programming, unformatted & formatted console I/O oprations. 2. parts of C++ program, tokens, oprators, Control structures. 3. Functions, function overloading, demonstration of Classes and objects, implementing abstraction using access specifiers. 4. Operator overloading, reusing code through Inheritance and its types. 5. Pointer & Arrays of classes, implementing Polymorphism, Template, Handling Exceptions		

B.Sc II Year COMPUTER SCIENCE

PAPER I : OBJECT ORIENTED PROGRAMMING CONCEPT USING C++

Academic Year: 2021-2022

MAX. MARKS: 40 **MIN. MARKS: 14**

UNIT- I

Introduction to C++: Programming paradigms , key concepts of object oriented programming ,advantage of Oop's. Input and output in C++: pre-defined streams, unformatted console I/O operations , formatted console I/O oprations .

UNIT- II

C++ declarations : parts of C++ program, types of tokens , keywords ,identifiers ,data types ,constants, operator ,precedence of oprators, refencing and derefrencing oprator ,scope access oprator. Control structures: decision making statements, looping statements.

UNIT- III

Functions : main(), parts of function, passing arguments : value, address ,refrence ,inline functions,function overloading :principles, precautions,library functions,Classes and objects: declaring classes and objects,accessing class members,keyword:public,private,protected,defining member functions:member function inside the class ,member function outside the class ,static member variables and functions ,friend function, friend classes ,overloading member functions .

UNIT- IV

Constructor and Destructor: cheracterisitcs, applications, constructor with arguments ,overloading constructors ,types of constructors ,Operator overloading : overloading unary operator ,binary operator. Inheritance :access specifiers : public inheritance,private inheritances ,protected data with private inheritance, Types of inheritance :single,multiple,hierarchical ,multilevel,hybrid ,multi-path ,virtual base class .

UNIT- V

Pointer & Arrays : pointer declaration, pointer to class & object ,Array : declaration and initialization, array of classes. Polymorphism:Static (Early)binding ,Dynamic (Late) binding ,virtual function ,pure virtual function. Template, Exceptoin handling.

Text book :

Object-Oriented Programming with ANSI & Turbo C++ by Ashok N. kamathane .
Object-Oriented Programming in C++ by E. Balagurusamy.

Referance Books:

C++ The complete reference by Herbert Schildt,TMH publication .
Object Oriented Programming in C++ Robert Lafore.

Suggested list of programs for practical

1.Write a program to find average of 3 numbers.
2. Write a program to find biggest among 3 numbers.
3. Write a menu driven program (Switch case) to perform arithmetic operations.
4. Write a program to check whether entered number is Prime or not..
5, Write a program to check whether entered number is even or odd.
6. Write a program for addition two matrices.
7. Write a program for multiplication of two matrices.
8. Write a program to find transpose of a matric.
9. Write a program to print

```
*
**
***
****
```

10. Write a program to print

```
1
2 2
3 3 3
```

11. Write a program to print

```
1
2 3
4 5 6
```

12. Write a program to check whether entered string is palindrome or not.
13. Write a program to print Fibonacci series .
14. Write a program to find factorial of given number.
15. Write a program to demonstrate use of static data member.
16. Write a program to demonstrate use of static member function.
17. Write a program to create array of objects.
18. Write a program to demonstrate use of friend function.
19. Write a program to illustrate use of copy constructor.
20.Write a program to demonstrate constructor overloading.
21. Write a program to illustrate use of destructor.
22. Write a program to overload a unary operator.
23. Write a program to overload to binary operator.
24. Write a program to demonstrate single inheritance.
25. Write a program to demonstrate multiple inheritance.
26. Write a program to demonstrate multilevel inheritance.
27.. Write a program to demonstrate hierarchical inheritance.
28. Write a program to demonstrate hybrid inheritance.
29. Write a program to demonstrate the use of function overloading.
30. Write a program to demonstrate the use of Inline member function.
31. Write a program to demonstrate the use of Parameterized constructor.

B.Sc. II Year COMPUTER SCIENCE
PAPER II : DATA STRUCTURE
Academic Year: 2021-2022

MAX. MARKS: 40 **MIN. MARKS: 14**

Part-A Introduction			
Program: Diploma	**Class: B.Sc.**	**year: II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: 206-II	**Course Title: DATA STRUCTURE**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Introduction to stack ,stack application ,introduction to queues ,applicatons of queue . 2. Introduction to linked list, dynamic m/r allocation 3. Concept of non-linear data structure, Tree-basic terminology, Applications of binary tree 4. Searching and sorting techniques, analysis of various searching and sorting algorithms, algorithm design. 5. Introduction to Graphs, graph traversal, shortest path algorithm, hashing		

B.Sc. II Year COMPUTER SCIENCE
PAPER II : DATA STRUCTURE
Academic Year: 2021-2022

MAX. MARKS: 40 **MIN. MARKS: 14**

UNIT- I

Concepts of data structure, abstract data structure , introduction to stack and primitive oprations on stack ,stack as an abstract data type ,stack application : infix,prefix,postfix and recursion ,introduction to queues ,primitive opration on queues, circular queue,dequeue , priority queue and applicatons of queue .

UNIT- II

Introduction to linked list , basic opration on linked list ,stack and queue using linked list ,doubly linked list ,circular linked list , applications of linked list.

UNIT- III

Tree-basic terminology , binary trees, tree representations as array and linked list, basic oprations on binary tree, traversal of binary trees : - inorder ,preorder,postorder, Applications of binary tree,threaded binary tree ,AVL tree , intorduction to B and B+ Tree.

UNIT- IV

Sequential search , binary search , insertion sort , selection sort , quick sort , bubble sort, heap sort ,comparision of sorting methods, analysis of searching and shorting algorithms.

UNIT- V

Hash Table, collision resolution technique, Introduction to Graphs , Definitions ,terminology ,directed ,undiredted and Weighted Graph, representation of graph ,graph traversal-Depth first , Breadth first search ,spanning tree , minimum spanning tree, shortest path algorithm.

Text book :

Data Structure : By Lipschultz (Schaums outline Series)
Data Structure through C (A practical Approach) by G.S. Baluja
Data Structure : By trembley & Sorrenson

Referance Books:

Fundamnetal of Data Structure By S.Sawhney & E.Horowitz

Suggested list of programs for practical

1. Write a program to find factorial of given number using recursion.
2. Write a program for bubble sorting.
3. Write a program for linear search.
4. Write a program for binary search.
5, Write a program selection sorting.
6. Write a program for quick sorting.
7. Write a program for insertion sorting..
8. Write a program to print Fibonacci series using recursion
9. Write a program to perform insertion and deletion operation in stack.
10. Write a program to perform insertion and deletion operation in the queue using static implementation.
11. Write a program to perform insertion and deletion operation in the queue using dynamic Implementation.
12. Write a program to insert a node at the beginning in singly linked list.
13. Write a program to insert a node at the middle in the singly linked list.
14. Write a program to insert a node at the last in the singly linked list .
15. Write a program to delete a node from the beginning in singly linked list.
16. Write a program to delete a node from the middle in the singly linked list.
17. Write a program to delete a node from the last in the singly linked list.
18. Write a program to traverse all nodes in singly link list .
19. Write a program to insert a node in the beginning in the circular link list.
20. Write a program to insert a node at the last circular link list .
21. Write a program to perform all the insertion operations in the singly link list using switch case.
22. Write a program to perform all the deletion operations in the singly link list using switch case.
23. Write a program to count the number of nodes in binary tree.
24. Write a program to evaluate postfix operation.
25. Write a program to convert infix operation to postfix operation.

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE INDORE

Yearly Syllabus for Undergraduates (Computer Science)

As recommended by Central Board of Studies of Computer Science and Approved by H E the Governor of M.P.

Academic Year: 2021-2022

Class: B.Sc. III year (Computer Science) for Regular Student

Govt. Holkar (Model Autonomous) Science College, Indore									
Computer Science Department									
Syllabus: Session Year 2021-22									
Programme :B.Sc.								**Class :B.Sc. IIIYEAR**	
Paper	**Title of the paper**	**Paper Code**	**Theory**					**Practical**	
			External	**Min. Mark**	**CCE**	**Min. Mark**	**Total Minimum**	**Maximum**	**Minimum**
Paper -1	Database Management System	306-I	40	28	10	3	33	50	17
Paper -2	Operating System Concept	306-II	40		10	3			
Internship		Report		Viva		Maximum Marks		Minimum Marks	
		50		50		100		33	

Remark :

I. Each theory paper will contain five objective type question of 1 mark

II. Five descriptive answer type question of 7 marks.

B.Sc. III Year COMPUTER SCIENCE
PAPER II : DATABASE MANAGEMENT SYSTEM

Academic Year: 2021-2022

MAX. MARKS: 40 **MIN. MARKS: 14**

Part-A Introduction			
Program: Diploma	**Class: B.Sc.**	**year: III**	**Session: 2021-22**
Subject: Computer Science			
Course Code: 306-I	**Course Title: DATABASE MANAGEMENT SYSTEM**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Demonstrate the basic elements of a relational database management system. 2. Identify the data models for relevant problems. 3. Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data. 4. Demonstrate their understanding of key notions of query evaluation and optimization techniques. 5. Extend normalization for the development of application software's.		

B.Sc. III YEAR COMPUTER SCIENCE
PAPER 1: DATABASE MANAGEMENT SYSTEM
Academic Year: 2021-2022

MAX. MARKS: 40 **MIN. MARKS: 14**

UNIT- I

Purpose of database system, views of data, data models: relation, network, hierarchical, instances and schemas, data dictionary, types of database languages: -DDL, DML, structure of DBMS, advantages and disadvantages of DBMS, 3-level architecture proposal:- external, conceptual & internal levels.

UNIT- II

Entity relationship model as a tool of conceptual design: entities & entities set, relationship and relationship set, attributes and mapping constraints, keys, ER diagram:-strong and week entities, generalization, specialization & aggregation, reducing ER diagram to tables.

UNIT- III

Fundamentals of set theoretical notations: relation, domains, attributes, tuples, concept of keys: primary key, super key, alternate key, candidate key, foreign key, fundamentals of integrity rules: entity & referential integrity, extension and intention, relation algebra: select, project, Cartesian product, different types of joins: theta, equi, natural, outer joins, set operations.

UNIT- IV

Functional Dependencies, Good & Bad Decomposition and Anomalies as a database: A consequences of bad design, Universal relation, Normalization: 1NF, 2NF, 3NF & BCNF normal forms, multivalued dependency, join dependency, 4NF, 5NF.

UNIT- V

SQL: Creating tables, adding constraints, altering tables, update, insert, delete, and various forms of select.
Transaction: concepts of transactions, ACID properties, states of transactions, concurrency control problem and concurrency control.
Basic concepts: - Indexing and Hashing, B-tree Index files, Hashing: Static & Dynamic hash function, Index Definition in SQL: Multiple key accesses.

Text Books-

Database System Concepts by Henry Korth and A. Silberschatz.
Simplified approach to DBMS, Prateek Bhatia, Gurvinder Singh Kalyani Publication

Reference Books-

An Introduction to Database System by Bipin Desai
An Introduction to Database System by C. J. Date.

B.Sc. III Year COMPUTER SCIENCE
PAPER II OPERATING SYSTEM CONCEPTS

Academic Year: 2021-2022

MAX. MARKS: 40 **MIN. MARKS: 14**

Part-A Introduction			
Program: Diploma	**Class: B.Sc.III**	**year: III**	**Session: 2021-22**
Subject: Computer Science			
Course Code: 306-II	**Course Title: OPERATING SYSTEM CONCEPTS**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Introduction and evoluation of Operating system along with various types. 2. Schedule CPU time using scheduling algorithm for processors 3. Apply page replacement policies for dynamic memory management 4. Design and construct the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems, Deadlock prevention and avoidance. 5. Working with linux OS. Introduction to various linux commands and vi editor etc.		

B.Sc. III YEAR COMPUTER SCIENCE
PAPER II: OPERATING SYSTEM CONCEPTS
Academic Year: 2021-2022

MAX. MARKS: 40 **MIN. MARKS: 14**

UNIT- I

Operating system: definitions, its component's , evolution of operating system, types of operating system: batch, multiprogramming, multitasking, multiprocessor ,real time, client server ,peer to peer, distributed ,clustered , operating system services ,system calls, protection of I/O, memory and CPU.

UNIT- II

Process scheduling : concept of a process ,process states ,PCB, process life cycle ,operating on process, context switch, types of schedulers ,CPU burst-I/O burst cycles, dispatcher, scheduling criteria, scheduling algorithms- FCFS,SJF,STRN, Round Robin, priority ,event driven, multilevel queue, Performance evaluation of algorithm ,through deterministic modelling.

UNIT- III

Memory management: address binding ,logical and physical address space, dynamic loading and linking ,Contiguous memory allocation :static and dynamic partitioned memory ,fragmentation , swapping relocation, compaction, protection , Non-contiguous memory allocation : Paging, Segmentation . Virtual Memory: demand paging , page fault ,page replacement algorithms-FIFO,LRU, Optimal. Thrashing, page fault frequency.

UNIT- IV

Inter-process communication need for synchronization, deadlocks-definition, avoidance, prevention, detection and recovery. Disk organization, directory structure, disk space management- contiguous and Non-contiguous allocation strategies ,disk address translation ,disk caching ,disk scheduling algorithms. Device Management: dedicated devices, shared Devices. Security and protection: security threats and goals, penetration attempts, Security policies and mechanisms, authentication, protection and access control.

UNIT- V

LINUX : history and features of Linux, Linux architecture ,file system of Linux, hardware requirements, Linux standards directories , Linux kernel. Working with Linux: KDE and Gnome graphical interface ,various types of shells available in Linux. Vi editor ,Linux commands: basic commands, file management commands, file security in linux.

TEXT BOOKS AND REFRENCE BOOKS

1. Operating System Concepts : by Silberschatz and Galvin and Gagne.
2. Operating System design and Concepts by Milan Milenkovic.

3. Operating System by Andrew Tanenbaum
4. Operating System by Peterson
5. Linux by Sumitabh Das

Suggest Practical : Basics Linux commands and vi editor

Suggested list of program for practical

Create the appropriate table and apply the following queries

1. WAQ to insert some new records in emp table.
2. WAQ to list the number of employee whose name is not 'ford','jams' or 'jones'.
3. WAQ to list the name and salary sort them in descending order of their salary.
4. WAQ to list the detail of employee whose name is start from 'a'.
5. WAQ to delete all record from emp table.
6. WAQ to insert value in three fields.
7. WAQ to list the student name having 'd' as second character.
8. WAQ to list the name and salary sort them in descending order of their salary.
9. WAQ to the name and salary sort them in descending order of their salary.
10. WAQ in employee table find all manager who earn between 1000 and 2000.
11. Display record of employee who have salary between 1000 and 2000.
12. List the name, salary and department no of the employee and order them by their salary in descending order.
13. In the employee table change the city of employee from existing one to new one.
14. Add a column salary of data type 'number' & having size '5' with default value 1000.
15. WAQ to find the employee who earn the lowest salary in each department ,display in ascending order of salary.
16. List the employee who earn the maximum salary in their department,find the name of all employee who works for 'first bank corporation'. Display the record of employee whose name start with 's' & age is greater than 18.
17. Find the name,street & city of residence of all employee who work for 'fbc'.
18. WAQ to update the salary of employee no 1902 to Rs. 10,000
19. WAQ to Find the name,street & city of all employee who work for 'fbc' and who earn more than 1000.
20. WAQ to increase the salary by 2000 and rename the column as "newsalary".
21. WAQ to find the name,street & city of all employee who work for 'fbc' and who earn more than 1000.
22. WAQ to find total of salaries of all employee from emp table.
23. WAQ to decrease the salary of emp from 5000 and rename the column as "newsalary".
24. List the employee number of employee who belongs to department 10,20.
25. List the employee no of employee who earn greater than 2000.
26. Insert new field called category in emp table.
27. Display different Jobs in departments 20,30.
28. List the names of employees having two 'aa' in the name.
29. Print the name ,empno,sal of employees in emp table.
30. List the name of employees who do the job of clerks or salesman .

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE
INDORE
(CENTER FOR EXCELLENCE)

Academic Year: 2021-2022

Affiliated to Devi Ahilya Vishwavidyalaya, Indore

Syllabus for B.C.A. I Semester

Computer Application

(Faculty of Computer Science)

DEPARTMENT OF COMPUTER SCIENCE

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE INDORE

Semester Syllabus for Undergraduates (Computer Application)

As recommended by Central Board of Studies of Computer Science and Approved by H E the Governor of M.P.

Academic Year: 2021-2022

Class: B.C.A. I Semester (Computer Application) for Regular Student

Govt. Holkar (Model Autonomous) Science College, Indore												
Computer Science Department												
Syllabus Session Year: 2021-22												
Programme: Certificate in Application											Class: B.C.A. I Semester	
S.No.	Paper	Paper Title	Paper Code	Theory Max. Marks 100				Practical Max. Marks 100				
				Credits	CCE	Exter. Asses.	Min Marks	Credits	Inter. Asses.	Exter. Asses.	Min. Mark.	Total Credit
1	Core Course	Digital Computer Organization	S1-BCA1T	4	40	60	35	2	40	60	35	6
2	Minor	Programming & Problem solving through C	S1-BCA2T	4	40	60	35	2	40	60	35	6
3	Open Elective	Probability and Statistics	S1-BCA3T	4	40	60	35					4
4	Foundation	English Language	S1-BCA4T	2		50	17					2
		Yoga and Meditation	S1-BCA5T	2		50	17					2

B.C.A. I Semester Computer Science
S1-51-I: Digital Computer Organization
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: I**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: S1-51-I	**Course Title: Digital Computer Organization**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Understand the basic structure, operation and characteristics of digital computer. 2. Be able to design simple combinational digital circuits based on given parameters. 3. Familiarity with working of arithmetic and logic unit as well as the concept of pipelining. 4. Know about hierarchical memory system including cache memories and virtual memory. 5. Understand concept and advantages of parallelism, threading, multiprocessors and multicore processors. 6. Know the contributions of Indians in the field of computer architecture and related technologies.		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lectures (in hours per week):	**2 Hrs. per week**	
Total no. of Lectures:	**60 Hrs.**	
Para.	**Topics**	**No. of Lectures**
I	**Basics of Computer:** Block diagram of computer, stored program concept, word length and processing speed of the computer, User interface, Hardware/Software concept, Microprocessor and single chip microprocessor concepts. Input and Output devices: Keyboard, mouse, joystick, scanner, printers: printers and types of printer, plotters and display devices.	12

II	**Number system** and codes. Decimal, binary, octal, hexadecimal and their inter conversion. ASCII, grey code excess-3 code, BCD numbers, binary addition, subtraction, multiplication and division (1's and 2's compliment methods)	12
III	**Logic gates:** NOT, OR, AND, NAND, NOR, XOR, XNOR gates. Boolean algebra, De Morgan's Theorem. Application of gates, half adder and full adder. Boolean functions & truth table, SOP, POS, min terms, Simplification of logical circuits using Boolean algebra and Karnaugh Maps.	12
IV	**Flip- Flop, Registers and counters**: RS-flip flop, level clocked D,F/P edge triggered D flip flop , edge triggered JK flip flop , racing in F/F, JK masters-slave flip flop, buffer registers, shift registers, ripple counters, synchronous counters , ring counters, Mod Counters.	12
V	**Computer Memory:** memory cell, memory organization, random Access Memory, read only Memory, PROM, EPROM, EEPROM, building large memories, magnetic hard disk, pen drive, Cache memory, optical disk. Transfer of information between I/O devices, CPU and Memory. Different Data Transfer Modes.	12

Keywords/tags: Input Output Devices, Number System, Codes, Gates, Circuits, Instruction Formats, Flipflop, Memory Hierarchy.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- M. Morris Mano, Digital Design, 3.ed. Prentice Hall of India Pvt. Ltd.,
- Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
- William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
- V. Carl Hamacher, "Computer Organization", TMH
- Tannenbaum, "Structured Computer Organization", PHI.

Suggestive digital platform web links :

- https://www.youtube.com/watch?v=TH9nd-KdVHs
- https://nptel.ac.in/courses/106/106/106106166/
- https://nptel.ac.in/courses/117/105/117105078/

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/105/106105163/

Part-D: Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE): **40 Marks** Shall be based on allotted assignments and Class Test. The division of marks is as follows:	**External Assessment:** University Exam (UE): **60 Marks** **Time: 02:00** Hours

<table>
<tr><td>A. Submission of Assignment followed by Presentation</td><td colspan="2"></td><td>Section A: 05 MCQ Questions</td><td>05x01 = 05 Marks</td></tr>
<tr><td>B. Class Test</td><td>Best Two test marks 20 Marks</td><td rowspan="4">Best two test Marks 40 Marks</td><td rowspan="2">Section B: Five Short Questions (200 Words Each)</td><td rowspan="2">05x05 = 25 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td><td rowspan="2">Section C: Two Long Questions (500 Words Each)</td><td rowspan="2">02x15 = 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td></tr>
<tr><td>Total Internal Assessment (Theory) Marks (A+B)</td><td colspan="2">40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+ C)</td><td>60 Marks</td></tr>
<tr><td colspan="5">Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

B.Sc I Semester Computer Science
S1-51-PI : Digital Computer Organization Lab
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: I**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: S1-51-PI	**Course Title: Digital Computer Organization Lab**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Realization of the basic logic and universal gates. 2. Verify the behavior of logic gates using truth tables. 3. Implement Binary-to-Gray, Gray-to-Binary code conversions 4. Design half and full adder circuit using basic gates. 5. Design and construct flip flops and verify the excitation tables.		
Credit value	**Practical- 2 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lab Practical's (in hours per week):		**2 Hrs. per week**
Total no. of Labs:		**30 Hrs.**
Para.	**Suggestive list of Practicals**	**No. of Labs.**
	1. To study basic gates (AND, OR, NOT) and verify their truth tables. 2. To study and verify NAND as Universal gate. 3. To study half adder using basic gates and verify its truth table. 4. To study Full Adder using basic gates and verify its truth table. 5. To design and construct RS flip Flop using gates and verifies the truth table. 6. To verify DeMorgan's Theorem. **Office Tools** **Using a Text Editor Tool** 1. Create a document and apply different Editing options. 2. Create Banner for your college. 3. Design a Greeting Card using Word Art for different festivals.	

	4. Design your Bio data and use page borders and shading. 5. Create a document and insert header and footer, page title, date, time, apply various page formatting features etc. 6. Implement Mail Merge. 7. Insert a table into a document and try different formatting options for the table. **Using a Spreadsheet Tool** 1. Design your class Time Table. 2. Prepare a Mark Sheet of your class result. 3. Prepare a Salary Slip of an employee of an organization. 4. Prepare a bar chart & pie chart for analysis of Election Results. **5.** Prepare a generic Bill of a Super Market. 6. Work on the following exercises on a Workbook: a. Copy an existing Sheet b. Rename the old Sheet c. Insert a new Sheet into an existing Workbook d. Delete the renamed Sheet. 7. Prepare an Attendance sheet of 10 students for any 6 subjects of your syllabus. Calculate their total attendance, total percentage of attendance of each student & average of attendance. 8. Create a worksheet of Students list of any 4 faculties and perform following database functions on it. a. Sort data by Name b. Filter data by Class c. Subtotal of no. of students by Class. **Using a Presentation Tool** 1. Design a presentation of your institute using auto content wizard, design template and blank presentation. 2. Design a presentation illustrating insertion of pictures, Word Art and ClipArt. Design a presentation, learn how to save it in different formats, copying and opening an existing presentation. 3. Design a presentation illustrating insertion of movie, animation and sound. 4. Illustrate use of custom animation and slide transition (using different effects) 5. Design a presentation using charts and tables of the marks obtained in class.	
Keywords/tags: **Keywords/tags**: Digital Electronics, Logic Gates, AND, OR, NOT, NANAD, NOR, Circuits, DeMorgan's Theorem, Office Tools.		
Part-C: Learning Resources		
Text Books, Reference Books, Other Resources		

Suggested Readings: • M. Morris Mano, "Computer System Architecture", PHI. • Heuring Jordan, "Computer System Design & Architecture" (A.W.L.) • William Stalling, "Computer Organization & Architecture", Pearson Education Asia. • V. Carl Hamacher, "Computer Organization", TMH • Tannenbaum, "Structured Computer Organization", PHI. **Suggestive digital platform web links :** • https://www.youtube.com/watch?v=TH9nd-KdVHs • https://nptel.ac.in/courses/106/106/106106166/ • https://nptel.ac.in/courses/117/105/117105078/	
Suggested equivalent online courses: • https://nptel.ac.in/courses/106/105/106105163/	
Part-D: Assessment and Evaluation	
Internal Assessment (A):	**40 Marks**
Lab Record / Class interaction/ Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours) / Mini Project (Project Demo + Report))	20 Marks
End Semester External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

B.C.A. I Semester Computer Science

S1-51-M : Programming & Problem solving through C

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: I**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: S1-51-M	**Course Title: Programming & Problem solving through C**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Minor**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lectures (in hours per week):	**2 Hrs. per week**	
Total no. of Lectures:	**60 Hrs.**	

Para.	Topics	No. of Lectures
I	**Algorithm for problem solving:** An Introduction, Properties of an algorithm, classification, algorithm logic, flowchart. Programming technique, basic constructs of structured programming, modular designing of programs. Programming Environment: High level programming language, Low level programming language, Middle level programming language, assembler, compiler, and interpreter.	12
II	**What is C:** Historical development of C where C stands, Getting Started with C. The C Character set, Types of C Constants, Types of C Variables, C keywords, identifiers literals. **C instructions:** Type Declaration Instruction, arithmetic Integer, Long Short, Signed, Unsigned, Storage classes, Integer and float conversion, Type conversion in assignment.	12

	Hierarchy of operations.	
III	**Operators:** Logical operator, hierarchy of logical operators, arithmetic operators, relational operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, special operators, "&,*,.,>, "sizeof". Decision control structure: control instructions in C, if, if-else, switch statement. Loops control structure: while loop, for loop, do – while loop, odd loop, nested do loop, nested while loop, loop using with logical operators break , continue, case control structure, go to, exit statement	**12**
IV	Array what are arrays, array initialization, bound checking 1D array, 2D array initialization of 1D and 2D array, memory map of 1D and 2D array, Multidimensional array. Strings: what are strings, standard library string function strlen(), strcpy(), strcat(), strcmp(), 2D array of characters.	**12**
V	Structure: Why use structure, declaration of structure, accessing structure elements, how structure elements are stored, array of structure, uses of structure Preprocessor: features of C Preprocessor, macro expansion, micro with arguments, file inclusion, conditional, #if, #elif, miscellaneous directives, #include, #define, directives, #undef, #pragma directives	**12**

Keywords/tags: Programming Constructs, Expressions, Control, Arrays, Structure, Preprocessor directives.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- Y. Kanetkar, "Let us C", BPB Publications
- "Programming in C", E. Balaguruswamy Tata McGraw Hill
- "C the Complete Reference", H. Schildt, Tata McGraw Hill
- First course in programming with 'C', T. Jeyapoovan (VIKAS)
- The C Programming language by Brian W. Kernighan Dennis M. Ritchie Prentice Hall
- Practical C Programming 3rd Edition A Nutshell Handbook O'Relly.

Suggestive digital platform web links :

- https://www.youtube.com/watch?v=XTiIiI-LOY8&list=PLJvIzs_rP6R73WlvumJvCQJrOY3U5zq1j
- https://www.youtube.com/watch?v=t9WKOcRB63Q&list=PLJ5C_6qdAvBFzL9su5J-FX8x80BMhkPy1

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/105/106105151/
- https://nptel.ac.in/courses/106/106/106106133/

Part-D: Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE): **40 Marks** Shall be based on allotted assignments and Class	**External Assessment:** University Exam (UE): **60 Marks** **Time: 02:00** Hours

<table>
<tr><td colspan="3">Test. The division of marks is as follows:</td><td colspan="2"></td></tr>
<tr><td>A. Submission of Assignment followed by Presentation</td><td colspan="2"></td><td>Section A: 05 MCQ Questions</td><td>05x01 = 05 Marks</td></tr>
<tr><td>B. Class Test</td><td>Best Two test marks 20 Marks</td><td rowspan="4">Best two test Marks 40 Marks</td><td rowspan="2">Section B: Five Short Questions (200 Words Each)</td><td rowspan="2">05x05 = 25 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td><td rowspan="2">Section C: Two Long Questions (500 Words Each)</td><td rowspan="2">02x15 = 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td></tr>
<tr><td>Total Internal Assessment (Theory) Marks (A+B)</td><td colspan="2">40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+C)</td><td>60 Marks</td></tr>
<tr><td colspan="5">Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

B.C.A. I Semester Computer Science
S1-51-PM : Programming & Problem solving through C Lab
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: S1-51-PM	**Course Title: Programming & Problem solving through C Lab**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Minor**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming. 5. Implementation of algorithms for searching and sorting.		
Credit value	**Practical- 2 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lab Practical's (in hours per week):		**2 Hrs. per week**	
Total no. of Labs:		**30 Hrs.**	

	Suggestive list of Practicals	**No. of Labs.**
	Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following: 1. a. To learn elementary techniques involving arithmetic operators and mathematical expressions, appropriate use of selection (if, switch, conditional operators) and control structures b. Learn how to use functions and parameter passing in functions, writing recursive programs. 2. Write a program to swap the contents of two variables.	**30**

	3. Write a program for finding the roots of a Quadratic Equation. 4. Write a program to find area of a circle, rectangle, square using switch case. 5. Write a program to check whether a given number is even or odd. 6. Write a program to print table of any number. 7. Write a program to print Fibonacci series. 8. Write a program to find factorial of a given number. 9. Write a program to convert decimal (integer) number into equivalent binary number. 10. Write a program to check given string is palindrome or not. 11. Write a program to perform multiplications of two matrices. 12. Write a program to print digits of entered number in reverse order. 13. Write a program to print sum of two matrices. 14. Write a program to print multiplication of two matrices. 15. Write a program to generate even/odd series from 1 to 100. 16. Write a program whether a given number is prime or not. 17. Write a program for call by value and call by reference. 18. Write a program to generate a series 1+1/1!+2/2!+3/3!+--- ---+n/n! 19. Write a program to create a pyramid structure * * * * * * * * * * 20. Write a program to create a pyramid structure 1 12 123 1234 21. Write a program to check entered number is Armstrong or not. 22. Write a program for traversing an Array. 23. Write a program to input N numbers add them and find average. 24. Write a program to find largest element from an array. 25. Write a program to store and retrieve records of 10 students.	
Keywords/tags: Programming Constructs, Expressions, Control, File Handling, Arrays, Structure, Preprocessor directives.		

Part-C: Learning Resources	
Text Books, Reference Books, Other Resources	
Suggested Readings: • Y. Kanetkar, "Let us C", BPB Publications • "Programming in C", E. Balaguruswamy Tata McGraw Hill • "C the Complete Reference", H. Schildt, Tata McGraw Hill • First course in programming with 'C', T. Jeyapoovan (VIKAS) • The C Programming language by Brian W. Kernighan Dennis M. Ritchie Prentice Hall • Practical C Programming 3rd Edition A Nutshell Handbook O'Relly. **Suggestive digital platform web links :** • https://www.youtube.com/watch?v=XTiIiI-LOY8&list=PLJvIzs_rP6R73WlvumJvCQJrOY3U5zq1j • https://www.youtube.com/watch?v=t9WKOcRB63Q&list=PLJ5C_6qdAvBFzL9su5J-FX8x80BMhkPy1	
Suggested equivalent online courses: • https://nptel.ac.in/courses/106/105/106105151/ • https://nptel.ac.in/courses/106/106/106106133/	
Part-D: Assessment and Evaluation	
Internal Assessment (A):	**40 Marks**
Lab Record / Class interaction/ Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours) / Mini Project (Project Demo + Report))	20 Marks
End Semester External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

BCA I Semester Computer Science
S1-51-O : Probability and Statistics
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: I**	**Session: 2020-2021**
Subject: Computer Application			
Course Code: S1-51-O	**Course Title: Probability and Statistics**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Elective**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**After the successful completion of this course, students should be able to:** 1. Understand statistics importance, scope and limitation. Compile and present data in tabular and graphical forms and analyse 2. Compute and interpret and compute different measures of central tendency and measures of dispersion 3. Compute elementary measures to characterize the data and understand elementary probability. 4. Use discrete, continuous probability distributions and curve fitting 5. Study bivariate data and compute correlation coefficient between random variables and analyses and interpret qualitative data (attributes).		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lectures (in hours per week):	**2 Hrs. per week**	
Total no. of Lectures:	**60 Hrs.**	
Para.	**Topics**	**No. of Lectures**
I	**Basic Statistics:** Definition of statistics, importance, scope and limitations. **Frequency Distribution:** Frequency distributions, histogram, frequency polygons, Frequency curve, cumulative frequency distribution, ogives.	**12**
II	**Measures of central tendency:** The arithmetic mean, weighted arithmetic mean,	**12**

	geometric mean, harmonic mean, median, mode, quartiles, deciles and percentiles. **Measures of dispersion:** The range, mean deviation, semi inter quartile range, quartile deviation, standard deviation, absolute and relative dispersion, coefficient of variation.	
III	**Moments:** Moments about mean in terms of moments about any point and vise – versa. Sheppard's correction for moments, Skewness and kurtosis and their measures. **Probability:** Random experiment, sample space, events, classical and relative frequency. Definition of Probability, theorems of total & compound probability, Independent & dependent events, mutually exclusive events, mathematical expectation and moment generating function.	**12**
IV	**Theoretical Distribution:** Discrete and continuous probability distribution. Basic concepts and application (Bernoulli, Binomial, Poisson, Negative Binomial, Geometric, Hyper geometric, Normal distributions). **Curve fitting:** Legendre's principle of least squares, fitting of straight line, parabola, power curve and exponential curve	**12**
V	**Bivariate Distribution:** Scatter diagram, Karl Parson's coefficient of correlation, determination of correlation coefficient for grouped data. Spearman's rank correlation coefficient (Repeated rank also), regression, line of regression and their properties, multiple and partial correlation coefficient (for three variables). **Theory of Attributes:** Class, Class frequencies, order of classes, consistency of data , condition for consistency of data, Independence of attributes, criterion for independence of attributes, association of attributes, Yule's coefficient of association, Coefficient of Colligation.	**12**

Keywords/tags: Measures of central tendency, Measures of dispersion, Moments, Probability, Theoretical Distribution, Curve fitting, Bivariate Distribution, Theory of Attributes.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- Fundamental of Statistics Vol.I, M. Goon, M.K. Gupta, B. Dasgupta, The world press pvt. Ltd.
- Fundamental of Mathematical Statistics: S.C. Gupta and V.K. Kaopor, S. Chand & Sons.
- Statistics Schaum's outline series, Spiegel, McGraw Hill Publishing Company.

Suggestive digital platform web links :

- https://nptel.ac.in/courses/111/105/111105090/

Part-D: Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE): **40 Marks** Shall be based on allotted assignments and	**External Assessment:** University Exam **(UE): 60 Marks** **Time: 02:00** Hours

<table>
<tr><td colspan="3">Class Test. The division of marks is as follows:</td><td colspan="2"></td></tr>
<tr><td>A. Submission of Assignment followed by Presentation</td><td colspan="2"></td><td>Section A: 05 MCQ Questions</td><td>05x01 = 05 Marks</td></tr>
<tr><td>B. Class Test</td><td>Best Two test marks 20 Marks</td><td rowspan="4">Best two test Marks 40 Marks</td><td rowspan="2">Section B: Five Short Questions (200 Words Each)</td><td rowspan="2">05x05 = 25 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td><td rowspan="2">Section C: Two Long Questions (500 Words Each)</td><td rowspan="2">02x15 = 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td></tr>
<tr><td>Total Internal Assessment (Theory) Marks (A+B)</td><td colspan="2">40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+ C)</td><td>60 Marks</td></tr>
<tr><td colspan="5">Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

BCA I Semester Computer Science

S1-51-G1 : English Language

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** BCA	**Semester :** I	**Session:2021-22**
Course Code: S1-51-G1	**Course Title: English Language**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Foundation Course**		
Pre-requisite (If any):	To study this course, a student must have basic knowledge of English language. This course will be studied by all the students of UG level under the Foundation Course category.		
Course Learning Outcomes (CLO)	**Through this course the students will be able to:** 1. Prepare for various Competitive exams by developing their English language competence. 2. Promote their comprehension skill by being exposed to a variety of texts and their interpretation. 3. Build and enhance their vocabulary. 4. Develop their communication skill by strengthening grammar and usages. 5. Inculcate values which make them aware of national heritage and environmental issues, making them responsible citizens.		
Credit value	Theory – **2 Credits**		
Total Marks	**Max. Marks: 50**	**Min. Passing Marks: 17**	

Part-B: Content of the Course		
No. of Lectures (in hours per week):		**1 Hrs. per week**
Total no. of Lectures:		**30 Hrs.**
Para.	**Topics**	**No. of Lectures**
I	Short answer question.	**06**
II	Reading Comprehension and vocabulary.	**06**
III	Paragraph Writing.	**06**
IV	Letter writing (both formal and informal)	**06**
V	Grammar	**06**

Part-C: Learning Resources

Text Books, Reference Books, Other Resources
Structural Items: 1. Simple, Compound and complex sentences. 2. Coordinate clauses (With , but, or, either-or, neither –nor, otherwise or else) 2.1 Subordinate clauses – noun , clause – as , subject object and compliment: elative clauses (restrictive and non-restrictive clauses): adverb clause (open and hypothetical conditional with because, thought, here, so-that, as soon as) 2.2 Comparative clause (as += adjective/adverb+as – no sooner.... Than) **Tenses:** 1. Simple present, progressive present perfect 2. Simple past, , progressive past perfect 3. Indication of futurity The passive (Simple present and past, present and past perfect and to infinitive structures), 4. Reported speech: 1. declarative sentences, 2. Imperatives, 3.Interrogative: wh-m questions, exclamatory sentences 5. Models (Will, Shall, Should, Would, Ought to, have to / have got to, Can- could, may – might and need) Verb Structure (infinitives and gerundial), Linking Devices. Questions on all the units shall be asked from the prescribed text which will comprise specimens of popular creative writing and the following items: 1. Indian art meaning of art Features of Indian art Elementary knowledge of painting, music, dancing, Sculpture, Archaeology, Iconography and other social arts. 2. Indian Literature ancient Indian Literature Elementary knowledge of Vedic Literature, Mahabharata, Ramayana and other main Granthas. 3. Indian freedom struggle. Freedom struggle of 1857 national consciousness, non-cooperation moment, Civil, disobedient moment, contribution of revolutionaries in freedom struggle. 4. Indian Constitution: Introduction, main future of Constitution, fundamental rights, fundamental duties. **Suggested Readings:** • English language and Indian Culture: publication by M.P. Hindi Granth Academy. **Suggestive digital platform web links :** • https://nptel.ac.in/courses/109/106/109106124/ • https://nptel.ac.in/courses/109/107/109107189/

Part-D: Assessment and Evaluation			
Max Marks: 50	**Min Marks: 17**	**University Exam (UE)**	**Total: 50**
University Exam (UE) Time: 2 Hours			
External Assessment (UE)		Time: 2 Hours	
Fifty Multiple choice/ Objective/ True-False type questions to be asked. Each question carries one mark.			

BCA I Semester Computer Science
S1-51-G2: Yoga and Meditation Academic
Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: I**	**Session: 2020-2021**
Subject: Computer Application			
Course Code: S1-51-G2	**Course Title: Yoga and Meditation Academic**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Foundation Course**		
Pre-requisite (If any):	This course is compulsory for all.		
Course Learning Outcomes (CLO)	**After studying this course, students will be able to::** • Take care of their own Physical, Mental, emotional, social and spiritual health.		
Credit value	**Theory – 2 Credits**		
Total Marks	**Max. Marks: 50**	**Min. Passing Marks: 17**	

Part-B: Content of the Course		
No. of Lectures (in hours per week):		**1 Hrs. per week**
Total no. of Lectures:		**15 Hrs.**
Para.	**Topics**	**No. of Lectures**
I	**Introduction to Yoga and Yogic Practices** 1. Yoga: Etymology, definitions, aim, objectives and misconceptions 2. Yoga: Its Origin, history and development 3. Rules and regulations to be followed by Yoga Practitioners 4. Introduction to Yoga practices 5. Shatkarma: meaning, purpose and their significance in Yoga Sadhana 6. Introduction to Yogic Loosening practices and Surya Namaskar **Key Words:** History and Development of Yoga, Shatkarma, Common Yogic Practices.	**10**
II	**Introduction to Yoga and Yogic Practices** 1. Yoga: Etymology, definitions, aim, objectives and misconceptions 2. Yoga: Its Origin, history and development 3. Rules and regulations to be followed by Yoga Practitioners 4. Introduction to Yoga practices 5. Shatkarma: meaning, purpose and their significance in Yoga Sadhana 6. Introduction to Yogic Loosening practices and Surya Namaskar	**10**

	Key Words: History and Development of Yoga, Shatkarma, Common Yogic Practices.	
III	**Practices leading to Meditation** 1.Recitation of Pranava Mantra 2. Recitation of Hymns, in vocations and prayers 3. Anter Maun 4. Breath Meditation 5. Om Dhyana **Key Words:** Pranav Mantra, Antermaun, Breath Meditation, Om Dhyan.	**10**

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:
Resources Suggested Readings:

1. Singh S. P & Yogi Mukesh: Foundation of Yoga, Standard Publication, New Delhi, 2010.
2. Swami Dhirendra Brahmchari: Yogasana Vijnana, Dhirendra Yoga Publication, New Delhi, 1966.
3. Saraswati, Swami Satyanand: Asana, Pranayama, Mudra, Bandha (APMB), Yoga Publication Trust, Munger, 2013.
4. H. R. Nagendra: Asana, Pranayama, Mudra, Bandha, Swami Vivekananda YogPrakashan, Bangalore, 2002.
5. Ishwar Bhardwaj: SaralYogasana, Satyam Publishing House, New Delhi, 2018.
6. Shri Rai Singh Chouhan: Mudra Rahasya, Bhartiya Yog Sansthan, New Delhi, 2014.
7. Dr. Vishwanath Prasad Sanha: Dhyan Yoga, Bhartiya Yog Sansthan, New Delhi, 1987.
8. Shri Deshraj: Dhyan Sadhana, Bhartiya Yoga Sansthan, New Delhi, 2015.

Suggestive digital platforms web links:

1. www.rishikeshnathyogshala.com

Suggested equivalent online courses:

- https://sahayji.com/hathayoga-course

Part-D: Assessment and Evaluation

Max Marks: 50
University Examination (Objective) 50
Time: 02:00 Hours

External Assessment: University Examination	Objective Questions	50
	Total	**50**

Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE
INDORE
(CENTER FOR EXCELLENCE)

Academic Year: 2021-2022

Affiliated to Devi Ahilya Vishwavidyalaya, Indore

Syllabus for B.C.A. II Semester

Computer Application

(Faculty of Computer Science)

DEPARTMENT OF COMPUTER SCIENCE

GOVT. HOLKAR AUTONOMOUS SCIENCE COLLEGE INDORE

Semester Syllabus for Undergraduates (Computer Application)

As recommended by Central Board of Studies of Computer Science and Approved by H E the Governor of M.P.

Academic Year: 2021-2022

Class: B.C.A. II Semester (Computer Application) for Regular Student

Govt. Holkar (Model Autonomous) Science College, Indore												
Computer Science Department												
Syllabus Session Year: 2021-22												
Programme :Certificate in Application											**Class : B.C.A. II**	
Semester												
S.No.	**Paper**	**Paper Title**	**Paper Code**	**Theory Max. Marks 100**				**Practical Max. Marks 100**				
				Credits	**CCE**	**Exter. Asses.**	**Min Marks**	**Credits**	**Inter. Asses.**	**Exter. Asses.**	**Min. Mark.**	**Total Credit**
1	Core Course	Programming Methodology & Data Structures	S2-BCA1T	4	40	60	35	2	40	60	35	6
2	Minor	Operating Systems	S2-BCA2T	4	40	60	35	2	40	60	35	6
3	Open Elective	Statistical Methods	S2-BCA3T	4	40	60	35					4
4	Foundation	Environmental Education	S2-BCA7T	2		50	17					2
		Hindi Language	S2-BCA8T	2		50	17					2

B.C.A. II Semester Computer Science
S2-51-I: Programming Methodologies & Data Structures
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: S2-51-I	**Course Title: Programming Methodology & Data Structures**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming 5. Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles 6. Have knowledge of complexity of basic operations like insert, delete, and search on these data structures. 7. Possess ability to choose a data structure to suitably model any data used in computer applications. 8. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc. 9. Assess efficiency tradeoffs among different data structure implementations. 10. Implement and know the applications of algorithms for searching and sorting etc. 11. Know the contributions of Indians in the field of programming and data structures.		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lectures (in hours per week):	**2 Hrs. per week**		

Total no. of Lectures:	60 Hrs.	
Para.	**Topics**	**No. of Lectures**
I	**Introduction to Programming** - Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies. **Basics of C++:** A Brief History of C++, Application of C++, Compiling & Linking, Tokens, Keywords, Identifiers & Constants, Basic Data Types, User-Defined Data Types, Symbolic Constant, Type Compatibility, Reference Variables, Operator in C++, Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators, Manipulators, Type Cast Operator. **Functions In C++:** The Main Function, Function Prototyping, Call by Reference Call by Address, Call by Value, Return by Reference, Inline Function, Default Arguments, Constant Arguments, Function Overloading, Function with Array.	12
II	**Classes & Objects:** A Sample C++ Program with Member Functions, Making an Outside Function Inline, Nesting of class, Defining Member Functions, Private Member Functions, Arrays within a Class, Memory Allocation for Objects, Static Data Members, Static Member, Functions. Array of Objects, Object as Function Arguments, Friend Functions, Virtual functions, Returning Objects, Constant member functions, Pointer to Members, Local Classes. **Constructor & Destructor:** Constructor, Parameterized Constructor, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructor and Destructor. **Inheritance**, Defining Derived Classes, Single Inheritance, Making a Private Member Inheritable, Multilevel Inheritance, Hierarchical Inheritance, Multiple Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructor in Derived Classes, Nesting of Classes. Operator Overloading & Type Conversion, Polymorphism, Pointers, Pointers with Arrays C++, Streams, C++ Stream Classes, Unformatted 1/0 Operation, Formatted 1/0 Operation, Managing Output with Manipulators, Exception Handling.	14
III	**Data Structure:** Basic concepts, Linear and Non-Linear data structures **Algorithm Specification:** Introduction, Recursive algorithms, Data Abstraction, Performance analysis. **Arrays:** Representation of single, two-dimensional arrays, triangular - arrays, sparse matrices-array and linked representations. **Stacks**: Operations, Array and Linked Implementations, Applications :Infix to Postfix Conversion, Infix to Prefix. Conversion, Postfix Expression Evaluation, Recursion Implementation. **Queues:** Definition, Operations, Array and Linked Implementations. Circular Queue-Insertion and Deletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation.	12

IV	**Linked Lists:** Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists-Operations, Doubly Circular Linked List, Header Linked List Trees: Representation of Trees, Binary tree, Properties of Binary Trees, Binary Tree Representations Array and Linked Representations, Binary Tree Traversals, Threaded Binary Trees. **Heap:** Definition, Insertion, Deletion. **Graphs**: Graph ADT, Graph Representations, Graph Traversals, Searching.	**12**
V	**Hashing**: Introduction, Hash tables, Hash functions, Overflow: Handling. **Sorting**: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Comparison of Sorting Methods, **Search Trees**: Binary Search Trees, AVL Trees Definition and Examples. **Indian Contribution to the field:** Innovations in India, origin of Julia Programming Language, Indian Engineers who designed new Programming Languages, open source languages, Dr. Sartaj Sahni computer scientist pioneer of data structures, Other relevant - contributors and contributions.	**10**

Keywords/tags: Programming, C++, Data Structures, if, else, for, while, do, call by value, call by reference, recursion, Arrays, Union, Hash, Linear search, Binary search, Bubble sort, Selection sort. Graph, Tree, Stack, Queue, Linked list, Hashing.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- J. R. Hanly and E. B. Koffinan, "Problem Solving and Program Design in C", Pearson, 2015 E Balguruswamy,
- "C++", TMH Publication ISBN O-07-462038-X
- Herbert Shildt, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7
- **मध्य प्रदेश हिंदी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें.**

Reference Books:

- R. Lafore, 'Object Oriented Programming C++"
- N. Dale and C. Weems, "Programming and problem solving with C++: brief edition", Jones & Bartlett Learning
- Adam Droozdek, "Data Structures and algorithm in C++, Third Edition, Cengage Learning.
- Sartaj Sahani, "Data Structures, Algorithms and Applications with C++", McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++, Pearson.
- D.S. Malik, "Data Structure using C++", Second edition, Cengage Learning.
- M. A. Weiss, "Data structures and Algorithm Analysis in C", 2nd edition, Pearson.
- Lipschutz. "Schaum's outline series Data structures". "Tata McGraw-Hill

Suggestive digital platform web links :

- https://www.youtube.com/watch?v=BCIS-40yzsA
- http://www.youtube.com/watch?v=vl.nPwxZdW4Y&vien
- https/www.youtube.com/watch?v Umm120S17w

Suggested equivalent online courses:

S.No.	Online Course	Duration	Platform
1	**Programming in C++** https://nptel.ac.in/courses/106/105/106105151/	**8 weeks**	**NPTEL**
2	**Beginning C++ Programming – From Beginner to Beyond** https://www.udemy.com/course/begining-c-plus-plus-programming/	**Self-paced**	**Udemy**

Part-D: Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE): **40 Marks** Shall be based on allotted assignments and Class Test. The division of marks is as follows:			**External Assessment:** University Exam **(UE): 60 Marks** **Time: 02:00** Hours	
A. **Submission of Assignment followed by Presentation**			**Section A**: 05 MCQ Questions	05x01 = 05 Marks
B. **Class Test**	**Best Two test marks 20 Marks**	**Best two test Marks 40 Marks**	**Section B:** Five Short Questions (200 Words Each)	05x05 = 25 Marks
Test I (Written Test)	20 Marks			
Test I (Written Test)	20 Marks		**Section C:** Two Long Questions (500 Words Each)	02x15 = 30 Marks
Test III (Quiz/ Seminar/ Assignment)	20 Marks			
Total Internal Assessment (Theory) Marks (A+B)	**40 Marks**		Total External Evaluation (Theory) Marks (A+B+ C)	**60 Marks**

Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.

B.Sc II Semester Computer Science
S2-51-PI : Programming Methodology & Data Structures Lab
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: S2-51-PI	**Course Title: Programming Methodology & Data Structures Lab**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow-charts to solve a problem with programming using top down design principles. 2. Write efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming. 5. Possess ability to choose a data structure to suitably model any data used in computer applications. 6. Implement algorithms for searching and sorting.		
Credit value	**Practical- 2 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lab Practical's (in hours per week):	**2 Hrs. per week**	
Total no. of Labs:	**30 Hrs.**	
Para.	**Suggestive list of Practicals**	**No. of Labs.**
	Given the problem statement, students are required to formulate problem, develop flowchart/algorithm, write code in C++, execute and test it. Students should be given assignments on following: 1. Write a program to swap the contents of two variables.	

2. Write a program for finding the roots of a Quadratic Equation.
3. Write a program to find area of a circle, rectangle and square using switch case.
4. Write a program to print table of any number.
5. Write a program to print Fibonacci series.
6. Write a program to find factorial of a given number using recursion
7. Write a program to convert decimal (integer) number into equivalent binary number,
8. Write a program to check given string is palindrome or not.
9. Write a program to print digits of entered number in reverse order.
10. Write a program to print sum of two matrices.
11. Write a program to print multiplication of two matrices.
12. Write a program to generate even/odd series from 1 to 100.
13. Write a program whether a given number is prime or not.
14. Write a program for call by value and call by reference.
15. Write a program to create a pyramid structure

    1
    12
    123
    1234
16. Write a program to check entered number is Armstrong or not.
17. Write a program to read N numbers and find their average.
18. Write a program to find the area and volume of a rectangular box using constructor.
19. Write a program to design a class time with hours, minutes and seconds as data members. Use a data function to perform the addition of two time objects in hours, minutes and seconds,
20. Write a program to implement single inheritance.
21. Write a program to find largest element from an array.
22. Write a program to implement push and pop operations on a stack using array.
23. Write a program to perform insert and delete operations on a queue using array.
24. Write a program for Linear search.
25. Write a program for Binary search.
26. Write a program for Bubble sort.
27. Write a program for Selection sort.
28. Write a program for Quick sort.

	29. Write a program for Insertion sort. 30. Write a program to implement linked list.	

Keywords/tags: **Keywords/tags**: Programming, C++, Data Structures, if, else, for, while, do, call by value, call by reference, recursion, Arrays, Union, Linear search, Binary search, Bubble sort, Selection sort. Graph, Tree, Stack, Queue, Linked list.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- J. R. Hanly and E. B. Koffman, "Problem Solving and Program Design in C", Pearson, 2015 E Balguruswamy,
- "C++", TMH Publication ISBN O-07-462038-X
- Herbert Shildt, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7
- **मध्य प्रदेश हिंदी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें|**

Reference Books:

- R. Lafore, 'Object Oriented Programming C++"
- N. Dale and C. Weems, "Programming and problem solving with C++: brief edition", Jones & Bartlett Learning
- Adam Droozdek, "Data Structures and algorithm in C++, Third Edition, Cengage Learning.
- Sartaj Sahani, "Data Structures, Algorithms and Applications with C++", McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++, Pearson.
- D.S. Malik, "Data Structure using C++", Second edition, Cengage Learning.
- M. A. Weiss, "Data structures and Algorithm Analysis in C", 2nd edition, Pearson. Lipschutz. "Schaum's outline series Data structures". "Tata McGraw-Hill.

Suggestive digital platform web links :

- https://www.youtube.com/watch?v=BCIS-40yzsA
- http://www.youtube.com/watch?v=vl.nPwxZdW4Y&vien
- https/www.youtube.com/watch?v Umm120S17w

Suggested equivalent online courses:

S.No.	Online Course	Duration	Platform
1	**Programming in C++** https://nptel.ac.in/courses/106/105/106105151/	**8 weeks**	**NPTEL**
2	**Beginning C++ Programming – From Beginner to Beyond** https://www.udemy.com/course/begining-c-plus-plus-programming/	**Self-paced**	**Udemy**

Part-D: Assessment and Evaluation

Internal Assessment (A):	**40 Marks**
Lab Record / Class interaction/ Quiz	15 Marks

Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours) / Mini Project (Project Demo + Report))	20 Marks
End Semester External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

B.C.A. II Semester Computer Science
S2-51-M : Operating System
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: S2-51-M	**Course Title: Operating Systems**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Minor**		
Pre-requisite (If any):	Open for All.		
Course Learning Outcomes (CLO)	**After the completion of this course, a student shall be able to do the following:** 1. Describe the importance of computer system resources and the role of operating system in their management policies and algorithms. 2. Specify objectives of modem operating systems and describe how operating systems have evolved over time. 3. Understand various process management concepts and can compare various scheduling techniques synchronization, and deadlocks. 4. Describe the concepts of memory management techniques. 5. Identify the best suited process management technique for any process. 6. Describe various file operations, file allocation methods and disk space management. 7. To understand and identify potential threats to operating systems and the security features to guard against them. 8. Learn to operate the Linux system		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lectures (in hours per week):		**2 Hrs. per week**	
Total no. of Lectures:		**60 Hrs.**	

Para.	Topics	No. of Lectures
I	**Introduction to Operating System:** what is Operating System? History and Evolution of OS, Basic OS functions, Resource Abstraction, Types of Operating Systems- Batch Systems, Multiprogramming Systems, Multiprocessing Systems, Time Sharing Systems, Distributed OS, Real time systems. Operating System for Personal Computers, Workstations and Hand-held Devices. Applications of various operating systems in real world. Some prevalent operating systems - Windows, UNIX/Linux, Android, MacOS, Blackberry OS, Symbian, Bada etc.	12
II	**Process Management:** Process Concepts, Process states & Process Control Block. **Process Scheduling:** Scheduling Criteria, Scheduling Algorithms (Preemptive & Non- Preemptive) - FCFS, SJF, SRTN, RR, Priority, Multiple-Processor, Real-Time, Multilevel Queue and Multilevel Feedback. Queue Scheduling, Deadlock Definition, Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock. Deadlock Handling Approaches: Prevention, Avoidance, Detection and Recovery.	12
III	**Memory Management**: Introduction, Address Binding, Logical versus Physical Address Space, Swapping, Contiguous & Non-Contiguous Allocation, Fragmentation (Internal & External), Compaction, Paging, Segmentation, Virtual Memory, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms. **File Management:** Concept of File System(File Attributes, Operations, Types), Functions of File System, Types of File System, Access Methods (Sequential, Direct & other methods), Directory Structure (Single-Level, Two-Level, Tree-Structured, Acyclic-Graph, General Graph), Allocation Methods (Contiguous, Linked, Indexed)	12
IV	**Disk Management**: Structure, Disk Scheduling Algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK), Swap Space Management, Disk Reliability, **Recovery. Security**: Security Threats, Security policy mechanism, Protection, Trusted Systems, Authentication and Internal Access Authorization, Windows Security.	12
V	**LINUX:** Introduction, History and features of Linux, advantages, hardware requirements for installation, Linux architecture, file system of Linux – boot block, super block, inode table and data blocks. Linux standard directories, Linux kernel, Partitioning the hard drive for Linux, installing the Linux system, system- startup and shut-down process, init and run levels. Process, Swap, Partition, fdisk, checking disk free spaces. Difference between CLI OS & GUI OS, Windows v/s Linux, Importance of Linux Kernel, Files and Directories. Concept of Open Source Software.	12

	Indian contribution to the field- the BOSS operating system, open source softwares, growth of LINUX, Aryabhatt Linux, contributions of innovators – RajenSheth, Sunder Pichai etc.	

Keywords/tags:

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications.
- A.S. Tanenbaum, Modem Operating Systems, 3rd Edition, Pearson Education.
- Operating System by Peterson
- Linux by Sumitabh Dasi
- **मध्यप्रदेश हिंदी ग्रन्थ अकादमी से प्रकाशित विषय से सम्बंधित पुस्तकें|**

Reference Books:

- G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education.
- W. Stallings, Operating Systems, Internals & Design Principles, 8th Edition, Pearson Education.
- M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill.
- Operating System design and Concepts by Milan Milenkovic.

Suggestive digital platform web links :

- https://web.fitd.ac.in/-minati/MTL458.html
- https://www.csc.iith.ac.in/-mythili/os/
- https://www.youtube.com/watch?v-aCJ3Ygoo HQ

Suggested equivalent online courses:

- https://nptel.ac.in/courses/106/102/106102132/

Part-D: Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE): **40 Marks** Shall be based on allotted assignments and Class Test. The division of marks is as follows:		**External Assessment:** University Exam **(UE): 60 Marks** **Time: 02:00** Hours	
A. Submission of Assignment followed by Presentation		**Section A**: 05 MCQ Questions	05x01 = 05 Marks

B. Class Test	**Best Two test marks 20 Marks**	**Best two test Marks 40 Marks**	**Section B:** Five Short Questions (200 Words Each)	05x05 = 25 Marks
Test I (Written Test)	20 Marks			
Test I (Written Test)	20 Marks		**Section C:** Two Long Questions (500 Words Each)	02x15 = 30 Marks
Test III (Quiz/ Seminar/ Assignment)	20 Marks			
Total Internal Assessment (Theory) Marks (A+B)	**40 Marks**		Total External Evaluation (Theory) Marks (A+B+ C)	**60 Marks**
Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.				

B.C.A. II Semester Computer Science
S2-51-PM : Operating System Lab
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: S2-51-PM	**Course Title: Operating Systems Lab**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Minor**		
Pre-requisite (If any):	Open for All.		
Course Learning Outcomes (CLO)	**After the Completion of this course, a student shall be able to:** • Operate the Linux System • Do administration • Use Vi Editor.		
Credit value	**Practical- 2 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	

Part-B: Content of the Course		
No. of Lab Practical's (in hours per week):		**2 Hrs. per week**
Total no. of Labs:		**30 Hrs.**
	Suggestive list of Practicals	**No. of Labs.**
	Linux: a) **Linux Directory Commands**: pwd, mkdir, rm -rf, ls, cd,cd /, cd~ b) **Linux File Commands:** touch, cat, cat>, cat >>, rm , cp, mv, rename c) **Linux Permission Commands**:su, id, useradd, passwd, groupadd, chmod, groupdel, chown, chgrp d) **Linux File Content & Filter Commands**: head, tail, tac, more, less, grep, cat, cut, comm, sed, tee, tr, uniq, wc, od, sorl, diff. e) **Linux Utility Commands**: find, bc, locate, date, cal, sleep, time, df, mount, exit, clear, gzip, gunzip. f) **Linux Networking Commands:** ip, ssh, mail, ping, host g) **Edit Crontab file**: to wall message on system on particular time automatically. h) **Vi editor:** Create file, edit, save and quit. Highlighting the searched term	

	within a file. Cut, yank,undo.	

Keywords/tags:

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- Linux by Sumitabh Das
- Linux Bible
- **मध्यप्रदेश हिंदी ग्रन्थ अकादमी से प्रकाशित विषय से सम्बंधित पुस्तकें|**

Suggestive digital platform web links :

- https://web.iitd.ac.in/~minati/MTL458.html
- https://www.cse.iitb.ac.in/-mythili/os/
- https://www.youtube.com/watch?v=aCJ3YgoolHQ

Suggested equivalent online courses:

https://nptel.ac.in/courses/106/102/106102132/3

https://www.youtube.com/watch?v=OHCMfsNpqCc

Part-D: Assessment and Evaluation

Internal Assessment (A):	**40 Marks**
Lab Record / Class interaction/ Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours) / Mini Project (Project Demo + Report))	20 Marks
End Semester External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

BCA II Semester Computer Science
S2-51-O : Statistical Methods
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: II**	**Session: 2020-2021**
Subject: Computer Application			
Course Code: S2-51-O	**Course Title: Statistical Methods**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Elective**		
Pre-requisite (If any):	**Open for ALL**		
Course Learning Outcomes (CLO)	**After the successful completion of this course, students should be able to** 1. Know the construction of point and interval estimators and evaluate the properties of estimators and understanding of the theory of maximum likelihood estimation 2. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-value 3. Use continuous probability distributions and learn to apply parametric tests in different real-life situations 4. Learn to apply Non-parametric tests in different real-life situations 5. Appropriately interpret results of analysis of variance tests and learn fundamental concepts of design of experiments, completely randomized design and randomized block design.		
Credit value	**Theory – 4 Credits**		
Total Marks	**Max. Marks: 40+60**	**Min. Passing Marks: 35**	
Part-B: Content of the Course			
No. of Lectures (in hours per week):		**2 Hrs. per week**	
Total no. of Lectures:		**60 Hrs.**	

Para.	**Topics**	**No. of Lectures**

I	**Estimation Theory:** Unbiasedness, Consistency, Efficiency and Sufficiency of estimators, Maximum likelihood estimators and their properties (without proof), Cramer Rao Inequality and Minimum variance estimators.	**12**
II	**Testing of Hypotheses** : Simple and composite hypothesis, error of type –I and type–II, critical region, level of significance, size and power of a test, Neymann Person's fundamental lemma and its application (with proof)	**12**
III	**Test of significance:** Test of simple hypothesis, Beta, Gamma distributions and their properties, Chi-square, t, F, z distributions and tests based on them.	**12**
IV	**Non- parametric Test:** Sign test, Median test, Run test for randomness, Wilcoxon's signed rank test and Contingency table.	**12**
V	**Analysis of Variance:** one –way classification & Two – way classification with one observation per cell. **Basic Design of Experiments:** Completely randomized design, Randomized block design & Latin square design.	**12**

Keywords/tags: Estimation Theory, Testing of Hypotheses, Test of significance, Non- parametric Test, Basic Design of Experiments.

Remark: Scientific calculator will be allowed during examination.

Part-C: Learning Resources

Text Books, Reference Books, Other Resources

Suggested Readings:

- Fundamental of Statistics Vol.I & II., M. Goon, M.K. Gupta, B. Dasgupta, The world press pvt. Ltd.
- Fundamental of Mathematical Statistics: S.C. Gupta and V.K. Kapoor, S. Chand & Sons.
- Fundamental of Applied Statistics: S.C. Gupta and V.K. Kapoor, S. Chand & Sons.
- **मध्य प्रदेश हिन्दी ग्रंथ अकादमी से प्रकाशित विषय से संबंधित पुस्तकें|**

Reference Books:

- Vijay K. Rohatgi, A. K. Md. EhsanesSaleh: An Introduction to Probability and Statistics, Wiley; 3rd edition, 2015.
- S. C Gupta and V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2014.

Suggestive digital platform web links :

- https ://www.highereducation,mp. gov.inl?page:xhzlQmp ZwkylQo2b%2F y 5 G7 w%3D%3D

Suggested equivalent online courses:

- https://nptel.ac.in/courses/111106112
- https://nptel.ac.in/courses/111105090
- https ://ugcmoocs. infl ibnet.ac.in/index.php/courses/view-_ug/313
- https ://ugcmoocs. infl ibnet.ac.in/index.php/courses/view-_ug/327

Part-D: Assessment and Evaluation

<table>
<tr><td colspan="3">Internal Assessment: Continuous Comprehensive Evaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Test. The division of marks is as follows:</td><td colspan="2">External Assessment: University Exam (UE): 60 Marks
Time: 02:00 Hours</td></tr>
<tr><td colspan="2">A. Submission of Assignment followed by Presentation</td><td></td><td>Section A: 05 MCQ Questions</td><td>05x01 = 05 Marks</td></tr>
<tr><td rowspan="4">B. Class Test</td><td>Best Two test marks 20 Marks</td><td rowspan="4">Best two test Marks 40 Marks</td><td rowspan="2">Section B: Five Short Questions (200 Words Each)</td><td rowspan="2">05x05 = 25 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td></tr>
<tr><td>Test I (Written Test)</td><td>20 Marks</td><td rowspan="2">Section C: Two Long Questions (500 Words Each)</td><td rowspan="2">02x15 = 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td></tr>
<tr><td colspan="2">Total Internal Assessment (Theory) Marks (A+B)</td><td>40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+ C)</td><td>60 Marks</td></tr>
<tr><td colspan="5">Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.</td></tr>
</table>

BCA II Semester Computer Science

S2-51-G1 : हिन्दी भाषा

Academic Year: 2021-2022

(भाग- ए) परिचय			
कार्यक्रम : प्रमाण-पत्र	**कक्षा : बी.सी ए**	**Semester: II**	सत्र: **2020-2021**
विषय: Computer Application			
कोर्स कोड: S2-51-G1	**कोर्स का शीर्षक: भाषा और संस्कृति**		
कोर्स का प्रकार:	**आधार पाठ्यक्रम**		
कोर्स अपेक्षित	**कक्षा** 12**वी उत्तीर्ण किसी भी विषय समूह से।**		
कोर्स अधिगम उपलब्धि (लर्निंग आउटकम).	1. **उत्कृष्ट साहित्यिक पाठों के अध्ययन से रुचि का विकास करना।** 2. **सांस्कृतिक चेतना और राष्ट्रीय भावना का विकास करना।** 3. **भाषा-ज्ञान। |** 4. **सामान्य शब्दावली और विशेष शब्दावली के अध्ययन द्वारा भाषा एवं संस्कृति बोध का विकास करना |** 5. **विशिष्ट शब्दावली (बीज शब्द/की वर्ड) से परिचित करवाते हुए बोध के स्तर को विकसित करना।** 6. **प्रतियोगी परीक्षाओं हेतु तैयार करना।**		
क्रेडिट मान	02 **क्रेडिट**		
कुल अंक	50 **अंक**	**उत्तीर्ण अंक**: 17 **अंक**	
(भाग - बी) कोर्स सामग्री			
कुल व्याख्यान (घंटा प्रति सप्ताह):		(1 **घंटा प्रति सप्ताह**)	
कुल व्याख्यान		15 **घंटे**	

पेरा	विषय:	कुल व्याख्यान
एक	1. **मैथिलीशरण गुप्त. परिचय । पाठः मातृभूमि (कविता)** 2. **प्रेमचन्दः परिचय पाठः शतंरज के खिलाडी (कहानी)** 3. **व्यंग्यः शरद जोशी-जीप पर सवार इल्लियाँ**	5 घण्टे

दो	1. **वैचारिक-भारतीय भाषाओं में राम** 2. **आचार्य रामचन्द्र शुक्ल: परिचय पाठः उत्साह (भावमूलक निबन्ध)** 3. **रामधारी सिंह दिनकरः परिचय पाठः भारत एक है (संस्कृति)** 4. **आदिशंकराचार्य-जीवन व दर्शन**	5 घण्टे
तीन	1. **पर्यायवाची शब्द; विलोम शब्द; अनेक शब्द के लिए एक शब्द (हिन्दी व्याकरण)** 2. **संधि और उसके प्रकार (हिन्दी व्याकरण)** 3. **बीज शब्द- धर्म, अद्वैत, भाषा, अवधारणा, उदारीकरण।**	5 घण्टे

सर्च करे:

- मैथिलीशरण गुप्तः **मैथिलीशरण गुप्त की कविता मातृभूमि,**
- प्रेमचंद: प्रेमचंद शतरंज के खिलाडी
- रामधारी सिंह दिनकर: भारत एक है रामधारी सिंह दिनकर
- आचार्य रामचन्द्र शुक्ल : उत्साह निबंध रामचन्द्र शुक्ल
- स्वामी विवेकानन्द : शिकागो व्याख्यान
- धर्म क्या है
- अद्वैत
- भाषा विकास
- भाषा परिभाषा
- अवधारणा का अर्थ एवं परिभाषा
- उदारीकरण की विशेषता
- पर्यायवाची शब्द, विलोम शब्द, अनेक शब्द के लिए एक शब्द ,संधि

(भाग सी) अनुशंसित अध्ययन संसाधन

पाठ्य पुस्तके, सन्दर्भ पुस्तकें, अन्य संसाधन

1. प्रेमचन्द- मानसरोवर, खण्ड:3
2. आचार्य रामचन्द्र शुक्ल- चिन्तामणि, भाग 1
3. डॉ. वासुदेव नन्दन प्रसादः आधुनिक हिन्दी व्याकरण और रचना, भारती भवन, ठाकुर बाडी रोड ,पटना, बिहार
4. डॉ. राजेश्वर चतुर्वेदी, हिन्दी व्याकरण- उपकार प्रकाशन, आगरा उ.प्र.
5. हिन्दी ज्ञान कोश
6. इन्टर नेट सामग्री- टैग में उल्लेखित

BCA II Semester Computer Science
S2-51-G2 : Environmental Education
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: II**	**Session: 2020-2021**
Subject: Computer Application			
Course Code: S2-51-G2	**Course Title: Environmental Education**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Foundation Course**		
Pre-requisite (If any):	A course intended to create awareness about the life of human beings which is an integral part of environment; and to inculcate the skills required to protect the environment from all sides. To study this course, the student must have knowledge about the environmental components, pollution, biodiversity, and ecosystem at senior secondary, class 12th level.		
Course Learning Outcomes (CLO)	**After the Completion of this course, a student shall be able to:** 1. To understand various aspects of life forms, ecological processes and the impacts on them by the human during Anthropocene era 2. To build capabilities to identify relevant environmental issues, analyze the various underlying causes, evaluate the practices and policies, and develop framework to make inform decisions. 3. To develop empathy for all life forms, awareness, and responsibility towards environmental protection and nature preservation. 4. To develop the critical thinking for shaping strategies such as; scientific, social, economic, administrative & legal, environmental protection, conservation of biodiversity, environmental equity and sustainable development. **5.** To prepare for the competitive exams.		
Credit value	**Theory – 2 Credits**		
Total Marks	**Max. Marks: 50**	**Min. Passing Marks: 17**	
Part-B: Content of the Course			
No. of Lectures (in hours per week):		**1 Hrs. per week**	

Total no. of Lectures:	15 Hrs.	
Para.	**Topics**	**No. of Lectures**
I	**Environment and Natural Resources:** • Multidisciplinary nature, Scope and Importance of Environment • Components of Environment: Atmosphere, Hydrosphere, Lithosphere, and Biosphere. • Brief account of Natural Resources and associated problems: Land Resource, Water Resource, Energy Resource. • Concept of Sustainability and Sustainable Development ***Keywords: Environment, Forest, Mineral, Food, Land, Water, Energy, Sustainable Development***	**10**
II	**Biome, Ecosystem and Biodiversity:** • Major Biomes: Tropical, Temperate, Forest, Grassland, Desert, Tundra, Wetland, Estuarine and Marine • Ecosystem: Structure function and types their Preservation & Restoration • Biodiversity and its conservation practices. ***Keywords: Biome, Ecosystem, Biodiversity***	**10**
III	**Environmental Pollution, Management and Social Issues:** • Pollution: Types, Control measures, Management and associated problems. • Environmental Law and Legislation: Protection and conservation Acts. • International Agreement & Programme. • Environmental Movements, communication and public awareness programme. National and International organizations related to environment conservation and monitoring. • Role of information technology in environment and human health. ***Keywords: Pollution, Environmental Legislation, Environmental Movement, Environmental programme and organization.***	**10**
Suggested activities(at least one) 1. Visit to an area to document environmental assets: rivers/ forest / flora/ fauna. 2. Visit to a local polluted site Urban/Rural/ Industrial / Agricultural 3. Study of simple ecosystem.		
Part-C: Learning Resources		
Text Books, Reference Books, Other Resources		

Suggested Readings:

- Singh; J.S., Singh S.P. and Gupta, S.R.; "Ecology; Environment Science and Conservation ",S Chand publishing , New Delhi , (2018)
- Divan, S. and Rosencranz, A., "Environmental Law and Policy in India :Cases, Material & Status" Oxford University Press, India , (2002) 2° Edition.
- Odum , E.P., "Fundamentals of Ecology", Philadelphia Saundres, (1971)
- Bharucha , Erach, "Environmental studies "Universities Press India Pvt. Ltd. Hyderabad (2014) (Hindi Edition also available).
- Kaushik, Anubha , Kaushik , C.P. "Perspectives in Environmental Studies "New age International Publishers, (2018), 6th Edition.
- Asthana, D. K Asthana Meera, "A Textbook of Environmental Studies", S. Chand.Publishing, New Delhi, (2007)
- National Digital Library (https://ndl.iitkgp.ac.in/homestudy/science)
- Epg- pathshala (https://epgp.inflibnet.ac.in/Home/Download)
- NPTEL (https://nptel.ac.in/course.html)
- Coursera (https://www.coursera.org/search?query=environmental+science&page=1)
- **इराक भरूचा, पर्यावरण अध्ययन ओरियंट ब्लैकस्वान प्राइवेट लिमिटेड नई दिल्ली** (2014)
- **दयाशंकर त्रिपाठी पर्यावरण अध्ययन मोतीलाल बनारसीलाल पब्लिशर्स दिल्ली**(2005)
- **रतन जोशी , पर्यावरण अध्ययन, साहित्य भवन पब्लिकेशन्स**(2018)

Suggested equivalent online courses:

- The Health Effects of Climate Change (edx)
- Climate Change: Financial Risks and Opportunities (edx)
- Introduction to Environmental Law and Policy (coursera)
- Women in environmental biology (coursera)
- Our Earth: It's Climate, History, and Processes (coursera)
- Ecology, physiology, environmental science (national digital library)

Part-D: Assessment and Evaluation

Max Marks: 50
University Examination (Objective) 50
Time: 02:00 Hours

External Assessment: University Examination	Objective Questions	50
	Total	**50**

Any remark/ Suggestion: Focus of the course/ teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem.

Semester-III

B.C.A.

Academic Year: 2021-2022

Course of studies for the BCA – III Semester

BCA – III Sem Course

SCHEME OF MARKS

Course	Theory Max. Marks		Practical Max. Marks	Max. Marks	Min. Marks
	Internal	External			
301 Discrete Mathematics	15	85	--	100	5 + 28
302 Data Structure Using C	15	85	--	100	5 + 28
303 Object Oriented Programming Using C++	15	85	--	100	5 + 28
304: Unix Operating System	15	85	--	100	5 + 28
305: Accounting And Financial Management	15	85	--	100	5 + 28
306: Communication Skills	15	85	--	100	5 +28
BCA-307: Practical- Data Structure Using C	--	---	50	50	17
BCA-908: Practical- Object Oriented Programming Using C++	--	--	50	50	17
BCA-908: Practical- Unix Operating System			50	50	17
Total Marks	90	510	150	750	--

B.C.A. III Semester Computer Science

302-I: Data Structure Using C

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 302	**Course Title: Data Structure Using C**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Develop simple algorithms and flow charts to solve a problem with programming using top down design principles. 2. Writing efficient and well-structured computer algorithms/programs. 3. Learn to formulate iterative solutions and array processing algorithms for problems. 4. Use recursive techniques, pointers and searching methods in programming 5. Will be familiar with fundamental data structures, their implementation; become accustomed to the description of algorithms in both functional and procedural styles 6. Have knowledge of complexity of basic operations like insert, delete, and search on these data structures. 7. Possess ability to choose a data structure to suitably model any data used in computer applications. 8. Design programs using various data structures including hash tables, Binary and general search trees, heaps, graphs etc. 9. Assess efficiency tradeoffs among different data structure implementations. 10. Implement and know the applications of algorithms for searching		

Semester III
BCA – 302 DATA STRUCTURE USING C
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

UNIT I

Introduction to Data Structure & Linked List: Types of Data Structure, Arrays representation and address calculation, Strings, Recursion, ADT (Abstract Data Type), Concept of Files, Operations with Files, Types of Files.

Linked List as an ADT, Linked list Vs. Arrays, and Memory Allocation &De-allocation for a Linked List, Linked List Operations, Types of Linked List, Implementation of Linked List, and Application of Linked-List: Polynomial, Sparse Matrix.

UNIT II

Stack & Queue: Stack as an ADT, Stack operation, Array Representation of stack, Link Representation of Stack, Application of Stack- Recursion, Polish Notation.

The Queue as an ADT, Queue Operations, Array Representation of Queue, Linked Representation of Queue, Circular queue, Priority Queue, De-queue. Application of queue: Johnsons Algorithm, Simulation.

UNIT III

Tree: Basic trees concept, Binary tree Representation, Binary tree Operation, Binary tree Traversal, Binary search tree Implementation, Thread Binary Tree, The Huffman Algorithm, Expression tree, Introduction to Multi-way search tree and its creation(AVL, B-tree, B+ tree).

UNIT IV

Sorting & Searching: Sorting concept, Shell Sort, Radix Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, List Search, Linear Index Search, and Index Sequential Search.

UNIT V

Hashing & Graph: Hash Table, Hashed List Search, Hashing Methods, Collision Resolution Techniques, Graph-its type and Representation, Graph Traversal: Depth First Search, Breadth First Search, Shortest Path Algorithm (Dijkstra's Algorithm)

TEXT BOOKS:

1. Data Structures A Pseudocode Approach with C, Richard F. Gilbarg & Behrouz A. Forouzan, second edition, CENGAGE Learning.
2. Data Structure using C, Reema Thareja, Oxford University press.
3. Introduction to Data Structure and its Applications, Jean-Paul Tremblay, P.G. Soenson

REFERENCE BOOKS:

1. Data Structure using C & C++, Rajesh K. Shukla, Wiley- India.
2. Data Structure using C, ISRD Group, Second Edition, Tata McGraw Hill.
3. Data Structure using C, Balagurusamy.
4. C & Data Structures, Prof. P.S. DeshPande, Prof. O.G. Kakde, Dreamtech press.
5. Data Structures, Adapted by: GAV PAI, Schaum's Outlines.

B.C.A. III Semester Computer Science

303: Object Oriented Programming Using C++

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 303	**Course Title: Object Oriented Programming Using C++**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Introduction to C++, key concepts of object oriented programming, unformatted & formatted console I/O oprations. 2. parts of C++ program, tokens, oprators, Control structures. 3. Functions, function overloading, demonstration of Classes and objects, implementing abstraction using access specifiers. 4. Operator overloading, reusing code through Inheritance and its types. 5. Pointer & Arrays of classes, implementing Polymorphism, Template, Handling Exceptions		

BCA – 303 Object Oriented Programming Using C++
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit - I

Introduction: OOP languages, characteristics of OOP languages, application of OOP, OOP paradigm. C++ concepts: object, class, data abstraction, data encapsulation, inheritance, and polymorphism. Static and dynamic binding, message passing, benefits and disadvantage of OOP.

Unit – II

C++ Programming Basics: tokens, expressions and control structures.
Functions in C++: main() function , function prototyping, call by value, call by reference , returning by reference, inline functions, default arguments, const arguments, variables and storage classes , function overloading, friend functions , virtual functions.

Unit- III

Classes & Objects: defining a class, defining member functions(inside and outside class definition), Constructors and Destructors, parameterized constructors, constructors with default arguments, copy constructor, dynamic constructor. Private member functions, arrays within the class, static data members and functions, arrays of objects, objects as function arguments, returning objects from functions. String handling functions.

Unit- IV

Data encapsulation, Polymorphism, Operator Overloading: overloading unary operators, overloading binary operators.

Unit-V

Inheritance, reusability of code through inheritance , Type of Inheritance: single inheritance, multilevel inheritance, multiple inheritance , hierarchical inheritance , hybrid inheritance virtual base classes, abstract classes. Constructors in derived classes, nesting of classes, pointers, virtual functions, Pure virtual functions, Templates and Exception handling.

TEXT BOOK:

Object oriented programming with C + by balagurusamy ,TMH publishing.

Reference books:

1. Object oriented programming in C++, 3rd edition,R.Lafore,galigotia publications pvt ltd.
2. The complete reference 4th edition ,Herbert schildt,TMH
3. C++ primer,3rd edition,S.B.Lippman and J.lajoie,pearson education.
4. The c++ programming language,3rd edition,B.Stroustrup,Pearson education.
5. OOP in C++, 3rd edition,T.Gaddis,J.Walters and G.Muganda,Wiley dream tech press.
6. Computer Science,A structured programming approach using c++,B. A. Forouzon and R.F.Gilberg,Thomson.

304: Unix Operating System

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 304	**Course Title: Unix Operating System**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Learn UNIX structure, commands, and utilities 2. Describe and understand the UNIX file system 3. Write shell scripts in order to perform shell programming 4. Acquire knowledge about text processing utilities, process management and system operation of UNIX. 5. Installation of softwares and hardwares on unix operating system		

Semester III
BCA–304: Unix Operating System
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

UNIT I

Unix operating system, background, philosophy, help facility, The file system, structure of file system, Basic commands related to file system: pwd, cd, ls, mkdir, rmdir, cp, mv, rm, cat. General utility commands: banner, cal, date, who, who am I, echo, printf, bc, uname, tty, stty, passwd.

UNIT II

Utilities: more, file, od, wc, cmp, comm, diff tar commands. I/O redirection. The Bourne shell: sh preceding a command by its own combining commands, pattern matching, echo, pipes, tees, shell variables and shell scripts. Basic file attributes chmod command.

UNIT III

Simple filters: pr, head, tail, cut, paste, sort, uniq, nl commands. Advanced filters: grep, egrep, fgrep, tr, join, sed, awk, filtering. The process: shell process, parent and children process status, system processes, multiple jobs, foreground and background, wait commands, pre mature termination of process, job execution with low priority, multiple jobs in foreground, shell layers, timing processes.

UNIT IV

Communication and scheduling: address all users, delay execution of jobs- later, periodically. Introduction to vi editor, Programming with shell: System variable, profile, conditional execution, script termination, conditional and loop control statement, set and shift statement.

UNIT V

System Administration: installing hardware and software, super user, security, user services, management operation, files system, administration backups.

TEXT BOOK

Sumitabha Das, "Unix : Concepts and Applications", Third Edition, 2006,Tata McGrawHill

REFERENCE BOOKS:

1. ISRD Group, Basics of OS, UNIX and SHELL Programming" TMH (2006)
2. A User guide to unix system",Thomas Rebecca yate,Second Edition,2002,.Tata McGraw Hill.
3. Stephen Prata "Advanced Unix -A programmer's Guide".

B.C.A. III Semester Computer Science

305: Accounting and Financial Management Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 305	**Course Title: Accounting and Financial Management**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Demonstrate the role of accounting in business in economic world. 2. Explain the principles of accounting and book keeping 3. Apply accounting rules in determining financial results and preparation of financial statement 4. Rectify errors caused during preparation of Final accounts. 5. Use software in preparation of Financial Statements		

Semester III
BCA–305: Accounting and Financial Management
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I:

Introduction: Financial Accounting -definition and Scope, Objectives of Financial Accounting, Accounting v/s Book Keeping Terms used in accounting, users of accounting information and limitations of Financial Accounting.

Conceptual Frame Work: Accounting Concepts, Principles and Conventions, Accounting Standards concept , objectives , benefits , brief review of Accounting Standards in India , Accounting Policies , Accounting as a Measurement Discipline, Valuation Principles, accounting estimates.

Recording of Transactions: Journal, Ledger and Trial Balance based on double entry book keeping.

Unit II

Subsidiary Books: Need, uses and types, Cash Book, Bank Reconciliation Statement.

Unit III

Depreciation: Meaning, need and importance of depreciation, methods of charging depreciation. (WDV & SLM).

Preparation of final accounts: Preparation of Trading Account, Profit and Loss Account, and Balance Sheet of sole proprietary business.

Introduction to Company Final Accounts: Important provisions of Companies Act, 1956 in respect of preparation of Final Accounts. Understanding of final accounts of a Company.

Unit-IV

Cash flow Statement(as per accounting standards) , Analysis of Financial Statement- Financial ratio

Unit V

Computerized Accounting: Computers and Financial application, Accounting Software Packages. An overview of computerized accounting system- Salient features and significance, Concept of grouping of accounts, Codification of accounts , Maintaining the hierarchy of ledger. Generating Accounting Reports.

Text book:

1. Fundamentals of Accounting and Financial Analysis: By Anil Chowdhary(pearson education)

Reference books:

1. Financial Accounting By Jane Reimers(Pearson Education)
2. Accounting Made Easy By Rajesh Agarwal & R Srinivasan (TataMcGraw-Hill)
3. Financial Accounting for Management: By Amrish Gupta (Pearson Education)
4. Financial Accounting for Management: By Dr. S. N. Maheshwari (Vikas Publishing House).

B.C.A. III Semester Computer Science

306: COMMUNICATION SKILLS

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			

Course Code: 306	**Course Title: COMMUNICATION SKILLS**
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. "Students will be able to understand and apply knowledge of human communication and language processes as they occur across various contexts, e.g., interpersonal, intrapersonal, small group, 2. organizational, media, gender, family, intercultural communication, technologically mediated 3. communication, etc. from multiple perspectives." 4. "Presentation skills training courses provide strategies to plan, structure and deliver powerful 5. presentations. Learn how to structure presentations in order to deliver effective messages as well as 6. receive the coaching to dramatically improve your personal presentation. This specific program is one of 7. the leading presentation skills training courses developed to help people engage audiences" 8. "A group discussion among students is being organized to see and evaluate their thinking skills, listening 9. abilities and how they are communicating their thoughts. One should learn to control the conversation 10. through listening attentively and then having the perseverance to

	mould it towards his/her own direction." 11. "Develop, exhibit and accurate sense of self and nurture a deep understanding of personal motivation. 12. Develop an understanding of and practice personal and professional responsibility." 13. "To practice and develop writing processes pertaining to invention, revision, organization, drafting 14. through multiple drafts, editing, and adjusting for rhetorical context (purpose, audience, persona)"

Semester-III
BCA -306: COMMUNICATION SKILLS
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

UNIT I

Fundamentals of Communication: Definitions, Need of Communication, importance, forms of communication, process of communication, channels, barriers and strategies to overcome barriers of communication.

Listening: Definitions, Importance, Benefits, barriers, approaches, be a better listener, exercises and cases.

UNIT II

Advance Communication: Art of communication, Key elements of Interpersonal communication, Principles of Interpersonal Communication, tone of voice, facial expressions, gestures and body langue, communication and introduction with unknown person, Cell Phone/ Telephone Etiquettes : the Do's and Dont's.

UNIT III

Group Discussions: Definitions, importance, process, points to be borne in mind while participating, Dos and Don'ts.

Interview: Types of Interviews, Points to be borne in mind as an interviewer or an Interviewee, self-introduction, commonly asked questions, Dos and Don'ts.

UNIT IV

Transactional Analysis: Transactional analysis, Johari Window, FIRO-B Written Communication: Cover letter, Report writing, Documentation, business correspondence, preparation of manuals and project reports, Drafting e-mails, Minutes of meeting, notices and circulars, Resumes. Writing formal letters, Memos, Create a questionnaire's.

UNIT V

Negotiation Skill: Basic principles, Building understanding, process of negotiation, essentials of negotiations. Contemporary Communication Styles, Technology enabled communication: Powerpoint presentation, Do's and Don'ts of PowerPoint presentation, Other types of Multimedia presentation.

TEXT BOOK :

1. Chturvedi, P.D. and Chaturvedi Mukesh (2004), "Business Communication" Pearson Education, Singapore Pvt. Ltd.3
2. Communcations – KK Sinhga
3. Organization Behaviour – Fred Luthans
4. Organization Behaviour – Stephen Robbins.

REFERENCE BOOKS:

1. Business Communication by ICMR, Feb 2001.
2. Toropov Brandon (2000), "Last Minute Interview Tips", Jaico Publishing House, Mumbai.
3. Heller Robert (1998), "Essential DK Managers: Communication Clearly", Dorling Kindersley, London.

Semester-IV
B.C.A.
Academic Year: 2021-2022

Course of studies for the BCA – IV Semester

BCA – IV Sem. Course

Course	Theory Max. Marks		Practical Max. Marks	Max. Marks	Min. Marks
	Internal	External			
401: Computer Oriented Numerical Methods (Using "C" Language)	15	85	--	100	5 + 28
402: Software Engineering	15	85	--	100	5 + 28
403: Database Management System	15	85	--	100	5 + 28
404: Programming with JAVA	15	85	--	100	5 + 28
405: Environment Awareness and Green Computing	15	85	--	100	5 + 28
406: Entrepreneurship	15	85	--	100	5 + 28
407: Practical- Computer Oriented Numerical Methods (Using "C" Language)	--	---	50	50	17
407: Practical- Database Management System	--	--	50	50	17
407: Practical- Programming with JAVA	--	--	50	50	17
Total Marks	90	510	150	750	--

B.C.A. Iv **Semester Computer Science**

401: Computer Oriented Numerical Methods (Using "C" Language)

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			

Course Code: 401	**Course Title: Computer Oriented Numerical Methods (Using "C" Language)**
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	Core Course
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. To develop the mathematical skills of the students in the areas of numerical methods. 2. To teach theory and applications of numerical methods in a large number of engineering subjects which require solutions of linear systems 3. finding Eigen values, eigenvectors, interpolation and applications, solving ODEs, PDEs. 4. To lay foundation of computational mathematics for post-graduate courses specialized studies and research. 5. Dealing with statistical problems like testing of hypotheses.

Semester-IV
BCA -401: Computer Oriented Numerical Methods (Using "C" Language)
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

UNIT –I

Numerical Computations: Computer Arithmetic: Floating Point Number Operations, Normalization and their consequences. **Iterative Methods:** Bisection Method, False Position Method, Newton Raphson Method, Secant Method, Graffes Root Squaring Method, Convergence of Solution

UNIT –II

Simultaneous Liner Equation : Solution of Simultaneous Liner Equation – Gauss Elimination Method, Gauss – Seidal Method, Gauss – Jordan Elimination Method, Triangularization Method & Pivoting Condensation, ill Conditioned Equation & Refinement of solution

Curve Fitting : Curve Fitting Method, Least Curve Fitting, Non Linear Curve Fitting.

UNIT-III

Difference Operators And Interpolation : - Definition Of Forward, Backward, Shifting, Divided, Difference Central and Averaging Operators and their Relationships. Newton's Forward Interpolation Formula, Newton's backward Interpolation Formula Newton's divided Interpolation Formula. Lagrange's Interpolation Formula.

UNIT – IV

Numerical Differentiation: Numerical Differentiation using Newton's Forward Interpolation Formula, Newton's Backward Interpolation Formula, Newton's divided Interpolation Formula.

Numerical Integration : General Quadrature Formula, Newton- Cote's Formula, Trapezoidal Rule, Simpson's one Third Rule, Simpson's Three Eight Rule.

UNIT – V

Numerical Solutions of Ordinary Differential Equations : Euler's Method , Euler's Modifies Method. Tailor's Series Method, Picard's Method, Runga Kutta Second Order and Fourth order Method.

TEXT BOOK:

V. Rajaraman, Computer Oriented Numerical Methods, Prentice Hall, India.

REFERENCE BOOKS:

1. S. S. Sastry, Introductory Methods of Numerical Analysis. M. K. Jain, S.R.K. Iyengar & R. K.

B.C.A. Iv **Semester Computer Science**

402: Software Engineering

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 402	**Course Title: 402: Software Engineering**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Understand the importance of the stages in the software life cycle. 2. Understand the various process models 3. Be able to design software by applying the software engineering principles 4. To understand important concepts of software engineering and project management. 5. introduction of management information system		

Semester-IV
BCA -402: Software Engineering
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I

System concepts and Information System environment:
The system concepts, characteristics of systems, elements of systems, The System Development Life Cycle, various information gathering tools, feasibility study, tools of system analysis, various methods of process design, form design methodologies.

Unit II

Software Process, Product and Project:
The Product: Software ,Software Myths, The process : Software Engineering: A Layered Technology , Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Software Process Model, Component-Based Development, Fourth Generation Techniques , Software process and Project Metrics Software measurement.

Unit III

Software Project Planning and Design:
Software Project Planning : Project planning objectives, Decompositions Techniques, Cost Estimation , Empirical estimation models, The Make/Buy Decision.
Software Design: Design Principles, Cohesion and Coupling, Design notation and specification, structure design methodology .

Unit IV

Software Quality Assurance And Testing:
Software Quality Assurance: Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Formal Approaches to SQA, Software Reliability, Mistake Proofing for Software, Testing Strategies: A strategic approach of software testing, White Box Testing, Black Box Testing Techniques, Strategic issues, unit testing, integration testing, validation testing ,system testing, the art of debugging.

Unit V

Advanced Topics:
MIS and DSS: Introduction to MIS, long range planning, development and implementation of an MIS, application of MIS in manufacturing sector and in-service sector. Decision Support System concept, types of DSS.

TEXT BOOK:

1 R.S .Pressman "Software Eengineering -a practitioner's approach" 6th edition McGraw Hill Int. Ed. 2002 .

REFERENCE BOOKS:

1. Pankaj Jalote "Software Eengineering" Narosa Publications.
2. Ian Sommerville : Software Eengineering 6/E (Addison-Wesley).
3. Richard Fairley: Software Engineering Concepts(TMH)
4. Elis Awad, "System Analysis and Design", Galgotia Publications.
4 W.S.Jawadekar: Management Information Systems ,TMH Publication, India .
5 Hoffer "Mmodern System Analysis and Design" 3e, Pearson Edition.

B.C.A. Iv **Semester Computer Science**

403: Database Management System Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 403	**Course Title: 403: Database Management System**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	Core Course		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Demonstrate the basic elements of a relational database management system. 2. Identify the data models for relevant problems. 3. Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data. 4. Demonstrate their understanding of key notions of query evaluation and optimization techniques. 5. Extend normalization for the development of application software's.		

BCA -403: Database Management System
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit-I

Purpose of database system, view of data, data models: relation, network, hierarchical, Instances and schemas, data dictionary, types of database languages:- DDL, DML, DCL, TCL, structure of DBMS, advantages and disadvantages of DBMS, 3- level architecture proposal - external, conceptual & internal levels. Database System architecture, level of abstraction, Database users and DBA, Classification of Database Management Systems. Components of database system, Traditional File System vs. Modern Database Systems. Introduction and applications of DBMS, Data Independence.

Unit-II

Entity relationship model as a tool of conceptual design: entities & entity set, relationship, relationship set & relationship types, attributes , role , participation and mapping constraints , Keys , strong and weak entities, Advance ER Model Features: generalization specialization & aggregation, reducing ER diagram to tales, Roles, Participation.

Unit - III

Fundamentals of set theoretical notations: relations, domains, attributes, tuples, concept of Keys: primary key, super key, alternate key, candidate key, foreign key, fundamentals of integrity rules: entity and referential integrity, extension and intention. Relational Algebra: select, project, Cartesian product, Evolution of SQL, Between Clause, Distinct Clause, Order by Clause, Group by Clause, SQL Functions, Sub queries, Handling null value, Aggregate functions , set operations, Different types of Joins ,View.

Unit- IV

PL /SQL Programming using Oracle, Oracle Data types, Looping and Decision Making, Working with Stored Procedure, Trigger, Cursor. Relational Database design, Features of good relational database design, Codd's Rule, Integrity constraints.

Unit-V:

Functional Dependencies, Good & Bad Decomposition and Anomalies as a database: A consequences of bed design, Universal relation, Normalization: 1NF, 2NF, 3NF & BCNF normal forms, multi-valued dependency, join dependency, 4NF, 5 NF.

TEXT BOOK:

1. Database System Concepts by Henry Korth and A. Silberschatz.

REFERENCE BOOKS:

1. An Introduction to Database System by Bipin Desai
2. Simplified Approach to DBMS, Prateek Bhatia, Gurvinder Singh, Kalyani Publication
3. Database Management System by Seema Kedar, Technical Publication.

B.C.A. Iv **Semester Computer Science**

404: Programming with JAVA

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 404	**Course Title: 404: Programming with JAVA**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. The students will have the competence in the use of Java Programming language 2. The development of small to medium sized application programs that demonstrate professionally acceptable coding. 3. An understanding of the principles and practice of object oriented programming in the construction of robust maintainable programs which satisfy the requirements. 4. Design and implement an application that demonstrates their competency with Java syntax, structure and programming logic, incorporating basic features of the language as well as some features from the I/O (Input/Output) or GUI libraries 5. Competence in the use of Java Programming language in the development of small to medium sized application programs that demonstrate professionally acceptable coding and performance standards.		

Semester-IV
BCA 404: Programming with JAVA
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

UNIT-I

Java Features like Platform Independent, Architecture Neutral, and Robust etc. JAVA Virtual Machine concept, Introduction to class in java and methods, Primitive data types, operators, reserve words, local variables, examples and exercises.

UNIT-II

Control Statements: Selection Statements, Iteration Statements, Jump Statements, String class, StringBuffer classes, Math library, Arrays.

UNIT-III

Definitions and naming conventions classes and class members, instance fields and methods, access modifiers: public, private, protected, final, static, abstract, volatile and transient, Initialization by constructor, Initialization by Default constructor, Multiple Definition of constructors, creation of objects, access modifiers, inheritance, super class, sub class, method overloading, method overriding..

UNIT-IV

Packages and Interfaces: defining packages, finding packages and CLASSPATH, Access Protection, importing packages, Exception Handling: fundamentals, exception types, try, catch and finally, throw & throws, Creating own exception, Exception by overriding, Thread, MultiThreading Example, synchronization, Java I/O Package, InputStream, OutputStream, File Handling.

UNIT-V

String Handling in Java , Special String operators, String Handling Methods, Classes of java lang package, java.util packages and classes: Calendar, Date, ArrayList, Vector class, Taking input from user by scanner class. Database Connectivity: Types of driver, Connecting database, creating table and running queries for insert, delete, update and selecting data and showing them to user. Examples and exercises.

TEXT BOOK

1. Complete Reference (Java 2) – Herbert Schildt - Tata McGraw Hill, New Delhi.
2. Programming with java E. Balagurusamy Tata McGraw Hill, New Dehli, 2nd
3. edition 2002.

REFERENCE BOOKS :

1. Joseph O'Neil, Teach yourself java, Tata McGraw Hill, New Dehli, 2001.
2. Java script : Don Gosselin, Thomson Learning (vikas Publication)
3. Java in a nut shell – Flanagan – Orielly Publication

B.C.A. Iv **Semester Computer Science**

405: Environment Awareness and Green Computing

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: III**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 405	**Course Title: 405: Environment Awareness and Green Computing**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. "Understand the concept of green IT and relate it to sustainable development" 2. Apply the green computing practices to save energy. 3. "Discuss how the choice of hardware and software can facilitate a more sustainable operation." 4. Use methods and tools to measure energy consumption 5. Understand benefits of renewable and sustainable energy systems.		

Semester-IV
BCA -405: Environment Awareness and Green Computing
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit -I

Study of Environment and ecology & Environmental Pollution:

Definition and Importance, Public participation and Public awareness, Air, Water, Noise, Heat and nuclear pollution- Definition, Causes, effect and prevention of pollution, Disaster management- flood, earthquake, cyclones and landslides.

Unit-II

Environment and social problems, Role of mankind conserving natural resources:

Sustainable development- Introduction, Energy problems of cities, solar energy, and biogas and wind energy, Water conservation: Rainwater harvesting, Food resources- World food problem, Energy resources- increasing demand for energy, Role of information technology in protecting environment and health.

Unit III

Fundamental of Green IT:

Green IT Fundamentals: Business, IT and the Environment- Green computing: carbon foot Print Measuring, Details, reasons to bother, plan for the future, Cost Savings, Hardware Power.

Unit IV

Green Assets and Power Problems:

Green Assets: Buildings, Data Centers, Network and Devices, Green Information System: Design and Development Model, Monitoring Power Usage, Servers, Low-Cost Options, Reducing Power Use, Data De-Duplication, Low-Power Computers and peripheral devices.

Unit V

Green Supply Chain &Green PC

Paper Reduction, Green Supply Chain, Reduce Pcs And Servers, Shared Services, Hardware Cost, Cooling, Green Grid Framework, Virtualizing of IT Systems, Materials recycling, Best ways for Green PC ,Green Data Centre Case Studies.

Reference books

1. Textbook for Environmental Studies-University Grant Commission, New Delhi and Bharti Vidyapeeth Institute of Environment Education and Research, Pune
2. Woody Leonhard, Katherrine Murray, "Green Home Computing for Dummies" , August 2009, ISBN 978-0-470-46745-9
3. Alvin Galea, Michael Schaefer, Mike Ebbers, "Green Data Center: Steps for the Journey".

BCA PART V Semester **Academic Year: 2021-2022**

Course of studies for the BCA – V Semester

BCA – V Semester Course

SCHEME OF MARKS

Course	Theory Max. Marks		Practical Max. Marks	Max. Marks	Min. Marks
	Internal	External			
BCA – 501 Linear Algebra and Geometry	15	85	--	100	5 + 28
BCA -502 Computer Networks	15	85	--	100	5 + 28
BCA -503 Introduction to Cloud Computing	15	85	--	100	5 + 28
BCA -504 Introduction to Data Science	15	85	--	100	5 + 28
BCA -505 Human Values and Professional Ethics	15	85	--	100	5 + 28
BCA -506 Information Technology Trends	15	85	--	100	5+28
BCA -507 Network and Cloud Computing Lab	--	--	50	50	17
BCA -508 Practical on Data Science using R	--	---	50	50	17
Total Marks	90	510	100	700	--

B.C.A. v Semester Computer Science

502: Computer Networks

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: v**	**Session: 2021-2022**
Subject: Computer Application			
Course Code502	**Course Title: Computer Networks**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Explain the importance of data communications and the Internet in supporting business Communications and daily activities. 2. Analyze the services and features of the various layers of data networks. 3. Explain how communication works in data networks and the Internet. 4. Recognize the different internetworking devices and their functions. 5. Explain the role of protocols in networking.		

Semester-V
BCA -502: Computer Networks
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I

Data communications and networking for Today's Enterprise, A communication model, Data Communications, Networking and the Internet. Network model, need for a protocol architecture, The TCP/IP protocol architecture, The OSI model, Addressing. Data transmission: Concept and terminology, Analog and digital signals, Transmission impairment, Channel capacity.

Unit II

Digital transmission: Digital-to-digital conversion, Analog-to-digital conversion, Transmission mode. Analog transmission, Digital-to-analog conversion, Analog-to-Analog conversion.

Unit III

Bandwidth utilization: Frequency division multiplexing, Wavelength division multiplexing, Synchronous and statistical time-division multiplexing, switching: Circuit switching Packet switching, Types of errors, framing (character and bit stuffing), error detection & correction method.

Unit IV

Data Link Layer protocols, LAN Protocol Architecture, Bridges, Emergence of High — Speed LANs, Ethernet, Token Bus, Token Ring, Wireless LAN Technology (Wi-Fi). Routing in switched network: Routing in packet switched networks,

Unit V

Internet and transport protocols: Principles of internetworking IPv4 & IPv6, Connection-oriented transport protocol mechanism, TCP and UDP. Network security: Encryption and decryption technique, Internet applications: E-mail, World Wide Web, And HTTP.

Text Books:

(1) Data Communications and Networking, BehrouzA. Forouzan, McGraw-Hill, 4th Ed.,
(2) A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI

Reference Books:

1) Computer Networking: James F. Kurore& Keith W. Rose , Pearson Education, Third Edition, 2005.
2) Communication Networks: Fundamentals Concepts and Key Architecture : Albert Leon-Garcia and IndraWidjaja, , Tata McGraw-Hill Publishing Company Limited, ISBN 0-07-0402235-3.

3) Data and Network Communication: Michael A. Miller, Delmar Thomson Learning inc ISBN 0-07668-1100-X.
4) Introduction to Computer Networks: Douglas E. Comer , Prentice-Hall. Alberto Leon-Garcia and IndraWidjaja, Communication Networks –Fundamentals
5) Concepts and Key Architecture , Tata McGraw-Hill Publishing Company Limited, ISBN

B.C.A. v Semester Computer Science

503: Introductions to Cloud Computing

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: v**	**Session: 2021-2022**
Subject: Computer Application			
Course Code503	**Course Title: 503: Introductions to Cloud Computing**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. "The fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; 2. benefits, as well as current and future challenges;" 3. "The basic ideas and principles in data center design; cloud management techniques and cloud software deployment considerations;" 4. Different CPU, memory and I/O virtualization techniques that serve in offering software, computation and storage services on the cloud; Software Defined Networks (SDN) and Software Defined Storage 5. cloud storage technologies and relevant distributed file systems, NoSQL databases and object storage; 6. The variety of programming models and develop working experience in several of them.		

Semester-V

BCA – 503: Introductions to Cloud Computing

Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I

Introduction to cloud computing, History, Importance of cloud computing in the current era, characteristics of cloud computing, what cloud computing really is and isn't, pros and cons of cloud computing, technologies in cloud computing, migrating into cloud.

Unit II

Types of clouds, cloud infrastructure, cloud application architecture, working of cloud computing, trends in cloud computing, cloud service models, cloud deployment models, cloud computing and services pros and cons.

Unit III

Cloud computing technology, cloud life cycle model, role of cloud modelling and architecture, cloud system architecture, virtualization, types of virtualization, importance and limitations of various types of virtualization, virtualization in cloud computing.

Unit IV

Data storage, introduction to enterprise data storage, data storage management, file system, cloud data stores, cloud storage characteristics, applications utilizing cloud storage.

Unit V

Introduction to web services, cloud service deployment tools, management/ administrative services, risk management in cloud computing, introduction to apache hadoop.

Text Books:

(1) Cloud Computing: A practical approach for learning and implementation, 1st edition, Pearson, A. Srinivasan, J. Suresh.

Reference Books:

1) Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2) Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
3) Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
4) Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

B.C.A. v Semester Computer Science

504: Introduction to Data Science

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: v**	**Session: 2021-2022**
Subject: Computer Application			
Course Code504	**Course Title: Introduction to Data Science**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Demonstrate knowledge of statistical data analysis techniques utilized in business decision making. 2. Apply principles of Data Science to the analysis of business problems. 3. Use data mining software to solve real-world problems. 4. Employ cutting edge tools and technologies to analyze Big Data. 5. Apply algorithms to build machine intelligence.		

Semester-V
BCA – 504: Introduction to Data Science
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I

Introduction: What is Data Science? The Data Science Process, Different Types of Data: Quantitative, Categorical. Graphical Summaries of Data: Pie Chart, Bar Graph, Pareto Chart, Histogram. Measuring the Center of Quantitative Data: Mean, Median, Mode. Measuring the Variability of Quantitative Data: Range, Standard Deviation, and Variance.

Unit II

Overview of R, R data types: Vectors, Matrices, Factors, Lists, Data Frames, reading and writing data, Control structures, functions, scoping rules, dates and times

Unit III

Introduction to Data Cleansing, Missing and Repeated Values, Feature Engineering, Outliers and Errors, Finding Outliers, Cleaning Data with R.

Unit IV

Machine Learning: Definition and overview, Regression, Simple Linear Regression, Multiple Regression, Assessing Performance, Ridge Regression, Feature Selection & Lasso, Nearest Neighbors & Kernel Regression

Unit V

Machine Learning: Classification, Linear Classifiers & Logistic Regression, Learning Linear Classifiers, Over fitting & Regularization in Logistic Regression, Decision Trees, Handling Missing Data, Boosting.

Text Books:

1) Allan G. Bluman, Elementary Statistics: A Step By Step Approach,10th Edition,McGraw-Hill, 2017.
2) Paul Teetor, R Cookbook, First Edition, O,ReillyMedia, 2011.
3) Tom Mitchell, Machine Learning, First Edition, McGraw Hill. 1997

B.C.A. v Semester Computer Science

505: Human Values and Professional Ethics

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: v**	**Session: 2021-2022**
Subject: Computer Application			
Course Code505	**Course Title: 505: Human Values and Professional Ethics**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. To understand professional responsibility of a Student 2. To appreciate ethical norms. 3. To appreciate ethical dilemma while discharging duties in professional life. 4. To understand Attitude formation and function. 5. To understand moral value and character Building.		

Semester-V
BCA – 505: Human Values and Professional Ethics
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I
Human Values; Types, Features and Classification Sources of Value System Values across Cultures.

Unit II
Morality Norms, Beliefs, Attitude Moral Norms, Moral Values Moral Standards

Unit III
Professional Ethics; Nature, Characteristics and Needs Ethics V/s Morals and Values Ethico-Moral Action Ethical Codes, Ethical Practices

Unit IV
Nature and Dimensions of Attitude Components of Attitude Attitude Formation Functions of Attitude Changing Attitude

Unit V
Moral Values and Character-Building Character; Meaning, Important Components of Character Character Development.

Text Books:

1) Beteille Andre (1991), Society and Politics in India, Athlone Press, Latest edition
2) Chakraborty S. K. (1999), Values and Ethics for Organizations, oxford university press, Latest edition
3) Fernando, A.C. (2009), Business Ethics - An Indian Perspective, Pearson Education, India, Latest edition

Reference Books:

1) Charles D. Fleddermann (2012), "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, (Indian Reprint), Latest edition
2) Boatright John R (2012), "Ethics and the Conduct of Business", Pearson Education, New Delhi, Latest edition
3) Crane, Andrew and Matten Dirk (2015), Business ethics, Oxford University Press Inc., New York., Latest edition
4) Murthy, C.S.V. (2016), Business Ethics – Text and Cases, Himalaya Publishing House Pvt. Ltd., Latest Edition
5) Naagrajan,R.R (2016), Professional Ethics and Human Values, New Age International Publications, , Latest edition
6) Campbell, V., & Bond, R. (1982). Evaluation of a character education curriculum. In D. McClelland, Education for values. New York: Irvington Publishers, Latest Edition.
7) R. S. Dwivedi (1995), "Human Relations and Organizational Behavior: A Global perspective", Macmillan Latest Edition

B.C.A. v Semester Computer Science

506: Information Technology Trends

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: v**	**Session: 2021-2022**
Subject: Computer Application			
Course Code506	**Course Title: 506: Information Technology Trends**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	Core Course		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. To understand professional responsibility of a Student 2. To appreciate ethical norms. 3. To appreciate ethical dilemma while discharging duties in professional life. 4. To understand Attitude formation and function. 5. To understand moral value and character Building.		

Semester-V

BCA – 506: Information Technology Trends
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I

Introduction and basic concepts of modern communication and telephony technology: CDMA, WLL, GSM, VOIP, Bluetooth, Wi-Fi, Communication Technology: 2G, 3G, 4G, 5G. Communication over Radio, Microwave systems, Communication satellites, Radar, Fiber optics, ISDN – their properties, Geographic Information System (GIS): Components of a GIS – Hardware, Software, Data, People, Methods, Working and application of GIS.

Unit II

Information Security - Introduction, Malicious Programs, Cryptography, Digital Signature, Firewall, Users Identification and Authentication, Security Awareness and policies, Application areas requiring security. Mobile Commerce: Introduction, Growth, Success stories of Mobile commerce, Technologies for mobile commerce, M-Commerce in India. Digital Marketing

Unit III

Data Warehouse and Data Marts: Introduction, Advantages of data warehouse, Data warehouse components, Data warehouse architecture and schemas. Big Data Concept, Data Mining: Introduction, Evolution of data mining, Data mining – verification versus discovery, Advantages of data mining, Technologies used in data mining.

Unit IV

Artificial Intelligence and Expert System: Concept of Artificial Intelligence and Expert System, Building of Expert System, Merits and Demerits of Expert System, Application of Expert System, Application of Artificial Intelligence

Unit V

Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Home automation, Industry applications, Surveillance and other IoT applications. Introduction to Virtual Reality: definition, Applications of VR. Smart Systems, Embedded systems,

Text Books:

1) Fundamentals of Information Technology by Alex Leon & M. Leon, Vikas Publications, New Delhi.
2) Frontiers of Electronic Commerce by Ravi Kalakota, Andrew B. Whinston, , Addison Wesley Longman Publication.
3) E-Commerce: An Indian Perspective (Second Edition) by S.J.P. T. Joseph, Prentice-hall Of India Pvt Ltd.
4) Security in Computing (Third Edition) by C.P.Pfleeger, S.L. Pfleeger, D.N. Shah, S.Ware, Prentice Hall 2002.
5) Mobile Communications, Joschen Schiller, Pearson Education.
6) Recent Magazines of Computers and Communication.
7) Cloud Computing PHI by Rao M.N.
8) Internet of Things McGrawHill by Raj Kamal

Reference Books:

1) Introduction to Information Technology - ITL Education Solutions Ltd., Seventh Impression, Pearson Education, 2008.
2) Data Mining Techniques - Arun K Pujari, University Press.
3) Enterprise Resource Planning 1/e - Alexis Leon, International edition-Tata McGraw Hill publication.
4) Concepts in computing - Kenneth Hoganson, First Indian Edition, Jones & Bartlett Publishers, Inc., 2010.
5) Artificial Intelligence - Elaine Rich, Kevin Knight, 2nd edition, McGraw Hill, 1991.

Computer Networks - Andrew S. Tanenbaum, 4th Edition, Pearson Education.

Semester-VI

B.C.A.

Academic Year: 2021-2022

BCA PART VI Semester Academic Year: 2021-2022

Course of studies for the BCA – VI Semester

BCA – VI Semester Course

SCHEME OF MARKS

Course	Theory Max. Marks		Practical Max. Marks	Max. Marks	Min. Marks
	Internal	External			
BCA – 601 Operations Research	15	85	--	100	5 + 28
BCA -602 Internet and Web Technology using PHP	15	85	--	100	5 + 28
BCA -603 Computer Graphics and Multimedia	15	85	--	100	5 + 28
BCA -604 Principal and Practices of Management	15	85	--	100	5 + 28
BCA -605 Project	40	60		100	33
BCA -606 Computer Graphics and Multimedia LAB	--	--	50	50	17
BCA -607 Practical on Internet and Web Technology using PHP	--	---	50	50	17
Total Marks	100	400	100	600	--

B.C.A. vi Semester Computer Science

601: Operational Research

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: VI**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 601	**Course Title: 601: Operational Research**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. "To impart knowledge in concepts and tools of Operations Research" 2. To understand mathematical models used in Operations Research 3. "To apply these techniques constructively to make effective business decisions" 4. Solving questions related to resources' operations such as: human, machine, materials, energy, information, and funds. " 5. Solving operational questions and decision-making questions.		

Semester-VI
BCA – 601: Operational Research
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I
Introduction to Operations Research: Origin and Development of OR, nature of OR, characteristics of OR, Meaning, Scope of Operations Research and Decision making, Advantages and Limitations of OR, Application of OR, Phases of OR, OR Models.

Unit II
Linear Programming: Meaning of Linear Programming, Mathematical Formulation of Linear Programming Problems, Graphical Solution, Simplex Method, Dual Simplex, Advantages and limitations of LPP.

Unit III
Transportation Problems: Mathematical Model and Formulation, Initial Basic Feasible Solution, North West Corner Method, Least Cost Method, Vogel's Approximation Method, Optimal Solution (Minimization And Maximization) using Modified Distribution Method, Degeneracy in Transportation Problem.

Unit IV
Assignment Problems:
Definition of Assignment Problem, comparison with Transportation Problem, formulation and solution of Assignment Problem using Hungerian Method (Minimization and Maximization), Travelling Salesman Problem.

Unit V
Sequencing and Scheduling: Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines.

Text Books:

1) Gillet B.E., Introduction to Operation Research, Computer Oriented Algorithmic Approach, Tata McGraw Hill publishing Co. Ltd., New Delhi.
2) P.K.Gupta & D.S. Hira, Operations Research, S. Chand & Co.

References Books:

1) Taha H.A., Operations Research: AN Introduction, Mc Millian Co., New York.
2) N.S. Kambo, Mathematical Programming Techniques, Affiliated East West Press Pvt. Ltd., New Delhi, 1984.
3) R. Panneserlvam, Operations Resaerch, Prentic Hall of India Pvt. Ltd., New Delhi, 2004.
4) S.D. Sharma, Operations Research, Kedar Nath & Co. Meerut.
5) Gupta, Kanti Swaroop, Gupta P.K. and Manmohan, Operations Research, Sultan Chand and Sons, New Delhi.

B.C.A. vi Semester Computer Science

602: Internet and Web Technology Using PHP

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: VI**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 602	**Course Title: 602: Internet and Web Technology Using PHP**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. " Understand how server-side programming works on the web." 2. PHP Basic syntax for variable types and calculations. 3. Using PHP built-in functions and creating custom functions 4. "How to receive and process form submission data and Reading and writing cookies." 5. Create a database in phpMyAdmin. Read and process data in a MySQL database.		

Semester-VI
BCA – 602: Internet and Web Technology Using PHP
Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I
Web Technology: Introduction to WWW, web browsers, web servers, HTTP, URL.
HTML: Introduction, Objective, HTML Command Tags: Text, List, Table, creation of links, inserting graphics, forms.
Cascading style sheets: Introduction to CSS

Unit II
A Brief History of PHP, PHP Characteristics, Installing and Configuring PHP on Windows, PHP Language Basics: Lexical Structure, Data Types, Variables, Expressions and Operators, Decision Statements, Flow Control Statements, Embedding PHP in Web Pages.
Strings: String Constants, Printing Strings, Accessing Individual Characters, String Handling Functions: length, Word count, string position, reverse, replace.
Maths: max, min, sqrt, sin, cos, tan, sinh, cosh, tanh, abs, count, ceil, round, floor, log, log10, pow() functions.
Arrays: Indexed Arrays, Associative Arrays, Identifying Elements of an Array, Storing Data in Arrays, Multidimensional Arrays, extracting multiple values, converting between arrays and variables, Traversing Arrays.

Unit III
Session: Session handling, creating session, storing values in session, accessing values from session, destroying session. Cookies: creating cooking, setting values, accessing cookies values, session cookie, persistant cookie, redirecting page.
Functions: Calling a Function, Defining a Function, Variable Scope, Function Parameters, Return Values, Variable Functions.
Object Oriented Programming Concepts: Classes, Objects, Member Functions, Encapsulations, Inheritance, and Polymorphism. (only basic definitions of these topics).

Unit IV
Form Handling in PHP: Setting Up Web Pages to Communicate with PHP, Handling Text Fields, Text Areas, Check box, Radio button, Submit, Reset, Button, Image Button, Select Box, input type email, password, date and url.
File Handling: Working with files: File Open and Read, File Create and Write, Reading and writing Character in file, reading entire file, Rename and Delete File, File Uploading.

Unit V
Database Access: Using PHP to access a database. Introduction to MySql, connectivity with MySql.
Creating form and saving data of form to MySql. Performing CRUD operation using PHP and MySql.

Text Books:

1) Programming PHP by Rasmus Lerdorf and Kevin Tatroe, O'Reilly Publications
2) Beginning PHP5 by Wrox Publication
3) Mastering PHP : BPB Publication

4) PHP 5.1 for beginners by Evan Bayross and Sharman Shah, SPD Publications
5) PHP 5.2 The Complete Reference by Steven Holzner, Mc Graw Hill Edition 2008.

B.C.A. vi Semester Computer Science

603: Computer Graphics & Multimedia

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: VI**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 603	**Course Title: 603: Computer Graphics & Multimedia**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** Understand the basics of computer graphics, different graphics systems and applications of computer graphics. b) Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis. c) Use of geometric transformations on graphics objects and their application in composite form. d) Extract scene with different clipping methods and its transformation to graphics display device. e) Explore projections and visible surface detection techniques for display of 3D scene on 2D screen		

Min. Marks: 28 **Max. Marks: 85**

Unit I

Computer Graphics: Introduction, Application of Computer Graphics, Display Devices: Refresh Cathode -Ray Tubes, Raster Scan Displays, Random Scan Displays, Color CRT Monitors, Flat Panel Displays. Video cards/display cards. Input Devices: Mouse, Trackball, Space ball, Data Glove, Joystick, Light pen, Scanner, Digital Camera, Touch Panels, Voice Systems. Hardcopy Devices: Printers and Plotters.

Unit II

Graphics Primitives: Line Generation Algorithms: DDA algorithm, Bresenham's algorithm. Circle Generation Algorithms: Midpoint Circle algorithm, Bresenham's circle generation algorithm. Displaying Lines, characters and polygon. Polygon filling Algorithms: Scan Line Polygon fill algorithm, Inside - Outside Tests, Boundary-Fill algorithm, Flood -Fill algorithm. Fundamentals of Aliasing, Antialiasing Technique.

Unit III

Clipping: Clipping operations. Point clipping. Line clipping: Cohen Sutherland Algorithm, Liang Barsky Algorithm, Nicholl-Lee-Nicholl Algorithm. Polygon clipping: Sutherland- Hodgeman Algorithm, Weiler Atherton Algorithm. Text clipping, Exterior clipping.

Unit IV

Two Dimensional: Two Dimensional Transformations: Translation, Scaling, Rotation, Reflection, Shear, Homogenous coordinate system, Composite transformations, Raster method of transformation. Two- D i m e n s i o n a l Viewing: Window to Viewport coordinates transformation.

Unit V

Multimedia: Introduction, Multimedia applications, Multimedia data and File formats, Multimedia tools. Advancements in the technology in Computer graphics and Multimedia.

Text Books:

1) Donald Hearn and M. Pauline Baker, *Computer Graphics: C Version*, Second Edition, Prentice Hall of India.
2) Tay Vaughan, Multimedia: Making it Works, Seventh Edition, Tata McGraw-Hill Professional, New Delhi.

Reference Books:

1) David F. Rogers, *Procedural Elements for Computer Graphics*,Tata Mc-Graw-Hill Publishing Company Ltd.,New Delhi,2001.
2) James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, *Computer Graphics: Principles and Practice in C*, Second Edition,Addison-Wesley Professional.
3) Zhigang Xiang, Roy A. Plastock, *Schaum's outline of Theory and Problems of Computer Graphics*, Second Edition ,Tata McGraw-Hill Professional, New Delhi.

B.C.A. vi Semester Computer Science

604: Principles and Practices of Management

Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class:** B.C.A.	**Semester: VI**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: 604	Course Title: – **604: Principles and Practices of Management**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. To understand nature ,Characteristics , Function ,Importance of management 2. To understand Planning and component ,Objectives of business 3. To understand organizing ,Deprtmentation and staffing 4. To understand principle of Direction and human Relation 5. To understand technique of control in management		

Semester-VI

BCA – 604: Principles and Practices of Management

Academic Year: 2021-2022

Min. Marks: 28 **Max. Marks: 85**

Unit I

The Nature of Management: Definition and role of management, Functions of Manager, Scientific Management, Human Relations school of Management, Contingency Theory of Management.

Unit II

Planning: Nature and Purpose of Planning, Components of Planning, objective of Business Management by Objectives.

Unit III

Organizing: Nature of Purpose of Organizing, Departmentation, Span of management, Delegation of Authority, Line and Staff Relationships. Staffing: Nature of staffing, problems faced in staffing, process of staffing.

Unit IV

Directing Process: Principles of Direction, Problems in Human Relation, Strategies for Establishing Healthy Human Relations.

Unit V

Control: Meaning and Process of Control, Control Techniques.

Text Book:

1) "Principles of Management", Harold Koontz, O'Donnel and Heinz Weihrich ,New York: McGraw Hill Book Co

Reference Books:

1) "Management", Stoner, Freeman and Gilbert Jr., PHI, 6th Ed.
2) "Organization and Management Concepts", R.D. Agarwal, New Delhi, Tata McGraw Hill. 1995.
3) "Management", Robbins and Coulter, PHI, 8th Ed.
4) "A. - Fundamentals of Management: Essential Concepts and Applications", Robbins S. P. and Decenzo David, Pearson Education, 5th Ed.
5) "Introduction to Management Science: A Modeling and Case Studies Approach with Spreadsheets", Hillier Frederick S. and Hillier Mark S. Tata McGraw Hill, 2nd Ed., 2008.

Semester-VI
BCA – 605: PROJECT
Academic Year: 2021-2022

Min. Marks: 33 **Max. Marks: 100**

The students are expected to work on a project in their final year. The student can formulate a project problem with the help of her/his Guide and submit the project proposal of the same. If approved, the student can commence working on it and complete it. The Project comprises of 25 marks, of which Project Demonstration & Report is evaluated for 20 marks and the Viva-Voce is for 15 marks by the external examiner.

Project Report Guidelines

I Introduction

Project Introduction
Existing System with limitations
Proposed System with aim and objectives
Preliminary investigation
Feasibility study
Software/ hardware Requirements

II System Analysis

Functional and non-functional requirements
System Flowcharts
Data Flow Diagram
E-R Diagrams

III System Design

Architectural design
File / Database Design
Normalization
User Interface Design

IV Coding

VI System Testing

Testing techniques and Testing strategies used
Testing Plan used
Test reports for Unit Test Cases and System Test Cases

VIII Conclusions
Bibliography
Appendices (if any)

GOVT. HOLKAR [MODEL, AUTONOMOUS] SCIENCE COLLEGE INDORE

Academic Year 2021-2022

Affiliated to Devi Ahilya Vishwavidyalaya, Indore

Syllabus for PGDCA

Computer Science

(Faculty of Computer Science)

DEPARTMENT OF COMPUTER SCIENCE

PGDCA

Academic Year 2021-2022

Govt. Holkar (Model Autonomous) Science College, Indore										
Computer Science Department										
Syllabus Session 2021-22										
Programme: PGDCA									**Class: PGDCA I Sem.**	
S.No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External Assessment Max.	External Assessment Min.	Total Max.	Total Min.
1	Core 1	Fundamental of Computer	PGDCA-11	4	25	9	75	26	100	35
2	Core 2	"C" Programing	PGDCA-12	4	25	9	75	26	100	35
3	Core 3	Operating System	PGDCA-13	4	25	9	75	26	100	35
4	Core 4	PC Software	PGDCA-14	4	25	9	75	26	100	35
5	Core 5	System Analysis and Design	PGDCA-15	4	25	9	75	26	100	35
6	Practical 1	Practical based on Theory paper 2 & 4		2			50			17
7	Project 1	Minor Project Phase I (Analysis Part)		2			50			17
				24	125		475		600	

P.G.D.C.A. I Semester Computer Science
PGDCA-11 : Fundamental of Computer
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: I**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-11	**Course Title: Fundamental of Computer**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Build an understanding of the fundamental concepts of data communication and computer networking. b. Understand how errors detected and corrected that occur in transmission c. How collisions to be handled when many stations share a single channel d. Know about routing mechanisms and different routing protocols e. Know about different application layer protocols		

PGDCA I -Semester
PGDCA-11: Fundamental of Computer
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT - I

Number System: Decimal, Binary, Octal, Hex Representations & Their Conversions.
Coding System: BCD, ACCESS-3, GRAY, ASCII, and EBCDIC. Logic Gates

UNIT- II

Block Diagram & Components of Computer System CU ALU.
Primary Memory: RAM- SRAM & DRAM, ROM-PROM. EPROM, EEPROM, Cache Memory Unified & Split.
Secondary Memory: Magnetic-Floppy, Hard Disk, Magnetic Tape, Optical CD, VCD CD-R CD-RW

UNIT- III

History & Development of Computer, Generations of Computers. Types of Computers Pentium & Power PC. Bus and its Types, I/O Port, Interconnections, Parallel Processing RAID

UNIT- IV

Input Devices Keyboard Mouse, Trackball Joystick Scanner. Dental Camera OMR Bar-Code Reader, Voice Recognizer Light pen, Touch screen.
Output Device: Monitors- Characteristics & Types, Digital, Analog, Size, Revolution, Pixel, Video Standard - VGA SVGA, XGA.
Printers- Character Impact & Character Non-Impact, Line Impact & Line Non-Impact Plotters, Speakers.

UNIT- V

Software: System & Application Software & Their Types.
Languages: Machine, Assembly & High Level languages. Generation of Languages.
Language Processor: Assembler, Interpreter, Compiler, Linker, Loader & Their Types

References:

1. Fundamentals of Information Technology : Leon
2. Fundamentals of Computers : Abhay Chandwani
3. Fundamentals of Computers : Kamal Prakashan
4. Digital Principals & Applications : Malvina & Leach

P.G.D.C.A. I Semester Computer Science
PGDCA-12 : "C" Programming
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: I**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-12	**Course Title: "C" Programming**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. General Knowledge of Programming types, Problem solving concepts, usage of Algorithm/ Flowchart .Writting, compiling and debugging programs in C language 2. students will learn how to design structure of c programs, using tokens 3. Formatted and unformatted I/O ,control statement and Looping.Design programs containing decision structures. 4. Array(1-d,2-d), Functions & Recursion, string handeling. 5. "structure,preprocessor directives(macros).		

PGDCA I -Semester
PGDCA-12: "C" Programming
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT – I

Programming Languages & Language Processor: Machine Language, Assembly Language, Procedural Oriented, Problem Oriented and Natural Languages, Generation of Programming Languages, Structured Programming, Assembler, Compiler, Interpreter, Linker, Loader, Editors.
Different Tools for Programming: Features, Advantages & Disadvantages of Algorithm, Flow Chart, Decision Table and Execution Table.

UNIT – II

Introduction to C Language: History of 'C' Language, Structure and Rules for 'C' program, Header Files, main(), Directory options for running C program. Editing Keys.
Basic Terms of C: Tokens, Variables, Expression, Constant & their types, Data Types, Storage Classes, I/O Functions and their types.

UNIT- III

Control Statements: Decision Control: if-else, Case Control: switch, Loop Control: while, do-while, for & Compression among them.
Functions: Function Prototype, Definition, Parameter passing, Recursion & their types.
Array: One dimensional, two dimensional & Multi-dimensional Arrays.
Structure and Union: Declaration, Initialization and Comparison between them.

UNIT- IV

Dynamic Memory Allocation: Heap, malloc(), calloc(), free(). Pointer variable, Address operator, Pointer Arithmetic, Pointer to Function, Pointer to Pointer, Pointer to Array, Pointer to Structure, Self-referential Structure, Call by value, Call by reference, Drawback of pointer, Storage classes and library function.

UNIT- V

Enumerated data types, files, Types of files in C, Defining, Opening & Closing a file, Input-Output operations on files, Different file access modes, Creation of files using structure, File copy & Merging of File, Random access to files, Error handing during I/O operation.

References:

1. Programming with C : E. Balaguruswami
2. Programming in C : Denis Richee
3. Flying With C : Kamal Prakashan

P.G.D.C.A. I Semester Computer Science
PGDCA-13: Operating System
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: I**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-13	**Course Title: 13: Operating System**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Introduction and evoluation of Operating system along with various types. 2. Schedule CPU time using scheduling algorithm for processors 3. Apply page replacement policies for dynamic memory management 4. Design and construct the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems, Deadlock prevention and avoidance. 5. Working with linux OS. Introduction to various linux commands and vi editor etc.		

PGDCA I -Semester

PGDCA-13: Operating System
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT- I

Introduction to OS: Definition, Types. Functions. Features: Batch Processing, Multiprogramming, Multiuser, Multitasking, Multiprocessing.
Process: Life Cycle, PCB, IPC, Critical section problems. Semaphore. Monitors.

UNIT-II

Deadlock: Reasons. Methods for Removing deadlocks, Bankers Algorithm
Process Scheduling: Preemptive and Non-preemptive scheduling like: FCFS. SJF. Round Robin. Priority Based. MLO.
RTS: Real Time OS and its scheduling methods.

UNIT-III

Memory Management: Static and Dynamic memory management, Internal & External Fragmentation Problem, Paging, Segmentation, Demand paying.
File & disk Management: File and Directory concepts and their types. File allocation Methods. Free space management methods. Disk Scheduling Methods.

UNIT -IV

DOS (Disk Operating System): DOS Basics: Booting, Post, BIOS, FAT, COM.EXE & Batch File, Pipes. Filters.
DOS Commands: Internal: DIR, MD, CD, RD, COPY, DEL, REN. VOL. VER. DATE. TIME, CLS. PATH, TYPE. PROMPT.
External: CHKDSK. DOSKEY, XCOPY, MOVE ,TREE ,DEL TREE LABLE, APPEND, FORMAT. UNFORMAT, PRINT, FDISK, SORT, MORE. ATTRIB, EDIT, SYS, DISKCOPY, DISKCOMP, BACKUP, RESTORE.

UNIT- V

Linux: History & Features, Linux Structure, File System, Various Flavor of Linux, Process creation & Process identification, Profile & login files. Kernel & shell.
Linux Command: ls, cat, who, who am i, cal, clear, date, banner, bc, ced, mkdir, rm, tty,cp, mv, chmod, chgrp, chown, cmp, find, ps, kill, wc.

References:

1. Operating System : Bhat
2. Operating System : Achut Godbole
3. Operating System : Tanbum
4. Concepts of Operating System : Kamal Prakashan
5. Linux Complete : BPB Publication

P.G.D.C.A. I Semester Computer Science
PGDCA-14: PC Software
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: I**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-14	**Course Title: 14: PC Software**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Software gives the instructions that tell the hardware what to do. There are two basic categories of software: operating systems and applications. 2. Operating systems provide access to the computer hardware and make system resources available. 3. Application software is designed to meet a specific goal. 4. introduce the components of an information system, i.e., hardware, software, data, networks, facilities, personnel, services and partners.		

PGDCA I -Semester
PGDCA-14: PC Software
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT-I

Windows 95/98: Features, Desktop, Taskbar, Start Menu, My Computer, Recycle Bin.
Accessories: Calculator, Notepad, Paint, WordPad, Windows, Explorer & Folder, Multiple users features of Windows. Dial-Up Networking.
Various Types Files & Application Format: .Pdf, .Avi, .Wav, .Zip, .Wmf, .Mp3, .Mpe, .Mpa, .Mti

UNIT-II

Word Processor-MSWORD: Introduction to MS Word: Features, Creating, Saving, Opening. Deleting files in Word, Interface, Toolbars, Ruler, Menus. Keyboard, Shortcut Printing document, editing document with Edit Menu.
Formatting Documents: Paragraph formats, Aligning Text & Paragraph, Borders & Shading, Headers & Footers, Macros.

UNIT-III

Spreadsheet. MSEXCEL Worksheet: Features, Creating, Saving. Opening. Deleting. Quitting, Toolbars: Menus, Keyboard Shortcuts.
Working with single and multiple workbook: Copying, Adding, Moving, Deleting.
Working with Formulas & Cell referencing: Autosum. Copying formulas. Absolute & Relative addressing.

UNIT-IV

MSEXCEL : Formatting Worksheet: - Autoformat, alignment, Character styles, Columnwidth, Date format, Borders & Colours, Currentely sign.
Previewing & Printing worksheet: Page setting, Print titles, Adjusting margines, Page break, Headers and Footers.
Graphics & Charts: - Using Wizards, Various charts type formatting grid lines, & Legends,
Previewing & Printing charts.
Functions: Database, Date & Time, Maths & Trigonometry. Statistical. Text and Logical

UNIT-V

Presentation Graphics - MS Power Point: Features and Basic terms, Creating presentation by using Wizards. Toolbars. Menus & Different Views.
Working with Slides: Create, Move, Copy, Delete, Duplicate, Lay-Outing of Slide, Zoom.
Printing Presentation: - Printing Slides, Notes, Handouts, and Outlines.

References:

1. PC Software : Kamal Prakashan
2. Microsoft Office97 : GiniCounter

P.G.D.C.A. I Semester Computer Science

PGDCA-15: System Analysis & Design Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: I**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-15	**Course Title: 15: System Analysis & Design**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. The objective of this course is to provide adequate understanding of systems concept, system analysis, and systems design, which would help them in having efficient and workable information system for management. 2. To provide an understanding the role of Hardware and Software for realizing organizational Objectives and automation. 3. To provide an understanding of the role of systems analyst and software development firms for their role in distributing meaningful ERP modules and other business intelligent system.		

PGDCA I -Semester
PGDCA-15: System Analysis & Design
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT-I
System and its type, Different software Engineering Models, Preliminary Investigation for System, Feasibility Study and its types, Cost/Benefit Analysis and its method, information finding Methods.

UNIT-II
Analysis: Tools for Structural Analysis: Flow Chart, DFD, Data Dictionary, Decision Tree, Decision Table.

UNIT-III
Design: Input, Output, Form, Database, File.
Testing: Black box, White box, Alpha, Beta, Unit, Integration and System SQA.

UNIT-IV
Implementation: Method of Deployment, System Conversion, User Traning.
Post Implementation: Planning, Maintenance, Extendibility, Replacement, Case- Study for a project.

UNIT-V
UML (Unifying Modeling Language): Concept of UML, UML Symbol, Basic UML Terms.
UML Diagrams: Use- Case, Sequence, Collaboration, Object, Class, Package, State Chart, Activity etc.

References:

1.	System Analysis & Design	: Awad
2.	Software Engineering	: Pressman
3.	Software Engineering	: James S. Sen
4.	SAD & Software Engineering	: Kamal Prakashan

PGDCA

Academic Year 2021-2022

Govt. Holkar (Model Autonomous) Science College, Indore										
Computer Science Department										
Syllabus Session 2021-22										
Programme: PCDCA									**Class :PGDCA II Sem.**	
S.No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External Assessment Max.	External Assessment Min.	Total Max.	Total Min.
1	Core 6	Web Designing (HTML,XML, DHTML)	PGDCA-21	4	25	9	75	26	100	35
2	Core 7	Visual Basic	PGDCA-22	4	25	9	75	26	100	35
3	Core 8	RDBMS using Oracle	PGDCA-23	4	25	9	75	26	100	35
4	Core 9	Computer Networking	PGDCA-24	4	25	9	75	26	100	35
5	Core 10	Internet & E-Commerce	PGDCA-25	4	25	9	75	26	100	35
6	Project 2	Software Project Phase II		4			100			35
				24	125		475		600	

P.G.D.C.A. II Semester Computer Science
PGDCA 21: Web Designing
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-21	**Course Title: 21: Web Designing**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Understand the principles of creating an effective web page, including an in-depth consideration of information architecture. 2. Become familiar with graphic design principles that relate to web design and learn how to implement theories into practice. 3. Develop skills in analyzing the usability of a web site. 4. Understand how to plan and conduct user research related to web usability. 5. Learn the language of the web: HTML and CSS.		

PGDCA II -Semester
PGDCA-21: Web Designing
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT-I
Webpage, Websites, HTML: HTML Tags Related To: Text. List, Tables, Frames, Hyperlink, Multimedia, Style Sheets.

UNIT- II
HTML: Event Handling, Meta, DIV & SPAN tags, DOM, DHTML (Without Scripting Language), Introduction to XML with examples.

UNIT-III
Java Script: Data Types, Operators, Keywords, Control Structure and Loops, Arrays, Inbuilt Functions and their types.

UNIT-IV
Java Script: User defined functions, calling function by HTML, Object properties & Methods: Hidden Fields & Cookies, Design a Website with dynamic Web Pages.

UNIT-V
Client-Server Computing, Distributed Computing, Introduction to ASP, JSP, CGI, PERL, WML, WAP.

References:

1. HTML in 24 Hours : Tech Media
2. Java Script Complete : BPB
3. Programming In Web Designing : V.Jain
4. Web Designing :Kamal Prakashan

P.G.D.C.A. II Semester Computer Science
PGDCA 22: Visual Basic
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-22	**Course Title: 22: Visual Basic**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Design, formulate, and construct applications with VB.NET 2. Integrate variables and constants into calculations applying VB.NET 3. Determine logical alternatives with VB.NET decision structures 4. Implement lists and loops with VB.NET controls and iteration 5. Separate operations into appropriate VB.NET procedures and functions		

PGDCA II -Semester
PGDCA-22: Visual Basic
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT-I

Introduction: Concept of Front End, Back End. GUI, About VB
Basics of VB: New Project Window, VB Project, IDE
Different Components of IDE: Project Explorer. Property Window, Tool Box, From Layout Window, Object Browser: Tool Box, Menu Editor, Image List, Form Design Run Time & Design Time Properties.
Menus: File Menu, Format Menu, Help Menu.

UNIT- II

Token's: Variables, Constants, Data Types.
Statements: Control Statements, Coding Statements & Style i.e. E.D.P, Different Types of Procedure's.
Input/ Output Statement: (MsgBox) and (Input Box).
Arrays, Collection and Types.
Programming with Objects / Controls.
Error handling: Types of Error, Exception. Method's & Functions

UNIT- III

Graphics & Multimedia: Function, Command's, Method's to implement Graphical & Multimedia Features' in the Application.
Activex Components: Basic Activex Components, Advance Active Components, Text Formatting Properties.
Timer Control, Mouse Pointer & Cursors, Control array, Multiple Document Interface. Implementation of VB Functions.

UNIT-IV

Database Programming with VB: Connectivity. Connectivity Tools: Data Control ADODC, ADODB, Data Environment, Connection Type, Data Bound Control's , Single value, multi-value, Multi-Column.
Report: Introduction to Report, Types of Reports, Report in VB, Grouping, Use of SQL, Executing SQL.

UNIT-V

Text Files: Types of Files in VB, Modes of Files, Different file Operation's Scripting Control & File System. Object Moving, Updating, and Deleting from file. Introduction to VB Script. ASP and Window Programming.

References:

1. Mastering Visual Basic : BPB Publications
2. Basics of Visual Basic : Kamal Prakashan
3. Beginning Visual Basic : Peter Wright

P.G.D.C.A. II Semester Computer Science
PGDCA 23: RDBMS Using ORACLE
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-23	**Course Title: 23: RDBMS Using ORACLE**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Master the basic concepts and appreciate the applications of database systems. 2. Master the basics of SQL and construct queries using SQL. 3. Be familiar with a commercial relational database system (Oracle) by writing SQL using the system. 4. Be familiar with the relational database theory, and be able to write relational algebra expressions for queries. 5. Mater sound design principles for logical design of databases, including the E-R method and normalization approach.		

PGDCA II -Semester
PGDCA-23: RDBMS Using ORACLE
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT-I
DBMS: Definition, Schemas, Instance, Catalog, Meta-Data, Three-Levels, Different, Users, Architecture.
Model: Different Features, Advantages & Disadvantages of Network, Hierarchical, Relational & Object-Oriented Models.

UNIT-II
ER Model: Types of Attributes, Entity & Entity Sets, Symbols, Keys, Mapping, Degree of Relationship, Generalization, Specialization, Aggregation, Conversion of ER Schema into Relational Schema.

UNIT-III
Normalization: Multivalve Attributes & 1NF, Function Dependence & 2NF, Transitive dependence & 3NF, BCNF ($3^{1/2}$NF), MVD & 4NF, Join Dependency & 5NF.

UNIT-IV
SQL (Using ORACLE): Query Languages: SQL, QUEL & QBE with Practical Examples, DDL, DML & DCL Commands, Types of Oracle Join, Types of Functions.

UNIT-V
SQL * PLUS: Different Types of SELECT, Data Constraints, Primary Key, Foreign Key, NULL, UNIQUE, CHECK, Subqueries, View, Index, Sequence, Granting & Revoking Permissions.

References:

1. Database Management System : Hoffer
2. ORACLE 8i : Ivan Bayross
3. The ORACLE Complete : Oracle Press
4. Concept of Database Management System : Kamal Prakashan

P.G.D.C.A. II Semester Computer Science

PGDCA 24: Computer Networking Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-24	**Course Title: 24: Computer Networking**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** CO1: Understand fundamental underlying principles of computer networking CO2: Understand details and functionality of layered network architecture. CO3: Apply mathematical foundations to solve computational problems in computer networking CO4: Analyze performance of various communication protocols.		

PGDCA II -Semester
PGDCA-24: Computer Networking
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT-I

Communications & its types: Analog & Digital, Synchronous & Asynchronous, Connection Oriented & Connectionless, Serial & Parallel, Wire & Wireless. OSI Model: Features, Functions Protocols of Different Layers. Transmission Media: Bounded & Unbounded with Their Types.

UNIT-II

LAN,MAN & WAN: Features, Advantages & Disadvantages. Network Topologies: Features, Advantages & Disadvantages of BUS, RING, STAR, TREE, MESH. Network Architecture: Ethernet, Token Bus, Token Ring, FDDI,ARC Net.

UNIT-III

Network Layer Functions: IP Addressing & Sub netting, Switching Packet Formation (Datagram & Virtual Circuit).Routine Algorithm: Static & Dynamic like shortest path, flooding, Flow Based, DVM, LSR

UNIT-IV

Data Link & Transport Layer: Error Detection & Correction: LRC. VRC, CRC. Checksum, Hamming Code. Character Oriented & Bit Oriented Protocol (HDLC) Line Discipline, Flow Control, Similarities & Differences between Data Link & Transport Layers.

UNIT- V

TCP/ IP Protocol Suite: TCP, IP, ARP, RARP, BGP, UDP, ICMP, DNC, RIPOSPF, FTP,SMTP, NFS, TELNET. DHCP, WINS, IPX/SPX Protocol suite, Apple Talk Protocol Suite.

References:

1. Computer Networks : Stallings
2. Computer Networks : Tanunbom
3. Data Network & Communication : Miller
4. Computer Networks : Kamal Prakashan

P.G.D.C.A. II Semester Computer Science
PGDCA 25: Internet & E-Commerce
Academic Year: 2021-2022

Part-A Introduction			
Program: Certificate	**Class: P.G.D.C.A**	**Semester: II**	**Session: 2021-2022**
Subject: Computer Application			
Course Code: PGDCA-25	**Course Title: 25: Internet & E-Commerce**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have graduation in any subject.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Identify the component parts of e-commerce 2. Identify the benefits of selling online Know how to optimise and stay safe when selling online 3. Have an outline strategy for eCommerce for your business. 4. Understand the risks around Cyber Security when trading and doing business online. 5. Understand how to protect your online business, keeping your accounts secure and being aware of cyber crime.		

PGDCA II -Semester
PGDCA-25: Internet & E-Commerce
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT-I
Internet, Intranet & Extranet: Features, Advantages & Disadvantages.
Connectivity Devices: MODEM, Repeater, Hub, Bridge, Router, Switch, Gateway Their Working & Types.

UNIT-II
History & Architecture of Internet, Types of Internet A/Cs. Internet Addressing: IP Address, Domain Name, E-Mail& URL.
ISP/IAP: Types, Criteria For Selection, Facts gather from ISP, Online Services.

UNIT-III
WWW, W3C. HTTP, FTP, SMTP. POP3, Web Sites, Internet Relay Chat. E-Mail: Working, Composing, Attachment, Smileys. Netiquette, Microsoft Outlook: Menus & features.

UNIT-IV
Web Browser: Internet Explorer. Netscape Navigator, Web Server, Proxy Server, Internet Viruses, Internet Security, Firewall, Encryption, Decryption, Digital Signature, Digital Certificate, Search Engines.

UNIT- V
E-Commerce & M-Commerce: Types of E-Commerce, functions, Technologies: EDI, PDE, Barcode etc. E-business, difference between E-Commerce & E-business. Advantages & Disadvantages of E-commerce & M-Commerce.

References:

1. Internet for Dummies : Pustak Mahal, New Delhi
2. The Internet Complete Refernce : Tata McGRAAW Hill
3. Internet & Web Technology : Kamal Prakashan

GOVT. HOLKAR [MODEL, AUTONOMOUS] SCIENCE COLLEGE INDORE

Academic Year 2021-2022

Affiliated to Devi Ahilya Vishwavidyalaya, Indore

Syllabus for M.Sc.

Computer Science

(Faculty of Computer Science)

DEPARTMENT OF COMPUTER SCIENCE

M.Sc. Computer Science

Academic Year 2021-2022

Govt. Holkar (Model Autonomous) Science College, Indore										
Computer Science Department										
Syllabus Session 2021-22										
Programme: M.Sc. Computer Science								**Class: M.Sc. I Sem.**		
S.No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External Assessment Max.	External Assessment Min.	Total Max.	Total Min.
1	Core 1	Computer & Communication Fundamentals	CS11	4	25	9	75	26	100	35
2	Core 2	Discrete Structure	CS12	4	25	9	75	26	100	35
3	Core 3	Operating System	CS13	4	25	9	75	26	100	35
4	Core 4	Programming & Problem solving Through "C-Language"	CS14	4	25	9	75	26	100	35
5	Practical 1	Practical based on Theory paper 1 & 2)		3			75		75	26
6	Practical 2	Practical based on Theory paper 3 & 4		3			75		75	26
7	Seminar 1			1			25		25	9
8	Seminar 2			1			25		25	9
				24	100		500		600	

M.Sc. I Semester
Computer Science
Paper-I : Computer and Communication Fundamentals
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester I**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS11	**Course Title: Computer and Communication Fundamentals**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Build an understanding of the fundamental concepts of data communication and computer networking. b. Understand how errors detected and corrected that occur in transmission c. How collisions to be handled when many stations share a single channel d. Know about routing mechanisms and different routing protocols e. Know about different application layer protocols		

M.Sc. (CS) I -Semester
CS-11 : Computer and Communication Fundamentals
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Computer Organization : Digital and Analog computers, Major components of a digital computer, Memory addressing capability of a CPU, Word length of a computer, Processing speed of a CPU, Definitions of Hardware, Software and Firmware. Definitions of Dumb, Smart and Intelligent terminals. Binary Systems: Digital Systems, Binary Numbers, Number Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Binary Codes: BCD code, Gray Code, ASCII code, Excess 3 Code, Error detecting Code.

Unit II

Computer Arithmetic :Binary representation of Negative Integers using 2's complement and Signed magnitude representation, Fixed point Arithmetic operations on Positive and Signed (Negative) Integers like addition, subtraction, multiplication.

Boolean Algebra and Logic Gates : Basic Definitions, Basic Theorems and properties of Boolean Algebra, Boolean Functions, Canonical and standard forms, Other Logic operations, Digital Logic gates, Integrated Circuits. Gate-Level Minimization: The K-Map Method, 3 and 4 variable K-Map, Product of sums simplification, Sum of Products simplification, Don't care conditions, NAND and NOR implementations, Exclusive-OR function.

Unit III

Combinational Logic: Combinational Circuits, Analysis Procedure, Design Procedure, Binary half adder, binary full adder, binary full subtractor, binary parallel adder, carry propagation delay and Propagation delay calculation of various digital circuits. Carry look ahead generator fast adder ,Decimal Adder, Binary multiplier, Magnitude comparator, Code converters like binary to gray, BCD to excess 3. Decoders, Encoders, Multiplexers, Demultiplexers.

Unit IV

Analysis of clocked sequential circuits: State diagrams, State equations for D, JK and T Flip flops. State reduction methods using all Flip Flops. Mealy and Moore Models. Shift Registers- Serial in Serial out, Serial in Parallel out, Parallel in Serial out and Parallel in Parallel out. Designing of Asynchronous (Ripple) Counters. Design of Synchronous Counters. Synchronous Sequential logic : Sequential circuits, Latches, Flip Flops : SR, D, JK, T, Master Slave JK Flip flop. Characteristic equations and Excitation tables of flip flops.

Unit V

Communication Systems: Basics of communication systems, Types of communication, Transmission impairments, analog vs. digital transmission, requirements of communication systems, channel capacity, Shannon's theorem. Data rate of a channel, Physical Communication Media- Bounded Media: Twisted Pair, Coaxial Cable, Optical Fiber. Unbounded Media – Microwave Communication, Radio wave Communication, Satellite Comm. Time Division Multiplexing and Frequency Division Multiplexing. Data communications and its components, Half Duplex and Full Duplex Transmission. Asynchronous and synchronous transmission LAN, MAN, WAN. Network Topologies- Bus, Star, mesh, Ring. Categories of networks: Introduction of Communication Protocols like OSI and TCP/IP model.

Required Text(s):

- Digital Design by M. Morris Mano. Third addition
- Computer Architecture By Dr. Rajkamal.
- Data communications and networking By A. Forouzan
- Computer Fundamentals – Architecture and Organisation By B. Ram.
- Computer networks by Andrew Tanenbaum
- Principles of digital communication system & computer networks By K.V.K.K. Prasad
- Computer organization and architecture by William Stallings.

M.Sc. I Semester
Computer Science
Paper-II : Discrete Structure

Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester : I**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS12	**Course Title: Discrete Structure**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Be able to reason at multiple levels of detail and abstraction, being aware, in particular, of the applicability and limitations of tools from mathematics and theoretical computer science 2. "Recognize the context in which a computer system may function, including its interactions with people and the physical world." 3. Able to communicate with, and learn from, experts from different domains throughout their careers 4. "Possess a solid foundation that allows and encourages them to maintain relevant skills as the field evolves" 5. To be able to manage their own career development and advancement		

M.Sc. (CS) I -Semester
CS-12: Discrete Structure
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

The foundation: Logic, Sets and Functions: Introduction, logic, prepositional equivalences. Predicates and quantifier, set, set operations, fuzzy sets, functions for computer science, sequences and summations.

Unit II

Mathematical reasoning: Methods of proof, mathematical induction, recursive definitions, recursive algorithms.

Languages and Grammars: Introduction to Languages and Grammars. Phrase-Structure Grammars, Types of Phrase structure grammars

Unit III

Combinatorics : The basics of counting, The Piegeon Hole Principle, Permutations and combinations, Advanced counting techiques, recurrence relations,solving recurrence relations, Algorithms, Complexity of Algoritms.

Unit IV

Relations: Relations and their properties, n-ary relations and their applications, representing relations, closures of relations, equivalence relations, partial ordering.

Unit V

Graph: Introduction to graphs terminology, representing graphs and graph isomorphism, connectivity, Euler and Hamiltonian Paths, shortest Path problems, planar graphsm, graph colouring, chromatic number, Euler's formula. Kuratowski's theorem. The Four Colour problem, applications of graph colouring, introduction to trees, application of trees, tree traversal,trees and sorting, spanning trees, minimum spanning trees.

Required Text(s):

- Kenneth H,Rosen, Discrete Mathematical and it's application, 6th Edition, Tata McGraw Hill, 2007.
- C.L Liu, "Elements of Discrete Mathematics, 2nd Edition, Tata McGraw Hill, 1985.
- Kolman, Busby & Ross Discrete Mathematical Structures, 5th Edition, Pearson education, 2003
- Trembly. J.P & Manohar. P,Discrete Mathematical Structures with Applications to Computer Science, 1975

M.Sc. I Semester
Computer Science
Paper-*III* : Operating System
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester : I**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS13	**Course Title: Operating System**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Introduction and evoluation of Operating system along with various types. 2. Schedule CPU time using scheduling algorithm for processors 3. Apply page replacement policies for dynamic memory management 4. Design and construct the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems, Deadlock prevention and avoidance. 5. Working with linux OS. Introduction to various linux commands and vi editor etc.		

M.Sc. (CS) I -Semester
CS-13: Operating System
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Introduction: Evolution of operating systems, operating system concepts, operating system Services, System Calls. Batch processing, time sharing operating systems, real time systems.
Process Management: Process Concept, Scheduling, operations on process, cooperating process.
CPU Scheduling: basic Concepts, Scheduling Criteria & Algorithms.

Unit II

Concurrent Process: Mutual Exclusion, Synchronization. IPC, Techniques of inter process communication, message driven operating systems. Deadlock handling techniques.

Unit III

Memory Management: Concepts, Single user memory management. Partition memory allocation. Virtual memory management using paging and segmentation techniques, Virtual Memory Concepts.

Unit IV

File Management: Operations on a file, Structure of File System, File Access Methods, Directory structure , sharing and protection of file , Directory structure & implementation, Allocation Methods, Free Space Management.

Unit V

Device Management: Goal of input /output software design, Structure of device hardware and software. Layers of I/O software. Structure of device driver, disk driver, disk arm scheduling Algorithms, terminal driver, function of clock driver, printer, mouse, scanner etc.
Case Studies: Unix/Linux, Windows operating system.

Required Text(s):

- A. Silberschatz and P. Galvin ,Operating System Concepts, 6th Edition, Addison Wesley, 2003.
- William Stallings, Operating systems, 4th Edition, Prentice Hall, 2000.
- D.Dhamdhere, Operating System: a concept based approach, 1st Edition, Tata McGraw Hill, 2003.
- A.S. Tanenbaum , Modern Operating System, 3rd Edition, Prentice Hall of India

M.Sc. I Semester
Computer Science
Paper-*IV* : Programming & Problem Solving Through "C"
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester : I**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS14	**Course Title: Programming & Problem Solving Through "C"**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. General Knowledge of Programming types, Problem solving concepts, usage of Algorithm/ Flowchart .Writting, compiling and debugging programs in C language 2. students will learn how to design structure of c programs, using tokens 3. Formatted and unformatted I/O ,control statement and Looping.Design programs containing decision structures. 4. Array(1-d,2-d), Functions & Recursion, string handeling. 5. "structure,preprocessor directives(macros). "		

M.Sc. (CS) I -Semester
CS-14: Programming & Problem Solving Through "C"
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Overview of Problem solving: Introduction to computer based Problem solving, Programming concepts with flowcharting and algorithms , classification of Programming languages, Programming environment {Assemblers, compilers, interpreters, linkers and loaders}. Developing and debugging flowcharts for programming problem.

Unit II

Fundaments of C programming: Overview of C - Various constructs of C program, coding style, data types, constants and variables, expressions and operators, basic input/output operations and formatting characters, decision making and branching, looping constructs, Arguments to main, Enumerations and bits fields, typedef, type casting, Storage class.

Unit III

Array and their Applications: Arrays {one dimensional and multidimensional array}, String Handling, Searching (Linear and binary) and sorting (selection, bubble, insertion) techniques, matrices operations.

Unit IV

Advanced Programming Concepts: Structures and union, Functions {Standard and User defined function, parameter passing, scope rules}. Recursion {Using recursion, conversion of recursive program to non-recursive}. Dynamic memory allocation and pointer{Uses, pitfalls, pointer to various user defined and standard data types}.

Unit V

More Advanced Programming Concepts: Pre-processors {define, include, macro's, ifdef…}.Introduction to file handling. Header files creation, introduction to Graphics.

Required Text(s):

- B.W. Kerighan & D.M. Ritchie, The C programming Language, 2nd Edition Prentice Hall, 1998.
- Herbert Schildt, C++ The Complete Reference , 4th Edition McGraw-Hill 2000.
- Yashavant Kanetkar, Let Us C, 8th Edition, Infinity Science Press 2008.
- Ashok N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education.

DEPARTMENT OF COMPUTER SCIENCE

M.Sc. Computer Science

Academic Year 2021-2022

Govt. Holkar (Model Autonomous) Science College, Indore										
Computer Science Department										
Syllabus Session 2021-22										
Programme: M.Sc. Computer Science								Class :M.Sc. II Sem.		
S.No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External Assessment Max.	External Assessment Min.	Total Max.	Total Min.
1	Core 5	Computer Networks	CS21	4	25	9	75	26	100	35
2	Core 6	Data Structures using C++	CS22	4	25	9	75	26	100	35
3	Core 7	Computer Oriented Numerical and Statistical Method	CS23	4	25	9	75	26	100	35
4	Core 8	Database Management Systems	CS24	4	25	9	75	26	100	35
5	Practical 3	Practical based on Theory paper 5 & 6		3			75		75	26
6	Practical 4	Practical based on Theory paper 7 & 8		3			75		75	26
7	Seminar 3			1			25		25	9
8	Seminar 4			1			25		25	9
				24	100		500		600	

M.Sc. II Semester
Computer Science
Paper-*I* : Computer Networks
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester : II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS21	**Course Title: Computer Networks**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Explain the importance of data communications and the Internet in supporting business Communications and daily activities. b. Analyze the services and features of the various layers of data networks. c. Explain how communication works in data networks and the Internet. d. Recognize the different internetworking devices and their functions. e. Explain the role of protocols in networking.		

M.Sc. (CS) II -Semester
CS 21: Computer Networks
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Introduction: Computer Network, Goals and Applications, Reference models – OSI and TCP/IP. A Comparative study. Network hardware – LAN, MAN and WAN and topologies. LAN components – File server, Workstations, Network Adapter Cards. Connection Oriented and Connection less services, Switching Techniques – Circuit Switching, Packet Switching.

Unit II

Design Issues: Framing, Error Control, Flow Control, Error Detection and Correction, entary Data Link Protocols, Sliding window protocol, Data link layer in the Internet – SLIP and PPP.

Unit III

Multiple Access Protocols: Aloha, CSMA Protocols, Collision-Free Protocols, Ethernet: Cabling, Manchester Encoding, MAC Sublayer Protocol, Token bus . MAC Sublayer Protocol, Token Ring. MAC Sublayer Protocol, High speed LANs – Fast Ethernet, FDDI, Wireless LANs, Bridges.

Unit IV

Network Layer: Design issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Flooding ,Distance Vector Routing, Link State Routing , Hierarchical Routing, Broadcasting Routing, Multicast Routing, The Network Layer in the Internet: Internet Protocol, Internet addressing and Internet Control protocols.

Unit V

Transport Layer: Services, The Internet, Transport Protocols : TCP and UDP.
Application Layer: DNS Name Space, Name Servers, FTP, TELNET, WWW, SNMP, HTTP, SMTP, Network Security : Cryptography, Symmetric- key Algorithms ,Public- key Algorithms, Digital Signatures, E-mail Security.

Required Text(s)

- A. Tanenbaum, Computer Networks, 5th Edition, Addison-Wesley, 2003.
- W. Stallings ,Data and Computer Communications, Prentice-Hall, 5th Edition, 1997
- Michael A. Miller Data and Network Communication, Delmar Thomson Learning Inc.
- Introduction to Computer Networks: Douglas E. Comer, Prentice-Hall.
- James F. Kurore & Keith W. Rose , Computer Networking ,3rd Edition Pearson Education, 2005.
- Alberto Leon-Garcia and Indra Widjaja, Communication Networks : Fundamentals Concepts and Key Architecture, Tata McGraw-Hill Publishing Company Limited

M.Sc. II Semester
Computer Science
Paper-I : Data Structures using C++
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS22	**Course Title: Data Structures using C++**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** 1. Introduction to C, key concepts of object oriented programming, unformatted & formatted console I/O oprations. 2. parts of C program, tokens, oprators, Control structures. 3. Functions, function overloading, demonstration of Classes and objects, implementing abstraction using access specifiers. 4. Operator overloading, reusing code through Inheritance and its types. 5. Pointer & Arrays of classes, implementing Polymorphism, Template, Handling Exceptions		

M.Sc. (CS) II -Semester
CS 22: Data Structures using C++
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Introduction to C++, Definition of data structures and abstract data types. Static and Dynamic implementations. Examples and real life applications. Data Structures: Arrays, Address calculation in a single and multi dimensional array. Sparse matrices.

Unit II

Definition, Array based implementation of stacks, Linked List based implementation of stacks, Examples. Infix, postfix, prefix representation .Applications: Mathematical expression Evaluation.
Definition: Queues & Lists: Array based implementation of Queues / Lists, Linked List implementation of Queues / Lists, Circular implementation of Queues and singly linked Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority queues, Applications.

Unit III

Definition of trees and Binary trees, Properties of Binary trees and Implementation, Binary Traversal – preorder, post order, in order traversal, Binary Search Trees, Implementations. Threaded trees, balanced multi way search trees, AVL Trees, Implementations, Applications. Definition of Undirected and Directed Graphs and Networks, The Array based implementation of graphs, Adjacency matrix, path matrix implementation, The Linked List representation of graphs, Shortest path Algorithm, Graph Traversal – Breadth first Traversal, Depth first Traversal, Connectivity of graphs; Connected components of graphs, Weighted Graphs, Applications.

Unit IV

Definition: Hash function, Collision Resolution Techniques, Hashing Applications. Time Complexity, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Evaluating time Complexity.

Unit V

Introduction, Sorting by exchange, selection, insertions, Bubble sort, Selection sort, Insertion sort, Pseudo code algorithm and their C++ implementation, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays, merge sort Algorithms Quick sort Algorithm. Analysis of Quick sort, Picking a Pivot, A partitioning strategy, Heap sort, Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach, Radix sort.

Straight Sequential Search, Array implementations, Linked List representations, Binary Search, non – recursive Algorithms, recursive Algorithms, Indexed Sequential Search.

Required Text(s)

- Jr. Symour Lipschetz, Schaum's outline of Theory & Problems of Data Structures, McGraw-Hill, 1986.
- Ellis Horowitz & Sartaj Sahni, Dinesh Mehta: Fundamentals of Data structures in C++,2nd Edition, Universitys Press,2008.
- Sartaj Sahni, Data Structure: Algorithms and application in C++, International edition, WCB/McGraw Hill, 2000.

M.Sc. II Semester
Computer Science
Paper-II : Computer Oriented Numerical and Statistical Method
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS23	**Course Title: Computer Oriented Numerical and Statistical Method**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. To develop the mathematical skills of the students in the areas of numerical methods. b. To teach theory and applications of numerical methods in a large number of engineering subjects which require solutions of linear systems c. finding Eigen values, eigenvectors, interpolation and applications, solving ODEs, PDEs. d. To lay foundation of computational mathematics for post-graduate courses specialized studies and research. e. Dealing with statistical problems like testing of hypotheses.		

M.Sc. (CS) II -Semester
CS 23: Computer Oriented Numerical and Statistical Method
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit 1

Solution of non-linear & transcendental equations

Computer Arithmetic: Floating-point representation of numbers, arithmetic operations with normalized floating-point numbers and their consequences, significant figures. Error in number representation-inherent error, truncation, absolute, relative, percentage and round-off error. Iterative Methods: Bisection method, method of false position, newton rapson method, secant method, method of successive approximation, concept oriented theoretical consideration of above methods.

Unit 2

Solution of linear equations Meaning, conditions for solutions, solution of equation by direct methods - (Gaussian elimination, Gaussian jordan), iterative methods - (Jacobi method, gaussian seidel), ill-conditional equations and solution.

Unit 3

Interpolation and approximation Introduction, finite differences, Newton's formulae, Central difference formulae, interpolation with unevenly spaced points, divided difference and their properties, inverse interpolation and double interpolation.

Unit 4

Numerical integration & solution of ordinary differential equations Concept of numerical integration with geometrical representation, trapezoidal method, simpson - 1/3 rule, simpson - 3/8 rule, veddle's rule, understanding and solution of Ordinary Differential Equation and theoretical consideration, euler method, modified euler's method, R-K 2nd order & 4th order method, predictor corrector methods.

Unit 5

Statistics Graphical representation, Frequency distributions, Measures of central tendency, Measures of dispersions, Correlation, Regression.

TEXT BOOK:

V. Rajaraman, Computer Oriented Numerical Methods, Prentice Hall, India.

REFERENCE BOOKS

1. S. S. Sastry, Introductory Methods of Numerical Analysis.
2. M. K. Jain, S.R.K. Iyengar & R. K. Jain, Numerical Methods for Scientific and Engineering Computation.
3. H. C. Saxena, Finite Differences and Numerical Analysis.
4. Modes A., Numerical Analysis for Computer Science.

M.Sc. II Semester
Computer Science
Paper-II : Database Management Systems
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester II**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS24	**Course Title: Database Management Systems**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Demonstrate the basic elements of a relational database management system. b. Identify the data models for relevant problems. c. Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data. d. Demonstrate their understanding of key notions of query evaluation and optimization techniques. e. Extend normalization for the development of application software's.		

M.Sc. (CS) II -Semester
CS 24: Database Management Systems
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Introduction: Purpose of DBMS, view of data, data independence, data model, data base languages, traditional/flat files versus database approach, merits and demerits of both approaches. Profile of people working in DB environment, database administration, and overall system structure.

Entity-relationship model: Basic concepts of entities and relationships, design issues, mapping constraints, keys, super key, entity-relationship (E-R) diagram, weak entity sets, extended E-R features, design of E-R database schema and reduction of E-R schema to tables.

Unit II

Relational –model: Structure of relational database, relational algebra, tuple relational calculus, and extended relational algebra operators.

Integrity Constraints: Domain constraints, referential integrity, foreign key.

Structure Query Language(SQL): Basic structure ,set operations, aggregate functions, Null values nested and correlated sub queries ,derived relations,views,Data Definition Language(DDL) Embedded SQL,and other SQL features, introduction to(other relational query languages),Query –By-Example(QBE) and QUEry Language(QUEL), assertions, triggers and stored procedures.

Unit III

Design theory of relational databases: Functional Dependencies, Design issues problem faced in designing an application, decomposition, Normalization using multivalve dependencies, Normalization using join dependencies, Domain key normal form and alternative approaches to database design.

Unit IV

Concurrent operation on database: Locked based protocols, Time-stamp based protocols, multiple granularity, multiversion schemes, deadlock handling, Insert and delete operation, Thomas Writing Rule and concurrency in index structures.

Unit V

Crash recovery systems: Failure classification, storage structure, recovery and Atomicity, Log Based Recovery mechanisms, Shadow paging, Recovery with concurrent transactions, and advanced recovery techniques.

Introduction to distributed and Object Oriented Databases.

Case study : Oracle

Required Text(s):

- Henry F. Kourth, Abraham Silverschatz, S. Sudarshan "Database System Concepts",5th Edition TataMcGraw Hills Publishing Co.,2005
- Ramez Elmasri, shamkant B. Navathe, Fundamentals of Database System, 5th edition, addition Wesley, 2006.
- An Introduction to Database system- Bipin C. Desai.
- SQL, PL/SQL the Programming Language of Oracle- Ivan Bayross.
- An Introduction to Database system- C.J. Date.

M.Sc. Computer Science

Academic Year 2021-2022

Govt. Holkar (Model Autonomous) Science College, Indore										
Computer Science Department										
Syllabus Session 2021-22										
Programme: M.Sc. Computer Science								Class :M.Sc. III Sem.		
S.No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External Assessment Max.	External Assessment Min.	Total Max.	Total Min.
1	Core 9	Object Oriented Programming using JAVA	CS31	4	25	9	75	26	100	35
2	Core 10	Database Applications and Tools	CS32	4	25	9	75	26	100	35
3	Elective 1/1	Theory of Computation	CS33 - A	4	25	9	75	26	100	35
	Elective 1/2	Computer Architecture	CS33 - B							
4	Elective 2/1	Software Engineering	CS34-A	4	25	9	75	26	100	35
	Elective 2/2	Linux/ UNIX Administration	CS 34-B							
5	Open Elective (Inter disciplinary)	Paper 13 (out of given group)		4	25	9	75		100	35
5	Practical 5	Practical based on Theory paper 9 & 10		3			75		75	26
6	Practical 6	Practical based on Theory paper 1 & 2 (Elective)		3			75		75	26
				26	125		525		650	

Open Elective Paper –

Name of Department responsible for framing of syllabus	Title of Paper
Bioinformatics	Basic of Bioinformatics
Biochemistry	Biochemical Techniques
Geology	Remote sensing
Botany	Environment Biology
Microbiology	Basic of Microbiology
Mathematics	Mathematical Modeling
Computer Science	Computer Application
Statistics	Bio- Statistical Techniques
Chemistry	Research Methodology
Language (English)	Communication Skills
Respective Departments	In-house Project

M.Sc. III Semester
Computer Science
Paper-I : Object Oriented Programming using Java
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester III**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS31	**Course Title: Object Oriented Programming using Java**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. The students will have the competence in the use of Java Programming language b. The development of small to medium sized application programs that demonstrate professionally acceptable coding. c. "An understanding of the principles and practice of object oriented programming in the construction of robust maintainable programs which satisfy the requirements." d. Design and implement an application that demonstrates their competency with Java syntax, structure and programming logic, incorporating basic features of the language as well as some features from the I/O (Input/Output) or GUI libraries e. Competence in the use of Java Programming language in the development of small to medium sized application programs that demonstrate professionally acceptable coding and performance standards.		

M.Sc. (CS) III -Semester
CS 31: Object Oriented Programming using Java
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Introduction to Java: Features of Java, Object-oriented programming overview, Introduction of Java Technologies, How to write simple Java programs, Data Types, Variables &Arrays, Naming Conventions, Type conversion & casting, Operators, Control Statements, Selection Statements, Iteration Statements, Jump Statements.

String Handling: The String constructors, String operators Character Exaction, String comparison, String Buffer.

Unit II

Introducing Class: Class fundamentals, Declaring objects, Introducing methods, Constructors, Garbage collection, Overloading methods, Parameter passing, Nested and Inner class.

Inheritance: Basic, Using super, Method overriding, Dynamic Method Dispatch, Abstract classes, The Object class.

Unit III

Packages and Interfaces: Defining a Package, Understanding CLASSPATH, Access Protection, Importing packages, defining an Interface, Achieving multiple inheritance through interfaces, Variables in Interfaces.

Exception Handling: Exception handling fundamentals, Exception types, Using try and catch, Multiple catch and nested try, Throw, throws and finally, Creating own exception classes.

Multithreading: What are threads, The java thread model, Thread priorities, Thread life cycle, Creating thread, Creating multiple threads, Thread Groups, Synchronization, Inter-thread Communication.

Unit IV

Streams and Files: Files and Streams

Introduction To Swing: Overview of swing Components, Event Handling, Layout managers

Applets: Applet basics, Applet Architecture, Applet skeleton, Applet HTML Tag and attributes, Passing parameters to Applets.

Unit V

Database connectivity: JDBC, The design of JDBC, Typical uses of JDBC, The Structured Query language, Basic JDBC Programming concepts, Executing Queries.

Introduction to Generic and Collection API.

Required Text(s)

- Deitel & Deitel JAVA How to Program, 6th Edition , Pearson Education.
- Herbert Schildt ,The Complete Reference JAVA 2, 4th Edition , Tata McGraw-Hill.
- John Hubbard, Schaum's Easy outline: Programming with Java .
- JAVA 2 Black Book.
- Bruce Eckel ,Thinking in Java by Bruce Eckel , Prentice Hall.
- Gary Cornell, Cay Horstmann ,Core Java 1.2: Volume 1 Fundamentals by Gary Cornell, Cay Horstmann, Prentice Hall.
- Java Series ,The Sun Microsystems Press Java Series.
- Janson Hunter with William Crawford Java Servlet Programming, ,O'Reilly.

M.Sc. III Semester
Computer Science
Paper-II : Database Applications and Tools

Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester III**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS32	**Course Title: Database Applications and Tools**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Eliminate redundant data. b. Make access to the data easy for the user. c. Provide for mass storage of relevant data. d. Protect the data from physical harm and un-authorised systems. e. Allow for growth in the data base system and Maintaining Warehouse.		

M.Sc. (CS) III -Semester
CS 32: Database Applications and Tools
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Database Development Process: Database Development within information Systems Development, Information System Architecture, Information Engineering, Information System planning. Database Development Process, System Development Lifecycle

Unit II

Database Analysis: Modeling Data in Organization, ER Model and ER Model Constructs, EER Models and EER Models Constructs, case study

Unit III

Logical and Physical Design of Database System: Relational Data model, Transforming EER into Relations, Normalization, Designing Fields, Choosing Data Types, Choosing Data Integrity, Designing Physical Records and De-normalization.

Unit IV

Designing Physical Files: File Organizations, Sequential File Organization, Indexed File Organization, Hashed File Organization, RAID, Query Processing and Optimization.

Unit V

Advanced Topics(Overview) : Data Warehousing, Data Mining, Distributed Databases, Object Oriented databases, Object Relational Databases, Case Study.

Reference Books:

- Jeffrey A. Hoffer, Mary Prescott, Fred McFadden, Modern Database Management, 8th Edition, Pearson Education.
- Thomas M. Connolly, Carolyn E. Begg, Data Base System: A Practical approach to Design, Implementation and Management, 4th edition, Addition Wesley, 2004.

M.Sc. III Semester
Computer Science
Paper-III : Theory of Computation

Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester III**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS33-A	**Course Title: Theory of Computation**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. To give an overview of the theoretical foundations of computer science from the perspective of formal languages b. To illustrate finite state machines to solve problems in computing c. To explain the hierarchy of problems arising in the computer sciences d. To solve various problems of applying normal form techniques, push down automata and Turing Machines e. To familiarize Regular grammars, context frees grammar		

M.Sc. (CS) III -Semester
CS 33 - A: Theory of Computation
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Introduction :Grammars and Languages. Context Free and Context Sensitive Languages. Programs , Languages and Parsing. Phrase Structure Grammars and their classification. Chomsky Hierarchy. Closure Properties.

UNIT II

Theory of Automata: Finite Automata, Deterministic Finite Accepters- Transition Graphs, Languages and DFAs. Regular Languages, Non-Deterministic Finite Acceptors. Equivalence of Deterministic and Non-deterministic Finite Accepters, Mealy and Moore models-Definitions, Transformation of Mealy Machine into Moore Machine and vice-versa. Minimization of Finite Automata – Definition and Construction.

UNIT III

Regular Languages: Regular Expressions, Connection between Regular Expressions and Regular Languages. Regular Grammars – Right and Left Linear Grammars, Equivalence between Regular Languages and Regular Grammars.

UNIT IV

Context-Free Languages : Context-Free Grammars- Leftmost and Rightmost Derivations, Derivation Trees, Parsing and Ambiguity, Simplification of CFGs. Chomsky Normal Form, Greibach Normal Form, Cockie-Kasami-Younger Algorithm. Properties of Context-Free Languages.

UNIT V

Pushdown Automata : Definition, Nondeterministic Pushdown Automata, Pushdown Automata for Context Free Languages. Context-Free Grammars for Pushdown Automata. Deterministic Pushdown Automata and Deterministic Context-Free Languages.

Turing Machines: Definition of standard Turing Machine, Turing Machine as Language Accepters and Transducers.

Required Text(s):

- Mishra and Chandrasekaran, Theory of Computer Science, Prentice Hall of India.
- Hopcraft and Ullman, Introduction to Automata Theory, Languages and Computation, Narosa Publishing House.
- John E. Hopcroft , Rajeev Motwani , Jeffrey D. Ullman , Introduction to Automata Theory, Languages, and Computation ,3rd Edition,Addison Wesley, 2006.
- Moll, Arbib and Kfoury, An Introduction to Formal Language Theory, Springer-Verlag.
- Peter Linz, An Introduction to Formal Languages and Automata, Narosa Publishing House

M.Sc. III Semester
Computer Science
Paper-III : Computer Architecture

Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester III**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS33-B	**Course Title: Computer Architecture**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Convert different type of codes and number systems which are used in digital transmission and computer systems. b. Compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency c. Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping d. various memory devices, their uses and applications in different types of digital circuits for real world application.		

M.Sc. (CS) III -Semester
CS33-B: Computer Architecture
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I
Technological trends, measuring performance, Amdahl's law.
Basic structure of computer hardware: Functional units and components in computer Organization. The memory unit, the input and output subsystem, the bus structures, ALU.
Program development tools: Compiler, interpreter, assembler.

Unit II
Instruction sets and processor organizations: Instruction and Interrupt Cycles, Instruction Sequencing, Addressing Modes. Instruction set.
8088 microprocessor: Architecture. 8088 Assembly language programming.

Unit III
Processing unit design: Processor micro architecture I - fundamental concepts of data path Implementation. Processor micro architecture II- data path implementation, Hardwired control
Unit, micro programmed Execution.

Unit IV
Instruction pipelining and parallel processing: Instruction pipelining hazards, Instruction set Design influence on pipelining, Example of a pipelined CISC & RISC processor.

Unit V
Instruction level parallelism: VLIW Processors, Vector processors, Multithreaded processors, Extracting parallelism. Caches. Data Caches, instruction caches, Unified caches, Cache implementations, multilevel caches.
Virtual memory : Organization, Mapping functions for translating the program pages in virtual to physical address space, Cache and virtual memory.

Required Text(s):

- Computer Architecture: Scahaum's outlines by Nicholas Carter Adapted by Dr. Rajkamal, 1st Edition, McGraw Hill,2001.
- Computer Organization by Hamecher.
- William stallings ,Computer Organization & Architecture, 6th Edition, Prentice Hall, 2002.
- Computer Architecture & Parallel Processing, Hwang & Briggs, McGraw Hill.

M.Sc. III Semester
Computer Science
Paper-III : Software Engineering

Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester III**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS34-A	**Course Title: Software Engineering**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Understand the importance of the stages in the software life cycle. b. Understand the various process models c. Be able to design software by applying the software engineering principles d. To understand important concepts of software engineering and project management. e. introduction of management information system		

M.Sc. (CS) III -Semester
CS 34-A: Software Engineering
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Introduction to Software Engineering & Software Processes: Software problem, Software engineering problem, Software engineering approach, Software characteristics and Applications. Software processes and its components, characteristics of software processes, Software development processes: Linear Sequential model, Prototyping model, RAD model, Iterative Enhancement model, Spiral model, Component based development, Comparative study of various development models.

Unit II

Project management process & Project Planning: The people, product, process and project, Phases of project management process, Project life cycle, the W5HH principle. Software configuration management process, Process management process: Capability Maturity Model (CMM). Project estimation (Size & Cost), Project Scheduling, Staffing and personnel planning, Software configuration management plans, Quality assurance plans, Project monitoring plans, Risk management.

Unit III

Software Requirement Analysis and Specification : Software requirements, Problem analysis (Structured analysis and Object Oriented analysis), Requirements specifications, Validation and Verification.

Unit IV

Software Design: Design principles: Problem partitioning and hierarchy, Abstraction, Modularity, Top-down and Bottom-up strategies. Effective Modular design: functional independency, Cohesion, Coupling. Structured design methodology.

Software Quality Assurance: Quality concept, Quality management system, movements and assurance, Software reviews: formal and technical, Formal approaches to SQA, Statistical software quality assurance, Software reliability, ISO 9000, SQA plan.

Unit V

Software Testing: Software testing techniques: Testing fundamentals, White box testing, Black box testing, Testing for specialized environments, architectures and applications. Software testing strategies: A strategic approach to software testing, Strategic issues, Unit testing, Integration testing, Validation testing and system testing, The art of debugging.

Required Text(s):

- Pankaj Jalote, An Integrated Approach to Software Engineering , Narosa Publishing House.
- R. S. Pressman ,Software Engineering-A practitioner's approach, 6th Edition Tata McGraw-Hill International Editions, New York,2004.
- Ian Sommerville , Software Engineering, 8th edition, Pearson Education, New Delhi.
- Richard E. Fairly, Software Engineering Concepts, Tata McGraw Hill Inc. New York.5.
- W. S. Jawadekar ,Software Engineering: Principle & Practice, Tata McGraw-Hill, New York.
- Rajib Mall ,Fundamentals of Software Engineering, PHI, New Delhi.

M.Sc. III Semester
Computer Science
Paper-III : Linux/ UNIX Administration

Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester III**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS34-B	**Course Title: Linux/ UNIX Administration**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Learn UNIX structure, commands, and utilities b. Describe and understand the UNIX file system c. Write shell scripts in order to perform shell programming d. Acquire knowledge about text processing utilities, process management and system operation of UNIX. e. Installation of softwares and hardwares on unix operating system		

M.Sc. (CS) III -Semester
CS 34-B: Linux/ UNIX Administration
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit 1
Background. Evolution of Unix OS. Unix implementations. Features of Unix operating system. Linux operating system: Development of Linux. Applications of Linux operating system.

Unit 2
Basic UNIX environment: Basic commands, directory management, pipes, tee, I/O redirection and other utilities. Advanced commands: File system and process management commands, Shell, Pattern matching, Navigating the File Systems.

Unit 3
Unix editor: VI editor, Creating new files. Text addition, deletion and changes. Dealing with sentences and paragraphs. Searching. Cut, paste and copy. Running C/C++ programs. Shell programming: Features of shell. Shell variables. Control statements. Advance shell programming: Command line arguments. Interactive shell scripts. Debugging of shell scripts. Communication facilities in UNIX.

Unit 4
Structure of unix operating system: Structure of unix kernel, Unix system calls. Unix system: File system calls, Process management calls. Advance Filter: Awk: Number processing, Interface with shell, functions.

Unit 5
Unix system administration: Adding and removing users. User accounting. Adding and removing hardware. Performing backups and restore. Disk space management. Unix system administration: Configuring the kernel. Network management in UNIX. Performance analysis. UNIX Desktop.

1. Text Book :
UNIX Operating Systems: Sumitabh Das, Tata McGraw Hills publication.

2. Reference books :
1. UNIX System Administration Handbook(Second edition): Evi Nemeth, Garth Synder, Scott Seebass, Trent R Hein, Pearson Education - Asia, 2000.
2. C: Design of UNIX Operating System: Maurice J. Back, Pearson Education – Asia

M.Sc. Computer Science

Academic Year 2021-2022

Govt. Holkar (Model Autonomous) Science College, Indore										
Computer Science Department										
Syllabus Session 2021-22										
Programme: M.Sc. Computer Science								Class :M.Sc. IV Sem.		
S.No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External Assessment Max.	External Assessment Min.	Total Max.	Total Min.
1	Core 11	System Analysis And Design	CS41	4	25	9	75	26	100	35
2	Core 12	Design and Analysis of Algorithms	CS42	4	25	9	75	26	100	35
3	Elective 3/1	Internets and Web Technology	CS43 – A	4	25	9	75	26	100	35
	Elective 3/2	Computer Graphics & Multimedia	CS43 – B							
4	Elective 4/1	Compiler Design	CS44-A	4	25	9	75	26	100	35
	Elective 4/2	Python for Data Science	CS 44-B							
5	Practical 7	Practical based on Theory paper 11 & 12		3			75		75	26
5	Practical 8	Practical based on Theory Paper 3 & 4 (Elective)		3			75		75	26
6	Internship			4	50	18	50	17	100	35
				26	150		500		650	

M.Sc. IV Semester
Computer Science
Paper-I : System Analysis and Design
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester IV**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS41	**Course Title: System Analysis and Design**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. A firm basis for understanding the life cycle of a systems development project; b. An understanding of the analysis and development techniques required as a team member of a medium-scale information systems development project; c. An understanding of the ways in which an analyst's interaction with system sponsors and users play a part in information systems development; d. Experience in developing information systems models; e. Experience in developing systems project documentation;		

M.Sc. (CS) IV -Semester
CS 41: System Analysis and Design
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT-I System Concept: Definition, Characteristics, Elements of system, Physical and abstract system, open and closed system, man-made information systems. System Development Life Cycle: Various phases of system development, Considerations for system planning and control for system success. System Planning: Base for planning a system, Dimensions of Planning.

UNIT-II Initial Investigation: Determining users requirements and analysis, fact finding process and techniques. Feasibility study: Determination of feasibility study, Technical, Operational & Economic Feasibilities, System performance constraints, and identification of system objectives, feasibility report. Cost/Benefit Analysis: Data analysis, cost and benefit analysis of a new system. Categories determination and system proposal.

UNIT-III Tools of structured Analysis: Logical and Physical models, context, diagram, data dictionary, data diagram, form driven methodology. IPO and HIPO charts, Gantt charts, system model, pseudo codes, Flow charts- system flow chart, run flow charts etc., decision tree, decision tables, data validation. Input/ Output and Form Design: Input and output form design methodologies, menu, screen design, layout consideration.

UNIT-IV Management standards – Systems analysis standards, Programming standards, Operating standards. Documentation standards – User Manual, system development manual, programming manual, programming specifications, operator manual. System testing & quality: System testing and quality assurance, steps in system implementation and software maintenance. System security: Data Security, Disaster/ recovery and ethics in system development, threat and risk analysis. System audit.

UNIT-V Organization of EDP: Introduction. Job Responsibilities & duties of EDP Personnels- EDP manager, System Analyst, Programmers, Operators etc. Essential features in EDP Organization. Selection of Data Processing Resources: purchase, lease, rent-advantages and disadvantages. Hardware and software procurement – In-house purchase v/s hiring and lease.

Text & Reference Books: ‰
System Analysis & Design by V K Jain, Dreamtech Press ‰
Modern System Analysis & Design by A Hoffer, F George, S Valaciah Low Priced Edn. Pearson Education. ‰

M.Sc. IV Semester
Computer Science
Paper-II : Designs and Analysis of Algorithms
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester IV**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS42	**Course Title: Designs and Analysis of Algorithms**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Analyze the asymptotic performance of algorithms. b. Demonstrate a familiarity with major algorithms and data structures. c. Write rigorous correctness proofs for algorithms. d. Apply important algorithmic design paradigms and methods of analysis. e. Synthesize efficient algorithms in common engineering design situations.		

M.Sc. (CS) IV -Semester
CS 42: Designs and Analysis of Algorithms
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Order Analysis: Objectives of time analysis of Algorithms. Big – oh and Theta notations. Master Theorem and its proof. Solutions of divides and conquers recurrence relations.

Searching, Sorting, and Divide and Conquer Strategy: Linear Search, binary Search, Searching, Sorting and Divide and Conquer Strategy: Merge-Sort; Quick-Sort with average case analysis. Heaps and heap-sort. Lower bound on comparison- based sorting and counting sort.

Unit II

Dynamic Programming: Methodology and examples (Fibonacci number, Knapsack problem and some other simple examples) Dynamic Programming. Matrix Chain Multiplication. Weighted interval scheduling. Assembly Line Scheduling.

Unit III

Greedy Method: Methodology, Examples and comparison with DP (more examples to come later in Graph Algorithms).

Greedy Method: Knapsack problem and some other simple examples.

Unit IV

Graph Algorithms: Basics of graphs and their representations. BFS, DFS, Topological Sorting. Minimum Spanning trees (Kruskal and Prim's Algorithms and brief discussions of disjoint set and Fibonacci heap data structure). Shortest Paths (Dijkstra, Bellman- Ford, Floyd-Warshall).

Unit V

Hard Problems and Approximation Algorithms: Problem classes P, NP, NP-hard and NP-complete, deterministic and nondeterministic Polynomial- time algorithms. Approximation algorithms for some NP-complete problems.

Recommended Books and Reference Material:

- A.V. Aho, J.E. Hop croft, and J. D. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley.
- Thomas H. Cormen, Charles E. leiserson, Ronald L. Rivest, Clifford stein, Introduction to algorithms, The MIT Press: 2nd Edition (1st September, 2001).
- E. horowitz and Sahni, Fundamentals of Computer Algorithms, galgotia Publications.

M.Sc. IV Semester
Computer Science
Paper-II : : Internet and Web Technology
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester IV**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS43- A	**Course Title: Internet and Web Technology**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Analyze a web page and identify its elements and attributes. b. Create web pages using XHTML and Cascading Style Sheets c. Build dynamic web pages using JavaScript (Client side programming). d. Analyze to Use appropriate client-side or Server-side applications e. Build interactive web applications using crud.		

M.Sc. (CS) IV -Semester
CS 43-A: Internet and Web Technology
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit 1
Introduction Dynamic Web Programming, HTML Forms, scripting languages, Introduction to HTTP, web Server and application Servers, Installation of Application servers, Configuration files, Web.xml. Java Servlet, Servlet Development Process, Deployment Descriptors, The Generic Servlet Lifecycle.

Unit 2
Servlet Packages, Classes, Interfaces, and Methods, Handling Forms with Servlets. Various methods of Session Handling. Various elements of deployment descriptors. Java Database Connectivity: various steps in process of connection to the database, Various type of JDBC Driver.

Unit 3
Connection of JSP and Servlet with different database viz. Oracle, MS-SQL Server, MySQL. java.sql Package. Accessing metadata from the database. Type of Statement. Connection pooling: multiple users and need of connection pooling.

Unit 4
JSP Basics. JSP lifecycle, Directives, scripting elements, standard actions, implicit objects. Writing JSPs. Expression Language (EL), Separating Business Logic and Presentation Logic, Building and using JavaBean.

Unit 5
Session handling in JSP, Types of errors and exceptions handling, Standard Tab Library in JSP, Building Custom Tag Library, JSP Tag Library, MVC Design pattern Advances in J2EE and Other Web technology

1. Text Book :
Kevin Mukhar, Chris Zelenak, James L Weaver, "Beginning Java EE 5: From Novice to Professional" Apress

2. Reference books :
1. Marty Hall, Larry Brown, "Core Servlets and Java Server Pages", 2nd edition, Pearson Education
2. JavaDoc for various technologies
3. Internet and Web technologies, TMH, 2002

M.Sc. IV Semester
Computer Science
Paper-IV : Computer Graphics and Multimedia
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester IV**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS43- B	**Course Title: Computer Graphics and Multimedia**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a) Understand the basics of computer graphics, different graphics systems and applications of computer graphics. b) Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis. c) Use of geometric transformations on graphics objects and their application in composite form. d) Extract scene with different clipping methods and its transformation to graphics display device. e) Explore projections and visible surface detection techniques for display of 3D scene on 2D screen		

M.Sc. (CS) IV -Semester
CS 43-B: Computer Graphics and Multimedia
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I
Introduction: Application of Graphics, Display Devices: Refresh Cathode -Ray Tubes, Raster Scan Displays, Random Scan Displays, Color CRT Monitors, Flat Panel Displays. Video cards/display cards.
Input Devices: Mouse, Trackball, Space ball, Data Glove, Joystick, Light pen, Scanner, Digital Camera, Touch Panels, Voice Systems.
Hardcopy Devices: Printers and Plotters

Unit II
Graphics Primitives:
Line Generation Algorithms: DDA algorithm, Bresenham's algorithm.
Circle Generation Algorithms: Midpoint Circle algorithm, Bresenham's circle generation algorithm.
Displaying Lines,characters and polygon.
Polygon filling Algorithms: Scan Line Polygon fill algorithm, Inside - Outside Tests, Boundary-Fill algorithm, Flood -Fill algorithm. Fundamentals of aliasing and Antialiasing Technique.

Unit III
Clipping: Clipping operations, Point clipping.,
Line clipping: Cohen Sutherland Algorithm, Liang Barsky Algorithm, Nicholl-Lee-Nicholl Algorithm.
Polygon clipping: Sutherland- Hodgeman Algorithm, Weiler Atherton Algorithm., Text clipping, Exterior clipping.

Unit IV
Two Dimensional & Three Dimensional
Two Dimensional Transformations: Translation, Scaling, Rotation, Reflection, Shear, Homogenous coordinate system, composite transformations, raster method of transformation.
Two Dimensional Viewing: Window to View port coordinate transformation.
Three Dimensional: 3D Geometry, 3D display techniques, transformations. Projections: Parallel Projection, Perspective Projection.

Unit V
Shading and Color Application:
Visible surface Detection Methods: Depth Buffer Method, A-Buffer Method.
Illumination Model: Diffuse & Specular reflection, Point Source, Ambient Light, Transparency, Surface Pattern & texture, shadow,
Holftoning, Dithering Techniques, Color Models.

Required Text(s)

- Donald Hearn and M. Pauline Baker, Computer Graphics , Second Edition, Tata McGraw Hill,1997.
- Donald Hearn and M. Pauline Baker, Computer Graphics : C version , Second Edition, Tata McGraw Hill,1996.
- William M. Newman, Principales of Interactive Computer Graphics, Second Edition, Tata McGraw Hill,1978.
- David F. Rogers,Tata Procedural Elements for Computer Graphics, Mc-Graw-Hill Edn,New Delhi, 2000.

M.Sc. IV Semester

Computer Science
Paper-IV : Compiler Design

Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester IV**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS44- A	**Course Title: Compiler Design**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Understand the major phases of compilation and to understand the knowledge of Lex tool b. Develop the parsers and experiment the knowledge of different parsers design without automated tools c. Construct the intermediate code representations and generation d. Convert source code for a novel language into machine code for a novel computer e. Apply for various optimization techniques for dataflow analysis		

M.Sc. (CS) IV -Semester
CS 44-A: Compiler Design
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit I

Translators, interpreters, assemblers, Compilers, Model of a compiler. Analysis of source program, The phases of a compiler, Cousins of the compilers. Finite automata, non-deterministic and deterministic finite automata, Acceptance of strings by NDFA and DFA, Transforming NDFA to DFA. Minimization/Optimization of a DFA, related algorithm, Regular sets and regular expression. Obtaining regular expression from finite automata. Lexical analyzer design, the role of Lexical Analyzer, Input Buffering, Specification of tokens, and Recognition of tokens. Syntax analysis, CFG, derivation of a parse tree, reduction of grammar, useless grammar symbols, Elimination of null and unitProductions. Elimination of left recursion Regular grammar, Right linear and left linear grammar.

Unit II

Parsing: Top-Down and Bottom Up parsing, general parsing strategies. Brute-force approach, recursive descent parser and algorithms. Simple LL (1) grammar, LL (1) with null and without null rules grammars. Bottom-up parsing- Handle of a right sentential Form, Shift-reduce parsers, operator precedence parsing, LR, SLR, canonical LR and LALR grammar and parsers.

Unit III

Symbol table contents, organization for non- block structured language-unordered, ordered, and tree-structured and hash ,Organization for block structured languages-stack symbols tables. Stack-implemented tree structured stack implemented hash structured symbol tables.

Unit IV

Specification of translations, implementation of translation specified by syntax-directed definition, L-attributed definitions, and syntax-directed translation schemes Intermediates code generation, representing three-address statement, translation schemes for programming language constructs.

Unit V

Code Optimization:- Definition, loop Optimization, Elimination of local and global common sub Expressions, loop unrolling, Loop Jamming.
Code Generation:- Definition, machine model, code generation methods, Peephole optimization. **Error Handling** :- Error recovery from various phase and parsing.

Required Text(s)

- Alfred V. Aho, Monica S. Lam Ravi Sethi, Jeffrey D. Ullman, Compilers: Principals, Techniques, and Tools, 2nd Edition, addition Wesley: 2006.
- Alfred V. Aho, Jeffrey D. Ullman, Principals, of Compiler Design,Addition Wesley: 1977
- Jean Paul Tremblay, Paul G. Sorenson, The Theory & Practice of Compiler Writing, Tata Mcgraw Hill, May 1985.
- William A. Barrett, John D. Couch ,Compiler Construction Theory & Practice, Sra, june 1979.

M.Sc. IV Semester
Computer Science
Paper-IV : : Python for Data Science
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester IV**	**Session: 2021-22**
Subject: Computer Science			
Course Code: CS44-B	**Course Title: Python for Data Science**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. Students who have completed the MS in Data Science and Business Analytics Program will be able to: b. Apply quantitative modeling and data analysis techniques to the solution of real world business problems. c. communicate findings, and effectively present results d. using data visualization techniques.		

M.Sc. (CS) IV -Semester
CS 44-B: Python for Data Science
Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

Unit: I

Introduction: History of Python, Need of Python Programming, The application area of python, Installation of Python IDE(PyCharm), Execute form command line and using IDE.

Python Basics: Keyword, Data Types &Variables, Type conversion in Python, Expression, Operator, Data input and output.

Control Statement in Python: if statement, if-elif-else statement, for loop, while loop, break, continue, pass, else clause.

Sequences in Python: Array, String, list, Tuple, Set, Dictionary.

Unit: II

Function: Define Function, main() in python, Calling function, Passing Argument, Keyword Arguments, Default Arguments, Variable length Argument, Anonymous Functions, Fruitful function(Function Returning Values), Scope of Variable in Function, Recursion, Decorator. **Module:** Definition, Importing module using import statement, from statement, Creating Module, namespacing, Python Packages, Introduction to PIP, installing package by a PIP.

Unit: III

Object- Oriented Programming in Python: Class & Object, Methods, Constructor and Destructor, Inheritance, Overriding, Overloading, Data Hiding, Error and Exception Handling.

Unit: IV

Introduction: What is Data Science, Data Science Process, Application of Data Science, **Types of Data**: Quantitative and Qualitative. **Graphical Reorientation of Data:** Pie Chart, Bar Graph, Line Chart, Pareto Chart, Histogram, Scatter. **Measuring the Centre of Quantitative Data:** Mean, Median, Mode. **Measuring the Variability of Quantitative Data:** Range, Standard Deviation, and Variance. Introduction to Data Cleansing, Missing and Repeated Values, Feature Engineering, Outliers and Errors, Finding Outliers, Cleaning Data.

Unit: V

File Handling in Python: Read, Create/Write, Delete, and Rename, Reading and Writing CSV Files in Python.

Data Analysis with Python: NumPy, SciPy, Pandas, Matplotlib.

Interface Python with SQL, Introduction to MongoDB.

Reference Book:

1. Paul Barry, **"Head First Python: A Brain-Friendly Guide"**, 2nd Edition, O'Reilly Media.
2. Eric Matthes, **"Python Crash Course"**, 2nd Edition, No Starch Press
3. Mark Lutz, **"Learning Python", 5th Edition,** O'Reilly Media.
4. Wes McKinney,**" Python For Data Analysis: Data Wrangling With Pandas, NumPy, And IPython"**, 2nd Edition**, O'Reilly Media.**

M.Sc. IV Semester
Computer Science
Paper-IV : Computer Application (Inter-disciplinary)
Academic Year: 2021-2022

Part-A Introduction			
Program: Diploma	**Class: M.Sc.**	**Semester IV**	**Session: 2021-22**
Subject: Computer Science			
Course Code:	**Course Title: Computer Application (Inter-disciplinary)**		
Course Type (Core Course/ Elective/ Generic Elective/ Vocational...):	**Core Course**		
Pre-requisite (If any):	To study this course, a student must have had the subject Physics/ Mathematics in 12th class.		
Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:** a. General Knowledge of Basic Computer and Window Basics (Manage Files & folders). b. MS-Office, Deigning Database, Tabulation, data representation etc. c. Knowledge of Number System, Gates, use in Traffics Signals, make Electronics Items, etc. d. Use of Memory in every Electronics Device and use of different types Microprocessor e. Knowledge of CPU and its working.		

Open Elective Paper: Computer Application (Inter-disciplinary)

Academic Year 2021-2022

Min. Marks: 26 **Max. Marks: 75**

UNIT- I

Computer Generations Von Neumann Machine Architecture, Functional Units and Components in Computer Organization. Computers – Block diagram, Basic components of a Digital Computer – Control unit, ALU, Memory, Uses of Program Development, Tool, Editor, Compiler, Assembler, Interpreter, Algorithm, Flowchart, Logic Development & Problem solving.

UNIT- II

MS-Windows: Operating system-Definition & functions, basics of Windows. Basic components of windows, icons, types of icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders. Control panel – display properties, adding and removing software and hardware, setting date and time, screen saver and appearance. Using windows accessories.

UNIT III

Documentation Using MS-Word - Introduction to Office Automation, Creating & Editing Document, Formatting Document, Auto-text, Autocorrect, Spelling and Grammar Tool, Document Dictionary, Page Formatting, Bookmark, Advance Features of MS-Word-Mail Merge, Macros, Tables, File Management, Printing, Styles, linking and embedding object, Template.

UNIT IV

Electronic Spread Sheet using MS-Excel - Introduction to MS-Excel, Creating & Editing Worksheet, Formatting and Essential Operations, Formulas and Functions, Charts, Advance features of MS-Excel-Pivot table & Pivot Chart, Linking and Consolidation.

UNIT V

Presentation using MS-PowerPoint: Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art, Layering art Objects, Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.

TEXT AND REFERENCE BOOK

1. Rashid Sheikh, "Computer Organization & Architecture" (***Only for First Unit***)
2. Learn Microsoft Office – Russell A. Shultz – BPB Publication
3. Microsoft Office – Complete Reference – BPB Publication
4. Courter, G Marquis (1999). Microsoft Office 2000: Professional Edition. BPB.
5. PC Software – Shree Sai Prakashan, Meerut

Note :-

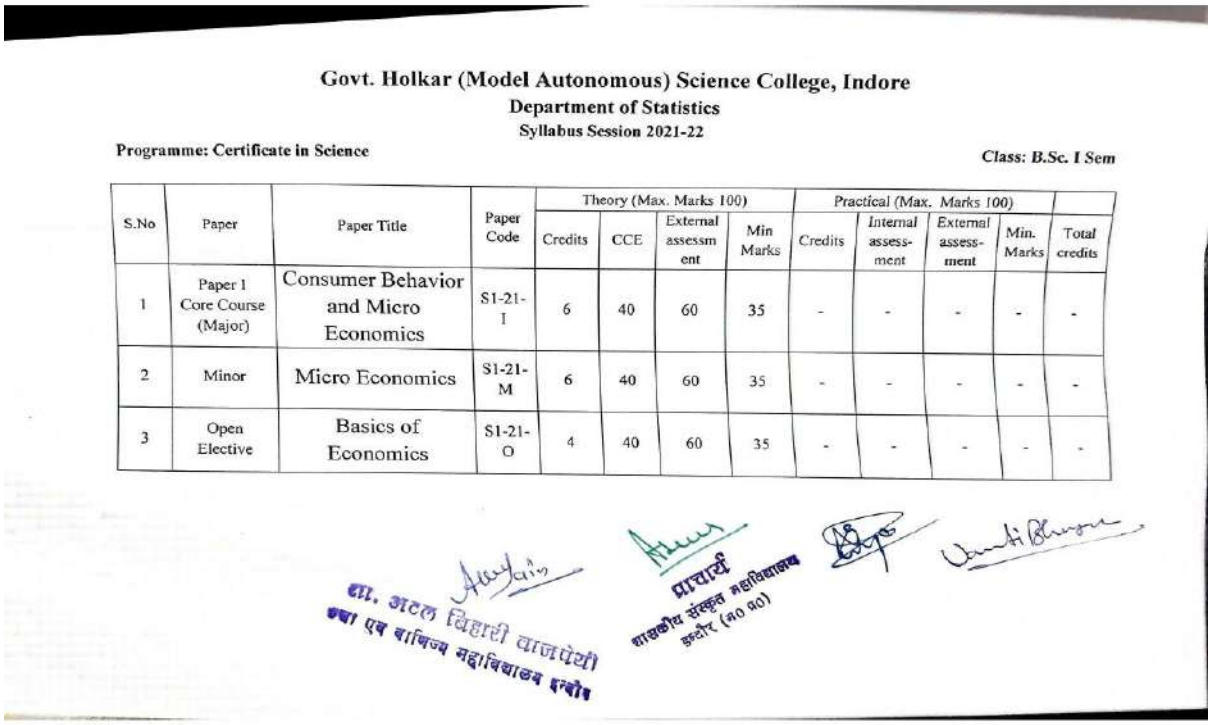
1. Where field visit is involved, it will be in lieu of one seminar and will be given 25 marks.
2. Where Academic tour (of one week at least) is involved, it will be in lieu of two seminar and will be given 50 marks. Deptt. will arrange tour either in 1st Sem or in 2nd Sem.
4. Minimum passing marks will be 40% each Theory, Practical, CCE, Internship/Project)
5. Grades and Grade points will be as follows:

Letter Grade	Grade Point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F (Fail)	Less than 4
Ab (Absent)	0

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Economics

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development



Govt. Holkar (Model Autonomous) Science College, Indore

Department of Statistics

Syllabus Session 2021-22

Programme: Certificate in Science ***Class: B.Sc. I Sem***

S.No	Paper	Paper Title	Paper Code	Theory (Max. Marks 100)				Practical (Max. Marks 100)				
				Credits	CCE	External assessment	Min Marks	Credits	Internal assess-ment	External assess-ment	Min. Marks	Total credits
1	Paper I Core Course (Major)	Consumer Behavior and Micro Economics	S1-21-I	6	40	60	35	-	-	-	-	-
2	Minor	Micro Economics	S1-21-M	6	40	60	35	-	-	-	-	-
3	Open Elective	Basics of Economics	S1-21-O	4	40	60	35	-	-	-	-	-

डा. अटल विहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

DEPARTMENT OF STATISTICS & ECONOMICS

Part A Introduction				
Program: UG/Certificate		Class: B.Sc.	Semester: I	Session: 2021-2022
Subject: ECONOMICS				
1	Course Code	S1-21-I		
2	Course Title	Consumer Behaviour & Micro Economics		
3	Course Type (Core Course/Open Elective/Generic Elective/Vocational)	Core Course		
4	Pre-requisite (if any)	-		
5	Course Objectives	This course is designed to expose the students to the basic principles of micro– economics theory and understand how market works. The emphasis will be on thinking like an economist the course will illustrate how micro economics concepts can be applied to household to analyse real life situations.		
6	Course Learning outcomes (CLO)	After the successful completion of the course students should be able to -		
		1. Explain the concept of nature of scope of economics, Inductive & Deductive analysis and will be able to explain core economic terms.		
		2. Get introduced to from work for learning about consumer's behaviour and laws of demands & Supply that determine equilibrium in a market economy.		
		3. Explain about firms and their decisions about optimal production.		
		4. Explain type of market structure and understand different between firm and industry demand curve.		
		5. Explain different theories to decide the rate of wages, interest & rent in different conditions.		
7	Credit Value	6 Credits		
8	Total Marks	Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

डा: अतुल [illegible] राजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर

Part B- Content of the Course

Total No. of Lectures-Tutorials- Practicals (in hours per week): L-T-P: 6-0-0

Paragraph	Topics	No. of Lectures
I	**Introduction of Economics** 1. Definition, Scope and Nature of Economics. 2. Relation of Economics with other Social Science Subjects 3. Positive and Normative Economics 4. Methods of Economics Analysis - Inductive and Deductive methods. 5. Basic Concept - Commodity, Price, Value, Rational Behavior, Economic Laws, Wants and Choices 6. Central Problems of An Economy - Production Possibility Curve	18
	अर्थशास्त्र का परिचय 1. अर्थशास्त्र की परिभाषा, क्षेत्र एवं प्रकृति 2. अर्थशास्त्र का सामाजिक विज्ञान के अन्य विषयों से संबंध 3. वास्तविक एवं आदर्शात्मक अर्थशास्त्र 4. आर्थिक विश्लेशण की पद्धतियां–आगमन एवं निगमन विधि 5. मूल्य अवधारणाएं–वस्तु, कीमत, मूल्य, विवेकशील व्यवहार, आर्थिक नियम, आव यकता एवं चयन 6. अर्थव्यवस्था की केन्द्रीय समस्याएं–उत्पादन संभावना वक	
II	**Consumer Behaviour** 1. Cardinal Approach - Utility, Marginal utility and Total Utility 2. Law of Diminishing Marginal Utility 3. Law of Equi -Marginal Utility, Consumer's Surplus 4. Ordinal Approach - Indifference curve -Meaning and Characteristics, Consumer's Equilibrium 5. Behavioural Approach - Revealed Preference Theory 6. Law of Demand and its exceptions- Giffen goods 7. Elasticity of Demand -Price, Income and Cross Elasticity	18
	उपभोक्ता का व्यवहार 1. गणनावाचक दृष्टिकोण – उपयोगिता,सीमांत व कुल उपयोगिता 2. सीमांत उपयोगिता ह्रास नियम 3. समसीमांत उपयोगिता नियम,उपभोक्ता की बचत 4. क्रमवाचक दृष्टिकोण – तटस्थता वक विश्लेषण अर्थ व विशेषताएं ,उपभोक्ता का संतुलन 5. व्यवहारवादी दृष्टिकोण–प्रकट अधिमान सिद्धांत 6. मांग का नियम एवं उसके अपवाद –गिफिन वस्तुएं 7. मांग की लोच – कीमत, आय व आड़ी लोच।	

प्राचार्य
राजकीय संस्कृत महाविद्यालय
हल्दौर (नo पo)

III	**Production** 1. Law of Supply and Elasticity of Supply 2. Production Function 3. Law of Variable Proportions 4. Returns to Scale 5. ISO- Product Curve - Meaning and Characteristics 6. Producer's Equilibrium 7. Economies of Scale 8. Concept of Revenue and Cost -Total, Average and Marginal	18
	उत्पादन 1. पूर्ति का नियम एवं पूर्ति की लोच 2. उत्पादन फलन 3. परिवर्तनशील अनुपातों के नियम 4. पैमाने के प्रतिफल 5. समोत्पाद वक–अर्थ व विशेषताएं 6. उत्पादक का संतुलन 7. पैमाने की बचते 8. आगम एवं लागत की अवधारणाएं–कुल, औसत व सीमांत	
IV	**Market and Price Determination** 1. Meaning and Classification of Markets 2. Perfect competition -Meaning and Characteristics 3. Perfect Competition and Pure Competition. 4. Determination of Price and Output under Perfect Competition 5. Determination of Price and Output under Monopoly 6. Price Discrimination under Monopoly 7. Monopolistic Competition	18
	बाजार एवं मूल्य निर्धारण 1. बाजार का अर्थ एवं वर्गीकरण 2. पूर्ण प्रतियोगिता अर्थ एवं विशेषताएं 3. पूर्ण प्रतियोगिता एवं शुद्ध प्रतियोगिता 4. पूर्ण प्रतियोगिता में कीमत व उत्पादन का निर्धारण 5. एकाधिकार में कीमत व उत्पादन का निर्धारण 6. एकाधिकार में कीमत विभेद 7. एकाधिकृत प्रतियोगिता	
V	**Theory of Factor Pricing** 1. Marginal Productivity Theory of Distribution 2. Theories of Distribution A. Rent B. Wage C. Interest D. Profit 3. Concept of Welfare Economics	18

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय

	साधन कीमत निर्धारण के सिद्धांत 1. वितरण का सीमांत उत्पादकता सिद्धांत 2. वितरण के सिद्धांत क. लगान ख. मजदूरी ग. ब्याज घ. लाभ 3. कल्याणवादी अर्थशास्त्र की अवधारणा।	

Keywords/Tags: Positive Economics, Normative Economics, Inductive and Deductive methods, Consumer Behaviour, Production Function, Perfect Competition, Monopoly, Monopolistic, Marginal Productivity.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Ahuja, H. L. (Latest Addition). Principles of Micro Economics, Sultan Chand and Company, New Delhi (Hindi and English Versions).
2. Barla, C.S. (Latest Addition), Micro Economics, National Publishing House, Jaipur, New Delhi (Hindi and English Version).
3. Jhingan, M.L. (Latest Addition), Micro Economics, Vrinda Publication, New Delhi (Hindi and English Versions).
4. Karl E. Case and Ray C. Fair (2007), Principles of Economics, 8th Ed., Pearson Education Inc.
5. Koutsoyiannis, A. (1979), Modern Microeconomics, (2nd Edition), Macmillan Press, London.
6. Kreps, David M. (1990), A Course in Microeconomics Theroy, Princeton University Press, Princeton.
7. Mankiw, G. (2010), Principles of Microeconomics ,6th ed., South-Western College Publication, USA.
8. Misra S.K. and Puri, V.K. (2001) - Advanced Micro Economic Theory, Himalaya Publishing House, Bombay (Hindi and English Versions).
9. Salvatore D. (2006) Microeconomics- Theory and Applications, Oxford University Press
10. Salvatore D, (2002) Theory and Problems of Micro Economic Theory, Schaum's Outline Series, McGraw-Hill Book Company, Singapore
11. पंत जे.सी. एवं मिश्रा जे.पी., सूक्ष्म अर्थशास्त्र, साहित्य भवन पब्लिकेशन, आगरा
12. सिन्हा वी.सी. एवं सिन्हा पुष्पा, व्यष्टि अर्थशास्त्र, S.B.P.D. पब्लिकेशन, आगरा
    Sinha V.C. and SrivastavRitu, (2020-21) S.B.P.D.

Suggestive Digital Platform:

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=11
2. https://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B%5D=&course%5B%5D=Fundamentals+of+microeconomic+theory&domain%5B%5D=Social+Sciences
   http://www.swayamprabha.gov.in/index.php/channel_profile/profile/7

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

डॉ. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय

Suggested equivalent online courses:

http://www.mcafee.cc/Introecon/IEA2007.pdf

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests. The division of marks are as follows:**			**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours	
A. **Submission of Assignment followed by Presentation**			**Section(A) :** 05 MCQ Questions	05 x 01 = 05
B. **Class Test**	**Best two test marks** **20 Marks**	**Best two test marks** **40 Marks**	**Section (B) :** Five Short Questions (200 Words Each)	05 x 05 = 25
Test I (Written Test)	**20 Marks**		**Section (C) :** Two Long Questions (500 Words Each)	02 x 15 = 30
Test II (Written Test)	**20 Marks**			
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

प्राचार्य
शासकीय संस्कृत महाविद्यालय

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय

DEPARTMENT OF STATISTICS & ECONOMICS

Part A Introduction				
Program: UG/Certificate		Class: B.Sc.	Semester: I	Session: 2021-2022
Subject: ECONOMICS				
1	Course Code	S1-21-M		
2	Course Title	Micro Economics		
3	Course Type (Core Course/Open Elective/Generic Elective/Vocational)	Core Course		
4	Pre-requisite (if any)	-		
5	Course Objectives	This course is designed to expose the students to the basic principles of micro– economics theory and understand how market works. The emphasis will be on thinking like an economist the course will illustrate how micro economics concepts can be applied to household to analyse real life situations.		
6	Course Learning outcomes (CLO)	After the successful completion of the course students should be able to -		
		1. Explain the concept of nature of scope of economics, Inductive & Deductive analysis and will be able to explain core economic terms.		
		2. Get introduced to from work for learning about consumer's behaviour and laws of demands & Supply that determine equilibrium in a market economy.		
		3. Explain about firms and their decisions about optimal production.		
		4. Explain type of market structure and understand different between firm and industry demand curve.		
		5. Explain different theories to decide the rate of wages, interest & rent in different conditions.		
7	Credit Value	6 Credits		
8	Total Marks	Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

Part B- Content of the Course

Total No. of Lectures-Tutorials- Practicals (in hours per week): L-T-P: 6-0-0

Paragraph	Topics	No. of Lectures
I	**Introduction of Economics** 1. Definition, Scope and Nature of Economics. 2. Relation of Economics with other Social Science Subjects 3. Positive and Normative Economics 4. Methods of Economics Analysis - Inductive and Deductive methods. 5. Basic Concept - Commodity, Price, Value, Rational Behavior, Economic Laws, Wants and Choices 6. Central Problems of An Economy - Production Possibility Curve	18
	अर्थशास्त्र का परिचय 1. अर्थशास्त्र की परिभाषा, क्षेत्र एवं प्रकृति 2. अर्थशास्त्र का सामाजिक विज्ञान के अन्य विषयों से संबंध 3. वास्तविक एवं आदर्शात्मक अर्थशास्त्र 4. आर्थिक विश्लेषण की पद्धतियां–आगमन एवं निगमन विधि 5. मूल्य अवधारणाएं–वस्तु, कीमत, मूल्य, विवेकशील व्यवहार, आर्थिक नियम, आव यकता एवं चयन 6. अर्थव्यवस्था की केन्द्रीय समस्याएं–उत्पादन संभावना वक्र	
II	**Consumer Behaviour** 1. Cardinal Approach - Utility, Marginal utility and Total Utility 2. Law of Diminishing Marginal Utility 3. Law of Equi -Marginal Utility, Consumer's Surplus 4. Ordinal Approach - Indifference curve -Meaning and Characteristics, Consumer's Equilibrium 5. Behavioural Approach - Revealed Preference Theory 6. Law of Demand and its exceptions- Giffen goods 7. Elasticity of Demand -Price, Income and Cross Elasticity	18
	उपभोक्ता का व्यवहार 1. गणनावाचक दृष्टिकोण – उपयोगिता,सीमांत व कुल उपयोगिता 2. सीमांत उपयोगिता ह्रास नियम 3. समसीमांत उपयोगिता नियम,उपभोक्ता की बचत 4. कमवाचक दृष्टिकोण – तटस्थता वक्र विश्लेषण अर्थ व विशेषताएं,उपभोक्ता का संतुलन 5. व्यवहारवादी दृष्टिकोण–प्रकट अधिमान सिद्धांत 6. मांग का नियम एवं उसके अपवाद –गिफिन वस्तुएं 7. मांग की लोच – कीमत, आय व आड़ी लोच।	

प्राचार्य
राजकीय संस्कृत महाविद्यालय
हनौर (म0 प्र0)

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय हनौर

III	**Production** 1. Law of Supply and Elasticity of Supply 2. Production Function 3. Law of Variable Proportions 4. Returns to Scale 5. ISO- Product Curve - Meaning and Characteristics 6. Producer's Equilibrium 7. Economies of Scale 8. Concept of Revenue and Cost -Total, Average and Marginal	18
	उत्पादन 1. पूर्ति का नियम एवं पूर्ति की लोच 2. उत्पादन फलन 3. परिवर्तनशील अनुपातों के नियम 4. पैमाने के प्रतिफल 5. समोत्पाद वक्र–अर्थ व विशेषताएं 6. उत्पादक का संतुलन 7. पैमाने की बचते 8. आगम एवं लागत की अवधारणाएं–कुल, औसत व सीमांत	
IV	**Market and Price Determination** 1. Meaning and Classification of Markets 2. Perfect competition -Meaning and Characteristics 3. Perfect Competition and Pure Competition. 4. Determination of Price and Output under Perfect Competition 5. Determination of Price and Output under Monopoly 6. Price Discrimination under Monopoly 7. Monopolistic Competition	18
	बाजार एवं मूल्य निर्धारण 1. बाजार का अर्थ एवं वर्गीकरण 2. पूर्ण प्रतियोगिता अर्थ एवं विशेषताएं 3. पूर्ण प्रतियोगिता एवं शुद्ध प्रतियोगिता 4. पूर्ण प्रतियोगिता में कीमत व उत्पादन का निर्धारण 5. एकाधिकार में कीमत व उत्पादन का निर्धारण 6. एकाधिकार में कीमत विभेद 7. एकाधिकृत प्रतियोगिता	
V	**Theory of Factor Pricing** 1. Marginal Productivity Theory of Distribution 2. Theories of Distribution A. Rent B. Wage C. Interest D. Profit 3. Concept of Welfare Economics	18

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर

प्राचार्य
राजकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

	साधन कीमत निर्धारण के सिद्धांत 1. वितरण का सीमांत उत्पादकता सिद्धांत 2. वितरण के सिद्धांत क. लगान ख. मजदूरी ग. ब्याज घ. लाभ 3. कल्याणवादी अर्थशास्त्र की अवधारणा।	

Keywords/Tags: Positive Economics, Normative Economics, Inductive and Deductive methods, Consumer Behaviour, Production Function, Perfect Competition, Monopoly, Monopolistic, Marginal Productivity.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Ahuja, H. L. (Latest Addition). Principles of Micro Economics, Sultan Chand and Company, New Delhi (Hindi and English Versions).
2. Barla, C.S. (Latest Addition), Micro Economics, National Publishing House, Jaipur, New Delhi (Hindi and English Version).
3. Jhingan, M.L. (Latest Addition), Micro Economics, Vrinda Publication, New Delhi (Hindi and English Versions).
4. Karl E. Case and Ray C. Fair (2007), Principles of Economics, 8th Ed., Pearson Education Inc.
5. Koutsoyiannis, A. (1979), Modern Microeconomics, (2nd Edition), Macmillan Press, London.
6. Kreps, David M. (1990), A Course in Microeconomics Theroy, Princeton University Press, Princeton.
7. Mankiw, G. (2010), Principles of Microeconomics ,6th ed., South-Western College Publication, USA.
8. Misra S.K. and Puri, V.K. (2001) - Advanced Micro Economic Theory, Himalaya Publishing House, Bombay (Hindi and English Versions).
9. Salvatore D. (2006) Microeconomics- Theory and Applications, Oxford University Press
10. Salvatore D, (2002) Theory and Problems of Micro Economic Theory, Schaum's Outline Series, McGraw-Hill Book Company, Singapore
11. पंत जे.सी. एवं मिश्रा जे.पी., सूक्ष्म अर्थशास्त्र, साहित्य भवन पब्लिकेशन, आगरा
12. सिन्हा वी.सी. एवं सिन्हा पुष्पा, व्यष्टि अर्थशास्त्र, S.B.P.D. पब्लिकेशन, आगरा

1. Sinha V.C. and SrivastavRitu, (2020-21) S.B.P.D.

Suggestive Digital Platform:

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=11
2. https://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B%5D=&course%5B%5D=Fundamentals+of+microeconomic+theory&domain%5B%5D=Social+Sciences
   http://www.swayamprabha.gov.in/index.php/channel_profile/profile/7

प्राचार्य
राजकीय संस्कृत महाविद्यालय
कोटा (राज.)

डा: अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय कोटा,

Suggested equivalent online courses:

http://www.meafee.cc/Introecon/IEA2007.pdf

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests. The division of marks are as follows:**			**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours	
A. **Submission of Assignment followed by Presentation**			**Section(A) :** 05 MCQ Questions	05 x 01 = 05
B. **Class Test**	**Best two test marks** **20 Marks**	**Best two test marks** **40 Marks**	**Section (B) :** Five Short Questions (200 Words Each)	05 x 05 = 25
Test I (Written Test)	**20 Marks**		**Section (C) :** Two Long Questions (500 Words Each)	02 x 15 = 30
Test II (Written Test)	**20 Marks**			
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

DEPARTMENT OF STATISTICS & ECONOMICS

Part A Introduction				
Program: UG/Certificate		Class: B.Sc.	Semester: I	Session: 2021-2022
Subject: ECONOMICS				
1	Course Code	S1-21-O		
2	Course Title	Basics of Economics		
3	Course Type (CoreCourse/Open Elective/Generic Elective/Vocational)	Core Course		
4	Pre-requisite (if any)	-		
5	Course Objectives	This course is designed to expose the students to the basic principles of micro– economics theory and understand how market works. The emphasis will be on thinking like an economist the course will illustrate how micro economics concepts can be applied to household to analyse real life situations.		
6	Course Learning outcomes (CLO)	After the successful completion of the course students should be able to -		
		1. Explain the concept of nature of scope of economics, Inductive & Deductive analysis and will be able to explain core economic terms.		
		2. Get introduced to from work for learning about consumer's behaviour and laws of demands & Supply that determine equilibrium in a market economy.		
		3. Explain about firms and their decisions about optimal production.		
		4. Explain type of market structure and understand different between firm and industry demand curve.		
		5. Explain different theories to decide the rate of wages, interest & rent in different conditions.		
7	Credit Value	4 Credits		
8	Total Marks	Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर

Part B- Content of the Course

Total No. of Lectures-Tutorials- Practicals (in hours per week): L-T-P: 4-0-0

Paragraph	Topics	No. of Lectures
I	**Introduction of Economics** 1. Definition, Scope and Nature of Economics. 2. Relation of Economics with other Social Science Subjects 3. Positive and Normative Economics 4. Methods of Economics Analysis - Inductive and Deductive methods. 5. Basic Concept - Commodity, Price, Value, Rational Behavior, Economic Laws, Wants and Choices	12
	अर्थशास्त्र का परिचय 1. अर्थशास्त्र की परिभाषा, क्षेत्र एवं प्रकृति 2. अर्थशास्त्र का सामाजिक विज्ञान के अन्य विषयों से संबंध 3. वास्तविक एवं आदर्शात्मक अर्थशास्त्र 4. आर्थिक विश्लेशण की पद्धतियां–आगमन एवं निगमन विधि 5. मूल अवधारणाएं–वस्तु, कीमत,मूल्य,विवेकशील व्यवहार,आर्थिक नियम,आवश्यकता एवं चयन	
II	**Consumer Behaviour** 1. Cardinal Approach - Utility, Marginal utility and Total Utility 2. Law of Diminishing Marginal Utility 3. Law of Equi -Marginal Utility, Consumer's Surplus 4. Ordinal Approach - Indifference curve -Meaning and Characteristics, Consumer's Equilibrium 5. Law of Demand and its exceptions- Giffen goods 6. Elasticity of Demand -Price, Income and Cross Elasticity	12
	उपभोक्ता का व्यवहार 1. गणनावाचक दृष्टिकोण – उपयोगिता, सीमांत व कुल उपयोगिता 2. सीमांत उपयोगिता ह्रास नियम 3. समसीमांत उपयोगिता नियम,उपभोक्ता की बचत 4. कमवाचक दृष्टिकोण – तटस्थता वक विश्लेषण अर्थ व विशेषताएं,उपभोक्ता का संतुलन 5. मांग का नियम एवं उसके अपवाद –गिफिन वस्तुएं 6. मांग की लोच – कीमत, आय व आड़ी लोच।	
III	**Production** 1. Law of Supply and Elasticity of Supply 2. Production Function 3. Law of Variable Proportions 4. Returns to Scale 5. ISO- Product Curve - Meaning and Characteristics	12

डा. अटल बिहारी वाजपेयी शासकीय संस्कृत महाविद्यालय इन्दौर (म0 प्र0)

	6. Economies of Scale	
	उत्पादन 1. पूर्ति का नियम एवं पूर्ति की लोच 2. उत्पादन फलन 3. परिवर्तनशील अनुपातों के नियम 4. पैमाने के प्रतिफल 5. समोत्पाद वक्र–अर्थ व विशेषताएं 6. पैमाने की बचते	
IV	**Market and Price Determination** 1. Meaning and Classification of Markets 2. Perfect competition -Meaning and Characteristics 3. Determination of Price and Output under Perfect Competition 4. Determination of Price and Output under Monopoly 5. Price Discrimination under Monopoly	12
	बाजार एवं मूल्य निर्धारण 1. बाजार का अर्थ एवं वर्गीकरण 2. पूर्ण प्रतियोगिता अर्थ एवं विशेषताएं 3. पूर्ण प्रतियोगिता में कीमत व उत्पादन का निर्धारण 4. एकाधिकार में कीमत व उत्पादन का निर्धारण 5. एकाधिकार में कीमत विभेद	
V	**Theory of Factor Pricing** 1. Marginal Productivity Theory of Distribution 2. Modern Theories of Distribution A. Rent B. Wage C. Interest D. Profit	12
	साधन कीमत निर्धारण के सिद्धांत 1. वितरण का सीमांत उत्पादकता सिद्धांत 2. वितरण के आधुनिक सिद्धांत क. लगान ख. मजदूरी ग. ब्याज घ. लाभ	

Keywords/Tags: Positive Economics, Normative Economics, Inductive and Deductive methods, Consumer Behaviour, Production Function, Perfect Competition, Monopoly, Monopolistic, Marginal Productivity.

Part C-Learning Resources

Text Books, Reference Books, Other resources

प्राचार्य
डा. अटल बिहारी वाजपेयी राजकीय संस्कृत महाविद्यालय
स्नातक एवं वाणिज्य महाविद्यालय इन्दौर (म0 प्र0)

Suggested Readings:

1. Ahuja, H. L. (Latest Addition). Principles of Micro Economics, Sultan Chand and Company, New Delhi (Hindi and English Versions).
2. Barla, C.S. (Latest Addition), Micro Economics, National Publishing House, Jaipur, New Delhi (Hindi and English Version).
3. Jhingan, M.L. (Latest Addition), Micro Economics, Vrinda Publication, New Delhi (Hindi and English Versions).
4. Karl E. Case and Ray C. Fair (2007), Principles of Economics, 8th Ed., Pearson Education Inc.
5. Koutsoyiannis, A. (1979), Modern Microeconomics, (2nd Edition), Macmillan Press, London.
6. Kreps, David M. (1990), A Course in Microeconomics Theroy, Princeton University Press, Princeton.
7. Mankiw, G. (2010), Principles of Microeconomics ,6th ed., South-Western College Publication, USA.
8. Misra S.K. and Puri, V.K. (2001) - Advanced Micro Economic Theory, Himalaya Publishing House, Bombay (Hindi and English Versions).
9. Salvatore D. (2006) Microeconomics- Theory and Applications, Oxford University Press
10. Salvatore D, (2002) Theory and Problems of Micro Economic Theory, Schaum's Outline Series, McGraw-Hill Book Company, Singapore
11. पंत जे.सी. एवं मिश्रा जे.पी., सूक्ष्म अर्थशास्त्र, साहित्यभवन पब्लिकेशन, आगरा
12. सिन्हा वी.सी. एवं सिन्हा पुष्पा, व्यष्टि अर्थशास्त्र, S.B.P.D. पब्लिकेशन, आगरा

1. Sinha V.C. and SrivastavRitu, (2020-21) S.B.P.D.

Suggestive Digital Platform:

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=11
2. https://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B%5D=&course%5B%5D=Fundamentals+of+microeconomic+theory&domain%5B%5D=Social+Sciences
   http://www.swayamprabha.gov.in/index.php/channel_profile/profile/7

Suggested equivalent online courses:

http://www.mcafee.cc/Introecon/IEA2007.pdf

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests. The division of marks are as follows:**			**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours	
A. **Submission of Assignment followed by Presentation**			**Section(A) :** 05 MCQ Questions	05 x 01 = 05
B. **Class Test**	**Best two test marks** **20 Marks**	**Best two test marks** **40 Marks**	**Section (B) :** Five Short Questions (200 Words	05 x 05 = 25

डॉ. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

			Each)	
Test I (Written Test)	**20 Marks**		**Section (C) :** Two Long Questions (500 Words Each)	02 x 15 = 30
Test II (Written Test)	**20 Marks**			
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

डा. अटल बिहारी वाजपेयी
शा. स्ना. वाणिज्य महाविद्यालय इन्दौर

शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Statistics

Syllabus Session 2021-22

Programme: Certificate in Science **Class: B.Sc. II Sem**

S.No	Paper	Paper Title	Paper Code	Theory (Max. Marks 100)				Practical (Max. Marks 100)				
				Credits	CCE	External assessment	Min Marks	Credits	Internal assess-ment	External assess-ment	Min. Marks	Total credits
1	Paper II Core Course (Major)	Indian and Agricultural	S2-21-I	6	40	60	35	-	-	-	-	-
2	Minor	Indian Economy	S2-21-M	6	40	60	35	-	-	-	-	-
3	Open Elective	Basics of Indian Economy	S2-21-O	4	40	60	35	-	-	-	-	-

डा. अटल बिहारी वाजपेयी
शा एव वाणिज्य महाविद्यालय इन्दौर

आचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

DEPARTMENT OF STATISTICS & ECONOMICS

Part A Introduction				
Program: UG/Certificate		Class: B.Sc.	Semester: II	Session: 2021-2022
Subject: ECONOMICS				
1	Course Code	S2-21-I		
2	Course Title	Indian & Agricultural Economy		
3	Course Type (Core Course/Open Elective/Generic Elective/Vocational)	Core Course		
4	Pre-requisite (if any)	-		
5	Course Objectives	This course will help in compressive understanding of Indian economy. To give death knowledge of booking & finance to students. A little understanding of India's foreign trade & various governmental policies & Programs will also be included to make student aware.		
6	Course Learning outcomes (CLO)	After the successful completion of the course students should be able to -		
		1. Develop ideas of the basic features of India economy & its Potential on natural resources.		
		2. Understand agriculture as the foundation of economic growth and development, analysis the Process & Changing nature of agricultural sector and its contribution to whole economy		
		3. Explain industrial Policy before & after independence & Concept of SSI and Cottage industries in India with Various flagship Programs.		
		4. Demonstrate India's Infrastructural growth and understand the structure of India's foreign Trade.		
		5. Grasp the importance of planning undertaken by the government of India have knowledge of various objectives, failures & Achievement's & Introduction of NITI Ayog.		
7	Credit Value	6 Credits		
8	Total Marks	Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

डा: अटल बिहारी वाजपेयी शासकीय संस्कृत महाविद्यालय
कला एवं वाणिज्य महाविद्यालय

Part B- Content of the Course		
Total No. of Lectures-Tutorials- Practicals (in hours per week): L-T-P: 6-0-0		
Paragraph	**Topics**	**No. of Lectures**
I	**Introduction** 1. Characteristics of Indian Economy 2. Trends and Sectoral Composition of National Income. 3. Sectoral Distribution of workforce 4. Natural Resource Endowments- Land, Water, Livestock, Forest and Minerals 5. Demographic Features- Population Composition, Size and Growth Rates 6. Problems and Causes of Over- Population and Population Policy	18
	1. भारतीय अर्थव्यवस्था की विशेषताएँ 2. राष्ट्रीय आय की क्षेत्रीय संरचना एवं प्रवृति 3. श्रमशक्ति का क्षेत्रीय वितरण 4. प्राकृतिक संसाधन सम्पदा–भूमि, जल, पशुधन, वन, खनिज 5. जनांकिकीय विशेषताएँ–जनसंख्या की संरचना, आकार एवं वृद्धि दर 6. जनाधिक्य की समस्या एवं जनसंख्या नीति	
II	**Agriculture** 1. Nature, Importance and Characteristics of Indian Agriculture 2. Land Use Pattern and Land Reforms 3. Trends in Agricultural Production and productivity 4. Green Revolution- Objectives, Achievements and Failures 5. Agricultural Finance and Insurance 6. Agriculture Marketing 7. New Technology in Agriculture	18
	कृषि 1. भारतीय कृषि की प्रवृति, महत्व व विशेषताएँ 2. भू उपयोग पद्धति एवं भू–सुधार 3. कृषि उत्पादन एवं उत्पादकता की प्रवृतियां 4. हरित कांति–उद्देश्य, सफलताएं एवं विफलताएं 5. कृषि वित्त एवं बीमा 6. कृषि विपणन 7. कृषि में नवीन तकनीक	
III	**Industry and Infrastructure**	18

डा. अटल बिहारी वाजपेयी शासकीय संस्कृत महाविद्यालय
कला एवं वाणिज्य महाविद्यालय इन्दौर

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

	1. Industrial Development of India after Independence 2. New Industrial Policy of 1991 3. Role of Public Sector and Private Sector in Industrialization 4. MSME- Definition, Characteristics and Its Role 5. Problems and Remedies of Small-Scale and Cottage Industries 6. Start-up India, Make in India and Aatm Nirbhar Bharat 7. Infrastructure Composition- Power, Transport and Communication.	
	उद्योग एवं आधारभूत संरचना 1. स्वतंत्रता प्राप्ति के पश्चात् भारत का औद्योगिक विकास 2. नई औद्योगिक नीति 1991 3. औद्योगीकरण में सार्वजनिक व निजी क्षेत्र की भूमिका 4. सूक्ष्म, लघु एवं मध्यम उपक्रम (MSME)- परिभाषा, विशेषताएँ एवं इनकी भूमिका 5. लघु एवं कुटीर उद्योगो की समस्याएं एवं समाधान 6. स्टार्टअप इण्डिया, मेक इन इण्डिया एवं आत्मनिर्भर भारत 7. आधारभूत संरचना–ऊर्जा, परिवहन एवं संचार	
IV	**Foreign Trade and Development** 1. India's Foreign Trade-Importance, Composition and Direction 2. Role of Foreign Direct Investment, Multinational Corporations 3. Disinvestment in India 4. Indian Planning – Objectives, Achievements and Failures 5. NITI Aayog 6. Indian Economic Problems- Poverty, Unemployment and Regional Inequality	**18**
	विदेशी व्यापार एवं विकास 1. भारत का विदेशी व्यापार–महत्व, दशा व दिशा 2. प्रत्यक्ष विदेशी निवेश व बहुराष्ट्रीय निगमों की भूमिका 3. भारत में विनिवेष 4. भारतीय नियोजन– उद्देश्य, सफलताएं एवं विफलताएं 5. नीति आयोग 6. भारतीय आर्थिक समस्याएं–गरीबी, बेरोजगारी एवं क्षेत्रीय विषमताएं	
V	**Economy of Madhya Pradesh** 1. Salient Features of Madhya Pradesh's Economy 2. Natural Resources of Madhya Pradesh- Land, Forest, Water and Minerals	**18**

	3. Trends and Regional Disparities in Agriculture Sector of Madhya Pradesh 4. Organic Farming and Poly house in Madhya Pradesh 5. Industrial Development in Madhya Pradesh 6. Infrastructure Development in Madhya Pradesh –Power, Transport and Communication 7. Development of Tourism in Madhya Pradesh 8. Employment oriented Scheme in Madhya Pradesh	
	मध्यप्रदेश की अर्थव्यवस्था 1. मध्यप्रदेश की अर्थव्यवस्था की मुख्य विशेषताएँ 2. मध्यप्रदेश के प्राकृतिक संसाधन–भूमि, जल, वन, खनिज 3. मध्यप्रदेश में कृषि की क्षेत्रीय विषमताएं एवं प्रवृतियाँ 4. मध्यप्रदेश में जैविक खेती एवं पॉलीघर 5. मध्यप्रदेश में औद्योगिक विकास 6. मध्यप्रदेश में आधारभूत संरचना का विकास– ऊर्जा ,परिवहन एवं संचार 7. मध्यप्रदेश में पर्यटन विकास 8. मध्यप्रदेश में रोजगार मूलक योजनाएं	

Keywords/Tags: Sectoral Composition, Human resources of India, Indian Agriculture, Industrialization, Infrastructure, Foreign Direct Investment, Regional Disparities, Organic Farming, Industrial development.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Panagariya, Arvind. (2020)- India Unlimited: Reclaiming the Lost Glory, HarperCollins Publishers
2. Mishra and Puri (2020) - Indian Economy, Himalaya Publishing House, New Delhi.
3. Rudra Dutt and Sundaram – Indian Economy, S. Chand and Company, New Delhi.
4. Hariharan, N.P. (2008) - Lights and Shades of Indian Economy, Vishal Publishing Co., Jalandhar.
5. Uma Kapila (20th Edition) (2009) - Indian Economy since Independence, Academic Foundation, New Delhi.
6. Reserve Bank of India-Annual Reports.
7. Annual Economic Survey, Government of India (Latest).
8. Brahmananda, P.R. and V.R. Panchmukhi (Eds.) (1987)- The Development Process of the Indian Economy, Himalaya Publishing House, Bomabay.
9. Government of India, Planning Commission, 12th Five Year Plan, New Delhi
10. रुद्रदत्त–विकास, गरीबी एवं समता, एवं समता, दीप एंड दीप पब्लिकेशन प्रा. लि., नई दिल्ली
11. जे. पी. मिश्रा– भारतीय अर्थव्यवस्था, साहित्य भवन पब्लिकेशन, आगरा

मध्यप्रदेश का आर्थिक सर्वेक्षण 2020–21 –आर्थिक एवं सांख्यिकी संचालनालय भोपाल मध्यप्रदेश

Suggestive Digital Platform:

1. http://des.mp.gov.in/portals/0/Economic_Survey_%202020-21.pdf
2. https://www.indiabudget.gov.in/economicsurvery/ebook_es2021/index.html
3. www.indiabudget.gov.in/economicsurvery/
4. https://www.rbi.org.in/Scripts/AnnualReportMainDisplay.aspx
5. https://www.rbi.org.in/hindi/Script/armainpage.aspx
6. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=11
7. https://www.swayamprabha.gov.in/index.php/channel_profile/profile/7

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests. The division of marks are as follows:**			**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours	
A. Submission of Assignment followed by Presentation			**Section(A) :** 05 MCQ Questions	05 x 01 = 05
B. Class Test	**Best two test marks** **20 Marks**	**Best two test marks** **40 Marks**	**Section (B) :** Five Short Questions (200 Words Each)	05 x 05 = 25
Test I (Written Test)	**20 Marks**		**Section (C) :** Two Long Questions (500 Words Each)	02 x 15 = 30
Test II (Written Test)	**20 Marks**			
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर

आचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

DEPARTMENT OF STATISTICS & ECONOMICS

Part A Introduction				
Program: UG/Certificate		Class: B.Sc.	Semester: II	Session: 2021-2022
Subject: ECONOMICS				
1	Course Code	S2-21-M		
2	Course Title	Indian Economy		
3	Course Type (Core Course/Open Elective/Generic Elective/Vocational)	Core Course		
4	Pre-requisite (if any)	-		
5	Course Objectives	This course will help in compressive understanding of Indian economy. To give death knowledge of booking & finance to students. A little understanding of India's foreign trade & various governmental policies & Programs will also be included to make student aware.		
6	Course Learning outcomes (CLO)	After the successful completion of the course students should be able to -		
		1. Develop ideas of the basic features of India economy & its Potential on natural resources.		
		2. Understand agriculture as the foundation of economic growth and development, analysis the Process & Changing nature of agricultural sector and its contribution to whole economy		
		3. Explain industrial Policy before & after independence & Concept of SSI and Cottage industries in India with Various flagship Programs.		
		4. Demonstrate India's Infrastructural growth and understand the structure of India's foreign Trade.		
		5. Grasp the importance of planning undertaken by the government of India have knowledge of various objectives, failures & Achievement's & Introduction of NITI Ayog.		
7	Credit Value	6 Credits		
8	Total Marks	Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

Part B- Content of the Course

Total No. of Lectures-Tutorials- Practicals (in hours per week): L-T-P: 6-0-0

Paragraph	Topics	No. of Lectures
I	**Introduction** 1. Characteristics of Indian Economy 2. Trends and Sectoral Composition of National Income. 3. Sectoral Distribution of workforce 4. Natural Resource Endowments- Land, Water, Livestock, Forest and Minerals 5. Demographic Features- Population Composition, Size and Growth Rates 6. Problems and Causes of Over- Population and Population Policy	18
	1. भारतीय अर्थव्यवस्था की विशेषताएँ 2. राष्ट्रीय आय की क्षेत्रीय संरचना एवं प्रवृति 3. श्रमशक्ति का क्षेत्रीय वितरण 4. प्राकृतिक संसाधन सम्पदा–भूमि, जल, पशुधन, वन, खनिज 5. जनांकिकीय विशेषताएँ–जनसंख्या की संरचना, आकार एवं वृद्धि दर 6. जनाधिक्य की समस्या एवं जनसंख्या नीति	
II	**Agriculture** 1. Nature, Importance and Characteristics of Indian Agriculture 2. Land Use Pattern and Land Reforms 3. Trends in Agricultural Production and productivity 4. Green Revolution- Objectives, Achievements and Failures 5. Agricultural Finance and Insurance 6. Agriculture Marketing 7. New Technology in Agriculture	18
	कृषि 1. भारतीय कृषि की प्रवृति, महत्व व विशेषताएँ 2. भू उपयोग पद्धति एवं भू–सुधार 3. कृषि उत्पादन एवं उत्पादकता की प्रवृतियां 4. हरित कांति–उद्देश्य, सफलताएं एवं विफलताएं 5. कृषि वित्त एवं बीमा 6. कृषि विपणन 7. कृषि में नवीन तकनीक	
III	**Industry and Infrastructure**	18

	1. Industrial Development of India after Independence 2. New Industrial Policy of 1991 3. Role of Public Sector and Private Sector in Industrialization 4. MSME- Definition, Characteristics and Its Role 5. Problems and Remedies of Small-Scale and Cottage Industries 6. Start-up India, Make in India and Aatm Nirbhar Bharat 7. Infrastructure Composition- Power, Transport and Communication.	
	उद्योग एवं आधारभूत संरचना 1. स्वतंत्रता प्राप्ति के पश्चात् भारत का औद्योगिक विकास 2. नई औद्योगिक नीति 1991 3. औद्योगीकरण में सार्वजनिक व निजी क्षेत्र की भूमिका 4. सूक्ष्म, लघु एवं मध्यम उपकम (MSME)- परिभाषा, विशेषताएँ एवं इनकी भूमिका 5. लघु एवं कुटीर उद्योगो की समस्याएं एवं समाधान 6. स्टार्टअप इण्डिया, मेक इन इण्डिया एवं आत्मनिर्भर भारत 7. आधारभूत संरचना–ऊर्जा, परिवहन एवं संचार	
IV	**Foreign Trade and Development** 1. India's Foreign Trade-Importance, Composition and Direction 2. Role of Foreign Direct Investment, Multinational Corporations 3. Disinvestment in India 4. Indian Planning – Objectives, Achievements and Failures 5. NITI Aayog 6. Indian Economic Problems- Poverty, Unemployment and Regional Inequality	**18**
	विदेशी व्यापार एवं विकास 1. भारत का विदेशी व्यापार–महत्व,दशा व दिशा 2. प्रत्यक्ष विदेशी निवेश व बहुराष्ट्रीय निगमों की भूमिका 3. भारत मे विनिवेष 4. भारतीय नियोजन– उद्देश्य, सफलताएं एवं विफलताएं 5. नीति आयोग 6. भारतीय आर्थिक समस्याएं–गरीबी, बेरोजगारी एवं क्षेत्रीय विषमताएं	
V	**Economy of Madhya Pradesh** 1. Salient Features of Madhya Pradesh's Economy 2. Natural Resources of Madhya Pradesh- Land, Forest, Water and Minerals	**18**

	3. Trends and Regional Disparities in Agriculture Sector of Madhya Pradesh 4. Organic Farming and Polyhouse in Madhya Pradesh 5. Industrial Development in Madhya Pradesh 6. Infrastructure Development in Madhya Pradesh –Power, Transport and Communication 7. Development of Tourism in Madhya Pradesh 8. Employment oriented Scheme in Madhya Pradesh	
	मध्यप्रदेश की अर्थव्यवस्था 1. मध्यप्रदेश की अर्थव्यवस्था की मुख्य विशेषताएँ 2. मध्यप्रदेश के प्राकृतिक संसाधन–भूमि, जल, वन, खनिज 3. मध्यप्रदेश में कृषि की क्षेत्रीय विषमताएं एवं प्रवृतियाँ 4. मध्यप्रदेश में जैविक खेती एवं पॉलीघर 5. मध्यप्रदेश में औद्योगिक विकास 6. मध्यप्रदेश में आधारभूत संरचना का विकास– ऊर्जा ,परिवहन एवं संचार 7. मध्यप्रदेश में पर्यटन विकास 8. मध्यप्रदेश में रोजगार मूलक योजनाएं	

Keywords/Tags: Sectoral Composition, Human resources of India, Indian Agriculture, Industrialization, Infrastructure, Foreign Direct Investment, Regional Disparities, Organic Farming, Industrial development.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Panagariya, Arvind. (2020)- India Unlimited: Reclaiming the Lost Glory, HarperCollins Publishers
2. Mishra and Puri (2020) - Indian Economy, Himalaya Publishing House, New Delhi.
3. Rudra Dutt and Sundaram – Indian Economy, S. Chand and Company, New Delhi.
4. Hariharan, N.P. (2008) - Lights and Shades of Indian Economy, Vishal Publishing Co., Jalandhar.
5. Uma Kapila (20th Edition) (2009) - Indian Economy since Independence, Academic Foundation, New Delhi.
6. Reserve Bank of India-Annual Reports.
7. Annual Economic Survey, Government of India (Latest).
8. Brahmananda, P.R. and V.R. Panchmukhi (Eds.) (1987)- The Development Process of the Indian Economy, Himalaya Publishing House, Bombay.
9. Government of India, Planning Commission, 12th Five Year Plan, New Delhi
10. रुद्रदत्त–विकास, गरीबी एवं समता, एवं समता, दीप एंड दीप पब्लिकेशन प्रा. लि., नई दिल्ली
11. जे. पी. मिश्रा– भारतीय अर्थव्यवस्था, साहित्य भवन पब्लिकेशन, आगरा

मध्यप्रदेश का आर्थिक सर्वेक्षण 2020–21 –आर्थिक एवं सांख्यिकी संचालनालय भोपाल मध्यप्रदेश

डॉ. अटल बिहारी वाजपेयी
प्राचार्य
शासकीय संस्कृत महाविद्यालय
कन्नौद (म0 प्र0)

Suggestive Digital Platform:

1. http://des.mp.gov.in/portals/0/Economic_Survey_%202020-21.pdf
2. https://www.indiabudget.gov.in/economicsurvery/ebook_es2021/index.html
3. www.indiabudget.gov.in/economicsurvery/
4. https://www.rbi.org.in/Scripts/AnnualReportMainDisplay.aspx
5. https://www.rbi.org.in/hindi/Script/armainpage.aspx
6. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=11
7. https://www.swayamprabha.gov.in/index.php/channel_profile/profile/7

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests. The division of marks are as follows:**			**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours	
A. Submission of Assignment followed by Presentation			**Section(A) :** 05 MCQ Questions	05 x 01 = 05
B. Class Test	**Best two test marks** **20 Marks**	**Best two test marks** **40 Marks**	**Section (B) :** Five Short Questions (200 Words Each)	05 x 05 = 25
Test I (Written Test)	**20 Marks**		**Section (C) :** Two Long Questions (500 Words Each)	02 x 15 = 30
Test II (Written Test)	**20 Marks**			
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

Vanti Bhayana

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर

DEPARTMENT OF STATISTICS & ECONOMICS

Part A Introduction				
Program: UG/Certificate		Class: B.Sc.	Semester: II	Session: 2021-2022
Subject: ECONOMICS				
1	Course Code	S2-21-O		
2	Course Title	Basics of Indian Economy		
3	Course Type (Core Course/Open Elective/Generic Elective/Vocational)	Core Course		
4	Pre-requisite (if any)	-		
5	Course Objectives	This course will help in compressive understanding of Indian economy. To give death knowledge of booking & finance to students. A little understanding of India's foreign trade & various governmental policies & Programs will also be included to make student aware.		
6	Course Learning outcomes (CLO)	After the successful completion of the course students should be able to -		
		1. Develop ideas of the basic features of India economy & its Potential on natural resources.		
		2. Understand agriculture as the foundation of economic growth and development, analysis the Process & Changing nature of agricultural sector and its contribution to whole economy		
		3. Explain industrial Policy before & after independence & Concept of SSI and Cottage industries in India with Various flagship Programs.		
		4. Demonstrate India's Infrastructural growth and understand the structure of India's foreign Trade.		
		5. Grasp the importance of planning undertaken by the government of India have knowledge of various objectives, failures & Achievement's & Introduction of NITI Ayog.		
7	Credit Value	4 Credits		
8	Total Marks	Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

प्राचार्य
राजकीय संस्कृत महाविद्यालय
कुल्लू (हि0 प्र0)

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय कुल्लू

Part B- Content of the Course		
Total No. of Lectures-Tutorials- Practicals (in hours per week): L-T-P: 4-0-0		
Paragraph	**Topics**	**No. of Lectures**
I	**Introduction** 1. Characteristics of Indian Economy 2. Trends and Sectoral Composition of National Income. 3. Natural Resource Endowments- Land, Water, Livestock, Forest and Minerals 4. Demographic Features- Population Composition, Size and Growth Rates	12
	परिचय 1. भारतीय अर्थव्यवस्था की विशेषताएँ 2. राष्ट्रीय आय की क्षेत्रीय संरचना एवं प्रवृति 3. प्राकृतिक संसाधन सम्पदा–भूमि,जल,पशुधन,वन,खनिज 4. जनांकिकीय विशेषताएँ–जनसंख्या की संरचना, आकार एवं वृद्धि दर	
II	**Agriculture** 1. Nature, Importance and Characteristics of Indian Agriculture 2. Land Reforms 3. Trends in Agricultural Production and productivity 4. Agricultural Finance and Insurance 5. Agriculture Marketing 6. New Technology in Agriculture	12
	कृषि 1. भारतीय कृषि की प्रवृति, महत्व व विशेषताएँ 2. भू–सुधार 3. कृषि उत्पादन एवं उत्पादकता की प्रवृतियां 4. कृषि वित्त एवं बीमा 5. कृषि विपणन 6. कृषि में नवीन तकनीक	
III	**Industry and Infrastructure** 1. Industrial Development of India after Independence 2. New Industrial Policy of 1991 3. Role of Public Sector and Private Sector in Industrialization	12

	4. MSME- Definition, Characteristics and Its Role 5. Problems and Remedies of Small-Scale and Cottage Industries 6. Start-up India, Make in India and Aatm Nirbhar Bharat	
	उद्योग एवं आधारभूत संरचना 1. स्वतत्रता प्राप्ति के पश्चात भारत का औद्योगिक विकास 2. नई औद्योगिक नीति 1991 3. औद्योगीकरण में सार्वजनिक व निजी क्षेत्र की भूमिका 4. सूक्ष्म,लघु एवं मध्यम उपक्रम (MSME)- परिभाषा, विशेषताएँ एवं इनकी भूमिका 5. लघु एवं कुटीर उद्योगो की समस्याएं एवं समाधान 6. स्टार्टअप इण्डिया,मेक इन इण्डिया एवं आत्मनिर्भर भारत	
IV	**Foreign Trade and Development** 1. India's Foreign Trade-Importance, Composition and Direction 2. Role of Foreign Direct Investment, Multinational Corporations 3. NITI Aayog 4. Indian Economic Problems- Poverty, Unemployment and Regional Inequality	12
	विदेशी व्यापार एवं विकास 1. भारत का विदेशी व्यापार–महत्व,दशा व दिशा 2. प्रत्यक्ष विदेशी निवेश व बहुराष्ट्रीय निगमों की भूमिका 3. नीति आयोग 4. भारतीय आर्थिक समस्याएं–गरीबी, बेरोजगारी एवं क्षेत्रीय विषमताएं	
V	**Economy of Madhya Pradesh** 1. Salient Features of Madhya Pradesh's Economy 2. Organic Farming and Polyhouse in Madhya Pradesh 3. Industrial Development in Madhya Pradesh 4. Infrastructure Development in Madhya Pradesh –Power, Transport and Communication 5. Development of Tourism in Madhya Pradesh 6. Employment oriented Scheme in Madhya Pradesh	12
	मध्यप्रदेश की अर्थव्यवस्था 1. मध्यप्रदेश की अर्थव्यवस्था की मुख्य विशेषताएँ 2. मध्यप्रदेश में जैविक खेती एवं पॉलीघर 3. मध्यप्रदेश में औद्योगिक विकास 4. मध्यप्रदेश में आधारभूत संरचना का विकास– ऊर्जा ,परिवहन एवं संचार 5. मध्यप्रदेश में पर्यटन विकास	

प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म0 प्र0)

	6. मध्यप्रदेश में रोजगार मूलक योजनाएं	

Keywords/Tags: Sectoral Composition, Human resources of India, Indian Agriculture, Industrialization, Infrastructure, Foreign Direct Investment, Regional Disparities, Organic Farming, Industrial development.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Panagariya, Arvind. (2020)- India Unlimited: Reclaiming the Lost Glory, HarperCollins Publishers
2. Mishra and Puri (2020) - Indian Economy, Himalaya Publishing House, New Delhi.
3. Rudra Dutt and Sundaram – Indian Economy, S. Chand and Company, New Delhi.
4. Hariharan, N.P. (2008) - Lights and Shades of Indian Economy, Vishal Publishing Co., Jalandhar.
5. Uma Kapila (20th Edition) (2009) - Indian Economy since Independence, Academic Foundation, New Delhi.
6. Reserve Bank of India-Annual Reports.
7. Annual Economic Survey, Government of India (Latest).
8. Brahmananda, P.R. and V.R. Panchmukhi (Eds.) (1987)- The Development Process of the Indian Economy, Himalaya Publishing House, Bomabay.
9. Government of India, Planning Commission, 12th Five Year Plan, New Delhi
10. रूद्रदत्त–विकास, गरीबी एवं समता, एवं समता,दीप एंड दीप पब्लिकेशन प्रा. लि., नई दिल्ली
11. जे. पी. मिश्रा– भारतीय अर्थव्यवस्था, साहित्य भवन पब्लिकेशन, आगरा

मध्यप्रदेश का आर्थिक सर्वेक्षण 2020–21 –आर्थिक एवं सांख्यिकी संचालनालय भोपाल मध्यप्रदेश

Suggestive Digital Platform:

1. http://des.mp.gov.in/portals/0/Economic_Survey_%202020-21.pdf
2. https://www.indiabudget.gov.in/economicsurvery/ebook_es2021/index.html
3. www.indiabudget.gov.in/economicsurvery/
4. https://www.rbi.org.in/Scripts/AnnualReportMainDisplay.aspx
5. https://www.rbi.org.in/hindi/Script/armainpage.aspx
6. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=11
7. https://www.swayamprabha.gov.in/index.php/channel_profile/profile/7

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests. The division of marks are as follows:**	**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours

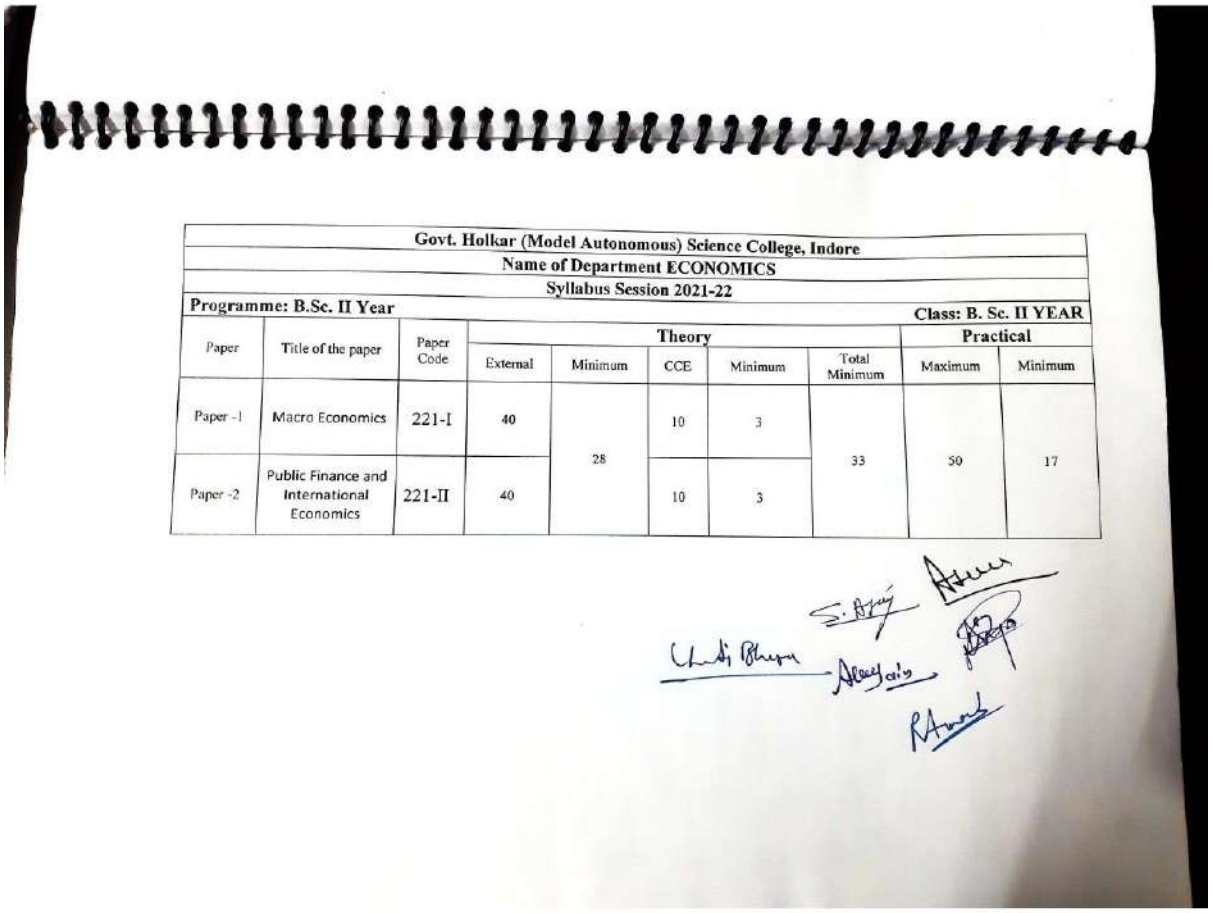
प्राचार्य
शासकीय संस्कृत महाविद्यालय
इन्दौर (म.प्र. 90)

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर

A. Submission of Assignment followed by Presentation			Section(A) : 05 MCQ Questions	05 x 01 = 05
B. Class Test	Best two test marks 20 Marks	Best two test marks 40 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 05 = 25
Test I (Written Test)	20 Marks		Section (C) : Two Long Questions (500 Words Each)	02 x 15 = 30
Test II (Written Test)	20 Marks			
Test III (Quiz/Seminar/Assignment)	20 Marks			
Total Internal Assessment (Theory) Marks (A+B)		40 Marks	Total External Evaluation (Theory) Marks (A+B+C)	60 Marks

प्राचार्य

डा. अटल बिहारी वाजपेयी
कला एवं वाणिज्य महाविद्यालय इन्दौर



Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department ECONOMICS

Syllabus Session 2021-22

Programme: B.Sc. II Year **Class: B. Sc. II YEAR**

Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -1	Macro Economics	221-I	40	28	10	3	33	50	17
Paper -2	Public Finance and International Economics	221-II	40		10	3			

DEPARTMENT OF ECONOMICS

Class: B. Sc. II Year | **Marks: 40+ (CCE) 10 = 50**

Subject: Economics | **Paper: Theory -I**

Title of Paper: Macro Economics | **Code of the Paper: C221-I**

Part A : Introduction for code-C221-I	
Pre-requisite (if any)	-
Course Objectives	This course is designed to discuss the preliminary concepts associated with the determination & measurement of aggregate macroeconomics variables like savings, investments, GDP, inflation, money and balance of payment. This course will Provided an overall idea about national economic policies & its implication.
	After the successful completion of the course students should be able to
Course Learning Outcomes	1. Calculate National Income and demonstrate Circular flow of income.
	2. Compare and contrast the circumstances under which it makes sense to apply the Keynsian theory of employment.
	3. Describe working of multiplier and interpret the meaning of MEC and MEI.
	4. Grade different measures of money supply and illustrate various versions of quantity theory of money.
	5. Identify types of banks, interpret credit creation process of commercial banks.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit I	Concept of Macro Economics, Inter-relation between Micro and Macro Economics, Macro Variables - Stock and Flow, Circular Flow of Income, Concept of National Income- Gross National Product (G.N.P.) and Gross Domestic Product (G.D.P.), National Income Accounting, Interrelation between National Income and Economic Welfare.
इकाई–1	समष्टि अर्थशास्त्र की अवधारणा – समष्टि और व्यष्टि अर्थशास्त्र के मध्य अंर्तसंबंध । समष्टि चर– स्टॉक और प्रवाह, आय का चक्रीय प्रवाह, राष्ट्रीय आय की अवधारणा, सकल राष्ट्रीय उत्पाद(जी.एन.पी.), सकल घरेलू उत्पाद(जी.डी.पी.) की अवधारणा , राष्ट्रीय आय लेखांकन. राष्ट्रीय आय एवं आर्थिक कल्याण के मध्य अंर्तसंबंध ।

Unit II	Classical Theory of Employment, Keynesian Theory of Employment- Aggregate Demand Function and Aggregate Supply Function, Effective demand, consumption and saving function, Principles of Multiplier and Accelerator.
इकाई–2	रोजगार का प्रतिष्ठित सिद्धांत, किन्स का रोजगार सिद्धांत– समग्र मांग फलन और समग्र पूर्ति फलन, प्रभावपूर्ण मांग। उपभोग एवं बचत फलन, गुणांक और त्वरक के सिद्धांत।
Unit III	Investment Function and Marginal Efficiency of Capital (MEC), Factors Affecting Investment function, Keynesian Theory of Liquidity Preference and Liquidity Trap.
इकाई–3	निवेश फलन एवं पूंजी की सीमांत क्षमता (एम.ई.सी.) निवेष फलन को प्रभावित करने वाले तत्व, कीन्स का तरलता पसन्दगी का सिद्धांत और तरलता जाल।
Unit IV	Money- Meaning and Functions, Stock of Money and its Measures- M1, M2, M3, M4. Quantity Theory of Money- Cash Transaction and Cash Balance Approaches. Inflation, Deflation and Depression - Definition, Causes and Effects on various Segments of the Economy, Parallel Economy of black money.
इकाई–4	मुद्रा – अर्थ और कार्य, मुद्रा का स्टॉक और उसके मापन – एम1, एम2, एम3, एम4, मुद्रा के परिमाण सिद्धांत– नकद व्यवहार और नकद शेष सिद्धांत। मुद्रा स्फीति, मुद्रा संकुचन और मंदी– परिभाषा, कारण और अर्थव्यवस्था के विभिन्न वर्गों पर प्रभाव। काले धन की सामानांतर अर्थव्यवस्था।
Unit V	Bank - Meaning and Types, Functions of Commercial Banks, Process of Credit Creation, Central Bank and its Functions with special Reference to Reserve Bank of India, Credit Control- Qualitative and Quantitative Methods, Concept of Monetary Policy, Objectives and Limitations of Monetary Policy, MUDRA and Jan Dhan Yojana.
इकाई–5	बैंक – अर्थ और प्रकार,, व्यापारिक बैंक के कार्य, साख निर्माण की प्रक्रिया, केंद्रीय बैंक और उसके कार्य (रिजर्व बैंक ऑफ इंडिया के विशेष संदर्भ में) साख नियंत्रण–गुणात्मक और परिमाणात्मक विधियां, मौद्रिक नीति की अवधारणा, मौद्रिक नीति के उद्देश्य और सीमाएं। मुद्रा एवं जनधन योजना।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

Heijdra, B.J. and F.V. Ploeg (2001) Foundations of Modern Macroeconomics, Oxford, University Press, Oxford

Lewis, M.K. and P.D. Mizan (2001) Foundations of Modern Macroeconomics, Oxford, University Press, Oxford.

Hanson, A.H. (1953) A Guide to Keynes. McGraw Hill, New York, Keynes, J.M. (1936), The General Theory of Employment, Interest and Money, Macmillan, London.

Gupta, S.B. (1994), Monetary Economics, S. Chand & Company, New Delhi.

एम.एल.झिंगन: समष्टि अर्थशास्त्र

खिमेसरा एवं पंवार: मुद्रा एवं अंतराष्ट्रीय अर्थशास्त्र

डॉ रामरतन शर्मा: अंतराष्ट्रीय अर्थशास्त्र एवं वित्त

मध्यप्रदेश हिन्दी ग्रंथ अकादमी के नवीनतम प्रकाशन

Suggested Weblink :-

- https://youtu.be/EeD6U41i3Xk
- https://youtu.be/flXOp5SMWLQ
- https://youtu.be/R8qQj4vO_qc
- https://youtu.be/DiYvJyitgQQ
- https://www.magadhuniversity.ac.in/download/econtent/pdf/lecture%2015.pdf
- https://youtu.be/AffhWKHYqJY
- https://youtu.be/Gjdj_6B7sBK

Part D :Assessment and Evaluation		
As per HE Syllabus		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): 10 College Exam: 40		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: 40 Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**

DEPARTMENT OF ECONOMICS

Class: B. Sc. II Year | **Marks: 40+ (CCE) 10 = 50**

Subject: Economics | **Paper: Theory -II**

Title of Paper: Public Finance and International Economics | **Code of the Paper: C221-II**

Part A : Introduction for code-C221-II	
Pre-requisite (if any)	-
Course Objectives	The main objective of this subject is to understand and analyze the impact of public policy of the allocation of resources and distributions of income in the economy & also analysis of public expenditures, Taxation, budgetary procedures and debt issues.
Course Learning Outcomes	After the successful completion of the course students should be able to
	1. Identify the sources of finance of govt. and classify the types of taxes.
	2. Describe budget process and summarize the role played by finance commission.
	3. Identify difference between intra and international trade and its importance with reference to trade theories.
	4. Recite terms of trade with different nations and role of International Organization in development.
	5. Tell composition and direction of foreign trade and connect appreciation and depreciation of currency in economy.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Public Finance- Meaning, Nature and Scope. Role of Public Finance in Modern Economy. Principle of Maximum Social Advantage, Sources of Revenue/ Taxes Revenue and Non Taxes Revenue, Kinds of Taxes- Direct and Indirect, General Introduction of Goods and Services Tax (G.S.T.) , Taxable Capacity in India.
इकाई-I	सार्वजनिक वित्त – अर्थ, प्रकृति एवं क्षेत्र, आधुनिक अर्थव्यवस्था में सार्वजनिक वित्त की भूमिका। अधिकतम सामाजिक लाभ का सिद्धांत, आगम के स्रोत / कर आगम और गैरकर आगम करों के प्रकार / वस्तु एवं सेवा कर (जी.एस.टी.) का एक सामान्य परिचय। भारत में करदान क्षमता।
Unit-II	Budget-Definition and Preparation, Fiscal Deficit, Fiscal Policy, Deficit Finance, Central-State Financial Relation , Recommendations of Latest Finance Commission.
इकाई-II	बजट– परिभाषा और निर्माण, राजकोषीय घाटा, राजकोषीय नीति, हीनार्थ प्रबंधन, केन्द्र –राज्य वित्तीय

	संबंध और नवीनतम वित्त आयोग की अनुशंसाएँ।
Unit-III	Meaning and Importance of International Economics, Intra and International Trade. Importance of International Trade in Economic Development. Theories of International Trade- Absolute and Comparative Advantage. Factor endowment Theory of Heckscher-Ohlin.
इकाई–III	अन्तर्राष्ट्रीय अर्थशास्त्र का अर्थ और महत्व, अन्तः और अन्तर्राष्ट्रीय व्यापार, आर्थिक विकास में अन्तर्राष्ट्रीय व्यापार का महत्व। अन्तर्राष्ट्रीय व्यापार के सिद्धान्त, निरपेक्ष और तुलनात्मक लाभ। हेक्षचर ओहलिन साधन प्रचुरता सिद्धान्त ।
Unit-IV	Terms of Trade- Concept and Types, Tariff and Non-Tariff in International Trade. World Trade Organization (W.T.O.) Objectives and its Functions. Balance of Trade- Concept, Types, Compositions and Structure of Balance of Trade (B.O.T.) and its relationship with Balance of Payment, Methods of Corrections of Imbalance of Payment.
इकाई–IV	व्यापार की शर्तें – संकल्पना और प्रकार, अन्तर्राष्ट्रीय व्यापार की प्रशुल्क और गैर –प्रशुल्क बाधाएँ। विश्व व्यापार संगठन (W.T.O.) उददेश्य और कार्य, भुगतान शेष– संकल्पना और प्रकार। व्यापार शेष की संरचना और घटक तथा भुगतान संतुलन के साथ संबंध, भुगतान असंतुलन में सुधार के तरीके।
Unit-V	Trends and direction of India's foreign trade, Exchange Rate - Theories of Exchange Rate - Mint Par parity Theory, Purchasing Power Parity Theory. Concept of Appreciation and Depreciation of Currency and its effects on Foreign Trade. Foreign Trade Policy and Developing Countries.
इकाई-V	भारतीय विदेशी व्यापार की प्रवृत्ति एवं दिशा। विनिमय दर:– विनिमय दर के सिद्धांत –टकसाली दर समता सिद्धांत, क्रय शक्ति समता सिद्धांत, मुद्रा का अवमूल्यन एवं अधिमूल्यन एवं विदेशी व्यापार पर प्रभाव। विदेशी व्यापार नीति एंव विकासशील देश।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

H.G. Mannur . International Economics

Kindleberger, C.P. International Economics

डॉ. राम रतन शर्मा : अन्तर्राष्ट्रीय अर्थशास्त्र एवं वित्त

वी सी सिन्हा : लोक वित्त

एच. एल. भाटिया : लोक वित्त

बी.पी.त्यागी : लोक वित्त

मध्यप्रदेश हिन्दी ग्रंथ अकादमी नवीनतम प्रकाशन

Suggestive digital platforms and Web-links:

- https://youtu.be/CqV34dFZe6Q
- https://youtu.be/ALWf34PuqsA
- https://youtu.be/LnxJQzoxdZw
- https://youtu.be/LVOnkLjNj08
- https://youtu.be/JTe7V7xltFs

Part D :Assessment and Evaluation		
As per HE Syllabus		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): 10 College Exam: 40		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**

Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department- Economics

Syllabus Session 2021-22

Programme: B.Sc. III Year **Class: B. Sc III YEAR**

Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -1	Development and Environment Economics	321-I	40	28	10	3	33	50	17
Paper -2	Statistics	321-II	40		10	3			
Internship			Report	Viva	Maximum	Minimum			
			50	50	100	33			

DEPARTMENT OF ECONOMICS

Class: B. Sc. III Year | **Marks: 40+ (CCE) 10 = 50**

Subject: Economics | **Paper: Theory -I**

Title of Paper: Development and Environment Economics | **Code of the Paper: C321-I**

Part A : Introduction for code-C321-I	
Pre-requisite (if any)	-
Course Objectives	To explain development economic Growth theories, international trade development theories and learn hardcore economic prescription to development. Demonstrate understanding of difference between growth & development, the measurement of inequality and concept of developed economics
	After the successful completion of the course students should be able to -
Course Learning Outcomes	1. Explain economic growth and development, illustrate factors of economic development.
	2. Illustrate and apply various classical theories of economic growth.
	3. Explain the concept of balanced and imbalanced growth, illustrate Harod-Domar and solow's growth model.
	4. Explain importance of gender equality and women empowerment and techniques of production.
	5. Realize the importance and influence of environment on the economy, suggest appropriate measures to correct environment degration.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Economic Growth and Development – Concept, Characteristics of Developing Countries, Factors of Economic Development and Growth-Capital, Physical and Human Recourses, Research& Development and Technology.
इकाई-I	आर्थिक वृध्दि और विकास– अवधारणा, विकासशील देशों की विशेषताएं आर्थिक वृध्दि और विकास के तत्व–पूँजी, भौतिक और मानव संसाधन, अनुसंधान और विकास एवं तकनीक।
Unit-II	Theories of Economic Development – Adam Smith, Karl Marx and Schumpeter, Rostow's Stages of Economic Growth, Investement Criteria of Economic Development, Human Resource Development.
इकाई-II	आर्थिक विकास के सिद्धांत – एडम स्मिथ, कार्ल मार्क्स, शुम्पीटर। रोस्टोव की आर्थिक विकास की

	अवस्थाए । आर्थिक विकास के निवेश मापदंड। मानव संसाधन विकास।
Unit-III	Balanced vs. unbalanced Growth -Theories of Big Push (Rodan), A.Lewis, Herschman, Leibenstein, Gunnar Myrdal, and Harrod-Domar, Kuzenets Model.
इकाई–III	संतुलित बनाम असंतुलित विकास – बडे धक्के का सिद्धांत (रोडान), ए.लुईस, हर्षमैन, लीबिंस्टीन, गुन्नार मिर्डल, हैरोड–डोमर, कुजनेट्स मॉडल।
Unit-IV	Economic Development and Gender Equality, Gender Development Index (GDI), Women Empowerment, Choices of Techniques of Development-Capital Intensive and Labour Intensive Techniques, Human Development Index.
इकाई–IV	आर्थिक विकास और लिंग समानता। लैंगिक विकास सूचकांक, महिला सशक्तिकरण, विकास की तकनीक का चुनाव –पूंजी प्रधान एंव श्रम प्रधान तकनीके। मानव विकास सूचकांक।
Unit-V	Environment Economics – Concepts, Components and Factors Affecting Environments, Environment – Economy Linkage, Population-Environment linkage, Market Failure for Environment Goods. Concept of Sustainable Development, Valuation of Environmental Damages:- Land, Water, Air, Forest Prevention and Control. Prevention of Pollution. Renewable and non –Renewable resources, Green Index – Concept.
इकाई-V	पर्यावरण अर्थशास्त्र – अवधारणा, घटक एंव पर्यावरण को प्रभावित करने वाले कारक , अर्थव्यवस्था– जनसंख्या अंर्तसंबंध, जनसंख्या पर्यावरण अंर्तसंबंध, बाजार विफलता के रूप में पर्यावरणीय वस्तु, धारणीय विकास की अवधारणा, पर्यावरणीय क्षति का आंकलन– भूमि, जल, वायु और वन ।पर्यावरण प्रदूषण निवारण और रोकथाम। पुनरूत्पादनीय एवं गैर पुनरूत्पादनीय संसाधन, हरित सूचकांक की अवधारणा।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

M L Jhingan : Economics of growth and development.

Heyami Y : Development Economics, Oxford University Press.

Karpagam M : Environmental Economics

सेठ एम.एल. – माइक्रो अर्थशास्त्र

योगेश शर्मा : पर्यावरण एवं मानव संसाधन विकास – पॉइन्ट पब्लिशर, जयपुर

वी सी सिन्हा : विकास एवं पर्यावरणीय अर्थशास्त्र – एस बी पी डी पब्लिशर हाउस, आगरा

दीप्ति शर्मा / महेन्द्र कुमार – पर्यावरण एवं संविकास – अर्जुन पब्लिशिंग, दिल्ली

मध्यप्रदेश हिन्दी ग्रंथ अकादमी के नवीनतम प्रकाशन

Suggestive digital platforms and Web-links:

- https://youtu.be/9VyOln2fnE4
- https://www.k-state.edu/economics/mafwayne/student/Ch_%205_%20Theories%20of%20Economic%20Development.ppt
- http://magadhmahilacollege.org/wp-content/uploads/2020/07/balanced_and_unbalanced_growth_theory.pp2_.pdf
- https://youtu.be/WuxhKC96HqQ
- https://youtu.be/idQlNUHcx54

Part D :Assessment and Evaluation		
As per HE Syllabus		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): 10 College Exam: 40		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: 40 Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**

DEPARTMENT OF ECONOMICS

Class: B. Sc. III Year
Subject: Economics
Title of Paper: Statistics

Marks: 40+ (CCE) 10 = 50
Paper: Theory -II
Code of the Paper: C321-II

Part A : Introduction for code-C321-II	
Pre-requisite (if any)	-
Course Objectives	This course will help students understand the issues regarding data collection, Processing organizing and Presentation. A particular emphasis will be placed on developing the ability to interpret the numerical information that forms basic of decision making in business.
	After the successful completion of the course students should be able to -
Course Learning Outcomes	1. Explain statistical importance and analyse statistical data graphically using frequency distribution.
	2. Use and apply statistical averages, dispersion and location.
	3. Employee the principles of linear regression and correlation.
	4. Demonstrate understanding of time series and illustrate different types of Index Number.
	5. Use basic probability rules and enhance research knowledge

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Meaning and Definition of Statistics, Nature and Scope, Functions, Importance and Limitations of Statistics. Universe and Sample, Techniques of Data Collection, Classification, Tabulation, Graphical Representation of Data, Frequency Distribution, Cumulative Frequency.
इकाई-I	सांख्यिकी का अर्थ एवं परिभाषा, प्रकृति एवं क्षेत्र, सांख्यिकी के कार्य, महत्व एवं सीमाएं समग्र एवं न्यादर्श, समंक संकलन की विधियां, वर्गीकरण, सारणीयन, समंकों का बिंदुरेखीय प्रदर्शन, आवृति वितरण,संचयी आवृति।
Unit-II	Measures of Central Tendency- Mean Median, Mode, Geometric Mean and Harmonic Mean. Measures of Dispersion- Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation.
इकाई-II	केन्द्रीय प्रवृत्ति के मापन – माध्य, माध्यिका, बहुलक, ज्यामितीय माध्य, हरात्मक माध्य, अपकिरण के मापन

	– विस्तार, चतुर्थक विचलन ,माध्य विचलन, प्रमाप विचलन, विचलन गुणांक।
Unit-III	Correlation – Karl Pearson's co-efficient of Correlation, Spearman's Rank difference, Regression Analysis, Regression Equation, Co-efficient of Regression. Use and Application of Regression and Correlation Analysis.
इकाई–III	सहसंबंध – कार्ल पियरसन का सहसंबंध गुणांक, स्पियरमेन का कोटि अंतर सहसंबंध गुणांक, प्रतीपगमन विश्लेषण, प्रतीपगमन समीकरण, प्रतीपगमन गुणांक ,प्रतीपगमन एंव सहसंबंध का उपयोग।
Unit-IV	Time Series Analysis, Concept and Component, Additive and Multiplicative Model, Index Numbers – Concept, Types and Importance, Problems in Construction of Index Number and their Limitations. Laspaire's, Passche's and Fisher's Index Numbers.
इकाई–IV	काल माला का विश्लेषण, संकल्पना एवं घटक, योगात्मक एवं गुणात्मक प्रादर्श, सूचकांक की अवधारणा, प्रकार, महत्व, सूचकांक निर्माण की समस्याएं एवं सीमाएं, लैस्पियर, पाश्चे, एवं फिशर का सूचकांक।
Unit-V	Probability: Concept, Rules of Probability, Conditional Probability, Research- Concept and Types, Selection of Research Problems, Hypothesis- Concept and Types, Research Report Writing.
इकाई-V	प्रायिकता : अवधारणा, प्रायिकता के नियम, सशर्त प्रायिकता, अनुसंधान– अवधारणा एवं प्रकार, अनुसंधान चयन की समस्या। परिकल्पना – अवधारणा एवं प्रकार, अनुसंधान प्रतिवेदन लेखन।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

Statistics : Elhance D N

Resarch Methodology : C.R. Kothari

सांख्यिकी के सिद्धांत : बी एन गुप्ता

सांख्यिकी के सिद्धांत : एस पी सिंह

सांख्यिकी : शुक्ला एवं सहाय

अनुसंधान का परिचय : पारसनाथ राय

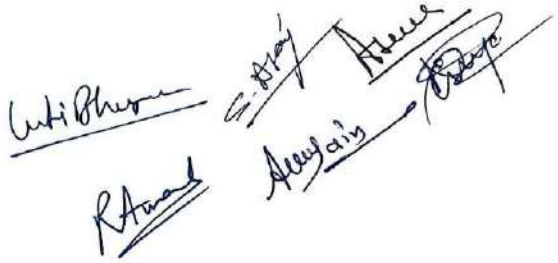
मध्यप्रदेश हिन्दी ग्रंथ अकादमी के नवीनतम प्रकाशन

Suggestive digital platforms and Web-links:

1. https://mathworld.wolfram.com/topics/DescriptiveStatistics.html
2. https://stattrek.com/statistics/charts/histogram.aspx?tutorial=AP
3. https://onlinecourses.swayam2.ac.in/cec21_ma01/preview
   https://www.youtube.com/watch?v=69oJW0HkOOk&list=RDCMUCLl511QwkqQn0Cf4nzdGKeQ&start_radio=1&rv=69oJW0HkOOk&t=24nWh68y

Part D :Assessment and Evaluation

As per HE Syllabus		
Suggested Continuous Evaluation Methods:		
Maximum Marks:	50	
Continuous Comprehensive Evaluation (CCE):	10	
College Exam:	40	
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**



Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Electronics

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

GOVT. HOLKAR (MODEL, AUTONOMOUS)

SCIENCE COLLEGE, INDORE

(A College of Excellence & NAAC Accredited with "A" Grade)

DEPARTMENT OF ELECTRONICS

SCHEME & SYLLABUS

OF THE

B.Sc. I SEM

2021-22

SESSION 2021 - 22

Govt. Holkar (Model, Autonomous) Science College, Indore												
Name of Department												
Syllabus Session 2021-22												
Programme: Certificate in Science											Class: B.Sc. I Sem	
Sn.No	Paper	Paper Title	Paper Code	Theory				Practical				
				Credits	CCE	External assessment	Min Marks	Credits	Internal assessment	External assessment	Min. Marks	total credits
1	Paper I Core Course (Major)	Semiconductor Devices	C108-I	4	25	75	33	2	25	75	33	6
2	Paper I Core Course (Minor)	Basic Circuit Theory and Network Analysis	C108-II	4	25	75	33	2	25	75	33	6
4	Open Elective	Introduction of Electronics Components and Network	O108-I	2	10	40	17	2	-	50	17	4
6	Certificate Course	Fabrication and Maintenance of Laboratory Equipment	LE01	2	10	40	17	2	-	50	17	4
		Robotics	RX02	2	10	40	17	2	-	50	17	4
		Basic Programming with Python	PY03	2	10	40	17	2	-	50	17	4

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Electronics
Syllabus Session 2021-22

Class: B.Sc. I Sem **Marks: 75 + (CCE) 25 = 100**
Subject: Electronics **Credit: 4**

Paper: Core (Major) I
Title of Paper: Semiconductor Devices **Code of the Paper: C108-I**

Part A: Introduction		
1	Pre-requisite (if any)	To study this course, a student must have had the subject Science in class 12th. इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है। …….. **This course can be opted as an elective by the student of following subjects: NA**
2	Course Objectives	To know the basic knowledge of semiconducting material and devices
	Course Learning Outcomes	1: Analyze the behavior of semiconductor materials अर्धचालक पदार्थों के व्यवहार का वर्णन करना।
		2: Reproduce the I-V characteristics of diode/ BJT/MOSFET devices डायोड/BJT/ मॉसफेट युक्तियों का I-V अभिलाक्षणिक आरेखित करना
		3: Apply standard devices models to explain/ calculate critical internal parameters of semi-conductor devices. अर्धचालक युक्तियां पर मानक युक्ति मॉडल को प्रदान कर वर्णित करना तथा उनके महत्वपूर्ण मापदंडो का पता करना।
		4: Categorize the behavior and characteristics of power devices, such as, SCR/UJT, etc. पावर युक्तियां जैसे SCR/UJT आदि के व्यवहार तथा अभिलाक्षणिक का वर्णन करना।

Part B-Content of the Course
भाग ब - पाठयक्रम की विषयवस्तु

Total No. of Lectures-Tutorials-Practical (in hours per week):60 L-T-P: 2-0-0
व्याख्यानों- ट्यूटोरियल -प्रायोगिक कक्षाओ की कुल संख्या (प्रति सप्ताह घंटे) : 60 L-T-P: 2-0-0

Unit	Topics	No. of Lectures
1	**Semiconductor Basics:** Introduction to Semiconductor Materials, Crystal Structure, Planes and Miller Indices, Energy Band in Solids, Concept of Effective Mass, Density of States. Carrier Concentration at Normal Equilibrium in Intrinsic Semiconductors. Derivation of Fermi Level for Intrinsic & Extrinsic Semiconductors, Donors, Acceptors, Dependence of Fermi Level on Temperature and Doping Concentration, Temperature Dependence of Carrier Concentrations.	**14**

	Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Carrier Injection, Generation and Recombination Processes, Continuity Equation. **सेमीकंडक्टर आधारभूत:** सेमीकंडक्टर मैटेरियल्स का परिचय, क्रिस्टल स्ट्रक्चर, प्लेन और मिलर इंडेक्स, ठोस में उर्जा बैंड, प्रभावी द्रव्यमान की अवधारणा, सघनता की अवस्था । आंतरिक अर्धचालकों में सामान्य साम्यावस्था पर वाहक सांद्रता । अर्धचालकों में आंतरिक और वाह्य के लिए फर्मी स्तर की व्युत्पत्ति। दाता, ग्राही । तापमान और डोपिंग पर फर्मी स्तर की निर्भरता, वाहक सांद्रता की तापमान निर्भरता। वाहक परिवहन घटना :वाहक ड्रिफ्ट, विचलता, प्रतिरोधकता, हॉल प्रभाव, विसरण क्रिया, आइंस्टीन संबंध, धारा सघनता समीकरण, वाहक अन्तःक्षेपण , जनरेशन तथा रेकोम्बिनेशन की अवधारणा, सातत्य समीकरण	
2	**P-N Junction Diode:** Formation of Depletion Layer, Space Charge at a junction, Derivation of Electrostatic Potential Difference at Thermal Equilibrium, Depletion Width and Depletion Capacitance of an Abrupt junction. Concept of Linearly Graded junction, Derivation of Diode Equation, and I-V Characteristics, Zener Diode, Zener and Avalanche junction Breakdown Mechanism. LED, Tunnel diode, Varactor diode, Solar cell, Schottky Diode: working, circuit symbol, characteristics and applications. **पीएन संधि डायोड:** PN संधि डायोड अवक्षय परत का निर्माण, संधि पर स्पेस चार्ज, तापीय साम्यावस्था पर इलेक्ट्रोस्टेटिक विभवान्तर के सूत्र व्युत्पत्ति, अब्रप्ट जंक्शन कि अवक्षय चौड़ाई तथा अवक्षय संधारित्र, रेखीय ग्रेडेड संधि की अवधारणा, डायोड समीकरण की व्युत्पत्ति तथा धारा-विभव अभिलाक्षणिक, जेनर डायोड, जेनर तथा ऐवेलॉन्वी भंजन,LED , टनल डायोड, वैरेक्टर डायोड, सोलर सेल, शॉर्टकी डायोड: प्रतीक, कार्यविधि , अभिलाक्षणिक तथा अनुप्रयोग.	**14**
3.	**Bipolar Junction Transistors (BJT):** PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Base Transport Factor, Current Gain, Energy Band Diagram of Transistor in Thermal Equilibrium, Quantitative Analysis of Static Characteristics (Minority Carrier Distribution and Terminal Currents). Base-Width Modulation, Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations. Metal Semiconductor Junctions: Ohmic and Rectifying Contacts. **द्विध्रुवी जंक्शन ट्रांजिस्टर (BJT):** PNP और NPN ट्रांजिस्टर, ट्रांजिस्टर की क्रिया की अवधारणा, उत्सर्जक दक्षता, आधार ट्रांसपोर्ट गुणांक, धारा लाभ, तापीय साम्यावस्था में ट्रांजिस्टर का ऊर्जा बैंड चित्र, स्थैतिक विशेषताओं मात्रात्मक विश्लेषण (अल्पसंख्याक आवेश वाहको का वितरण तथा टर्मिनल धारा), बेस विड्थ माड्यूलेशन, कार्यप्रणाली, उभयनिष्ठ आधार, उभयनिष्ठ उत्सर्जक, उभयनिष्ठ संग्राहक अभिविन्यासओ की इनपुट तथा आउटपुट अभिलाक्षणिक, धातु अर्धचालक संधि: ओमिक तथा रेक्टिफाइंग कॉन्टैक्ट्स।	**14**
4	**Field Effects Transistors:** JEET, Construction, Idea of Channel Formation, Pinch-OFF and Saturation Voltage, Current-Voltage Output Characteristics. MOSFET, type of MOSFETs, Circuit Symbols, Working and Characteristic curves of Depletion type MOSFET (both N channel and P channel). Complimentary MOS (CMOS).	**18**

	Power Devices: UJT: Basic construction and working, Equivalent circuit, intrinsic Standoff Ratio, Characteristics and relaxation oscillator-expression. **SCR:** Construction, Working and Characteristics, Triac, Diac, IGBT, MESFET: circuit symbols, basic constructional features, operation and application. **क्षेत्र प्रभाव ट्रांजिस्टर :**JFET, संरचना, चैनल निर्माण की अवधारणा, पिंच-ऑफ तथा संतृप्ति विभव, धारा विभव आउटपुट अभिलाक्षणिक। MOSFET, MOSFETs के प्रकार। परिपथ प्रतीक, डिप्लेशन टाइप MOSFET (N चैनल तथा P चैनल) तथा एन्हेंसमेंट टाइप MOSFET (N चैनल तथा P चैनल) कि कियाविधि तथा अभिलाक्षणिक । कॉम्प्लीमेंट्री MOS (CMOS). **पॉवर युक्तियाँ: UJT:** आधारभूत संरचना तथा कार्यविधि, समतुल्य परिपथ, इंट्रिंसिक स्टैंडऑफ अनुपात, रिलेक्सेशन दोलित्र का समीकरण तथा अभिलाक्षणिक। **SCR:** संरचना, कार्यविधि तथा अभिलाक्षणिक, Triac, Diac, IGBT, MESFET: परिपथ, प्रतीक, आधारभूत संरचना, कार्यविधि तथा अनुप्रयोग।	

Keywords/Tags:

Part C-Learning Resources
भाग स - अनुशंसित अध्ययन संसाधन

Text Books, Reference Books, Other resources
पाठय पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

Suggested Readings:
अनुशंसित सहायक पुस्तकें / ग्रन्थ/अन्य पाठय संसाधन/पाठय सामग्री

1. Malvino A.P., *Electronic Principles*, Tata Me Graw Hill pub, 7th Ed., 2017
2. Mehta V.K., Principles of Electronics, S. Chand & Co, 2007
3. S.M. Sze, Physics of Semiconductor Devices: Physics and Technology, 2nd Edition, Wiley India edition, 2008.

2 Suggestive digital platforms web links
अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक

National Digital Library:https://ndl.iitkgp.ac.in/

Suggested equivalent online courses:
1. https://www.coursera.org/
2. Lectures: MIT open courseware, MIT Course Number 6.012
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-fall-2009/lecture-notes/
3. NPTEL E-Learning Courses: https://nptel.ac.in/courses/117/102/117102061/

Part D- Assessment and Evaluation
भाग द - अनुशंसित मूल्यांकन विधियां

Suggested Continuous Evaluation Methods:
अनुशंसित सतत मूल्यांकन विधियाँ:
Maximum Marks:100, अधिकतम अंक :100

Continuous Comprehensive Evaluation (CCE) : 25marks	End Term Exam (ETE) : 75marks
सतत व्यापक मूल्यांकन) CCE) अंक : 25	मुख्य सिद्धांत परीक्षा(ETE) अंक : **75**

Internal Assessment: आंतरिक मूल्यांकन : Continuous Comprehensive Evaluation (CCE):25	Class Test Assignment/Presentation	15 10 =25

सतत व्यापक मूल्यांकन) CCE):		
External Assessment: आकलन University Exam Section :75 Time: 02.00 Hours विश्वविद्यालय परीक्षा 75 समय 02: 00 घंटे	**Section(A):** Three Very Short Question (50 Words Each) **(अनुभाग-अ):** तीन अति लघु प्रश्न (प्रत्येक 50 शब्द) **Section (B):** Four Short Questions (200 Words Each) **(अनुभाग-ब):** चार लघु प्रश्न (प्रत्येक 200 शब्द) **Section(C):** Two Long Questions (500 Word Each) **(अनुभाग-स):** दो दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	03 x 03 = 9 04 x 09 =36 02 x 15 = 30 Total 75
Any remarks/ suggestions:		

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics
Syllabus Session 2021-22

Class: B.Sc. I Sem **Marks: 75 + (CCE) 25 = 100**
Subject: Electronics **Credit: 2**
Paper: Practical (Major)
Title of Paper: Semiconductor Devices Laboratory **Code of the Paper: P1**

Part A Introduction		
1	Pre-requisite (if any)	To study this course, a student must have had the subject Science in class 12th इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है। **And have opted SI-ELEC2G. This course can be opted as an elective by the students of following subjects.**
2	Course Objectives	**To understand practical behavior of Semiconductor Devices.**
	Course Learning Outcomes	**On completion of this course , learners will be able to:** 1. Examine the characteristics of basic semiconductor devices. आधारभूत अर्धचालक युक्तिओं के अभिलाक्षणिक की जांच करना।
		2. Perform experiments for studying the behavior of semiconductor devices for circuit design applications. सर्किट डिजाइन अनुप्रयोगों के लिए, अर्धचालक उपकरणों के व्यवहार का अध्ययन करने के लिए प्रयोग करना।
		3. Calculate various device parameters values from their I-V characteristics. I-V अभिलाक्षणिक माध्यम से युक्तिओं के विभिन्न मापदण्डों के मानों को परिकलित करना।
		4. Interpret the experimental data for better understanding the device behavior युक्तियों के व्यवहार को सुव्यवस्थित तरीके से समझने के लिए प्रयोगात्मक डेटा की व्याख्या करना।

Part B- Content of the Course		
Total No. of Lectures- Tutorials- Practical (in hours per week) : 60		**L-T-P: 0-0-2**
Unit	**Topics**	**No. of Lectures**
1	1. Study of the I-V Characteristics of Diode – Ordinary and Zener Diode. 2. Study of I-V Characteristics of LED. 3. Study of the I-V Characteristics of the CE configuration of BJT and obtain r_i, r_o, β. 4. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain r_i, r_o, α. 5. Study of the I-V Characteristics of the Common Collector	**60**

	Configuration of BJT and obtain voltage gain, ri and ro. 6. Study of the I-V Characteristics of the UJT 7. Study of the I-V Characteristics of the SCR 8. Study of the I-V Characteristics of the JFET. 9. Study of the I-V Characteristics of the MOSFET. 10. Study of Characteristics of Solar Cell 11. Study of Hall Effect.	

Keywords/Tags:

Part C-Learning Resources
भाग स - अनुशंसित अध्ययन संसाधन

Text Books, Reference Books, Other resources
पाठय पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

Suggested Readings:
अनुशंसित सहायक पुस्तकें / ग्रन्थ/अन्य पाठय संसाधन/पाठय सामग्री

1. S P Chandra, B shashikala, Electronics Laboratory Primer, S. Chand & Co. 2008
2. Harnam Singh, P.S. Hemne, Practical Physics, S Chand & Co, 2000

Suggestive digital platforms web links
अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक

National Digital Library: **https://ndl.iitkgp.ac.in/**

Suggested equivalent online courses:
अनुशंसित समकक्ष ऑनलाइन पाठयक्रम:

Virtual Lab: http://vlabs.iitkgp.ac.in/be/

Part D-Assessment and Evaluation
भाग द - अनुशंसित मूल्यांकन विधियां

Suggested Continuous Evaluation Methods: अनुशंसित सतत मूल्यांकन विधियाँ:

Internal Assessment आंतरिक मूल्यांकन	**Marks** अंक	**External Assessment** बाह्य मूल्यांकन	**Marks** अंक
Class Interaction/ Quiz कक्षा में संवाद/प्रश्नोत्तरी	**10**	**Viva Voce on Practical** प्रायोगिक मौखिक वायवा	**15**
Attendance उपस्थिति	**5**	**Practical Record File** प्रायोगिक रिकार्ड फाइल	**10**
Assignments (Charts/Model Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial visit) असाइनमेंट (चार्ट/मॉडल/सेमिनार /ग्रामीण सेवा/प्रौद्योगिकी प्रसार/भ्रमण/ प्रयोगशाला भ्रमण/ औद्योगिक यात्रा)	**10**	**Table work/ Experiments** टेबल वर्क/प्रयोग	**50**
Total	25		75

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics
Syllabus Session 2021-22

Class: B.Sc. I Sem **Marks: 75 + (CCE) 25 = 100**
Subject: Electronics **Credit: 4**

Paper: Core (Minor)
Title of Paper: Basic Circuit Theory and Network Analysis **Code of the Paper: C108-II**

Part A: Introduction		
1	Pre-requisite (if any)	To study this course, a student must have had the subject Science in class 12th इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है। **This course can be opted as an elective by the student of follow subjects: NA**
2	Course Objectives	To know the basic knowledge of electronic components (Active & Passive), circuits, laws of current and voltage and circuit theorems.
	Course Learning Outcomes	1: Study circuits in a systematic manner suitable for analysis and design. परिपथ के परिक्षण तथा निर्माण के लिए सुव्यवस्थित तरीके से अध्ययन करना।
		2: Understand how to formulate circuit analysis problems in a mathematically tractable way with an emphasis on solving linear systems of equations. समीकरणों की रैखिक प्रणालियों को हल करने प्रमुखता के साथ परिपथ को गणितीय तरीके से समस्याओं परिक्षण कैसे करते हैं, समझाना।
		3: Analyze the electric circuit using network theorems. नेटवर्क प्रमेयों का उपयोग करके विद्युत परिपथो का परिक्षण करना।
		4: Determine Sinusoidal steady state response. साइनोसॉइडल स्थिर अवस्था प्रतिक्रिया ज्ञात करना।
		5: Evaluate the two-port network parameters with an ability to find out two-port network parameters & overall response for interconnection of two-port networks टू-पोर्ट नेटवर्क पैरामीटर्स को समझने के साथ टू-पोर्ट नेटवर्क पैरामीटर्स का पता लगाना तथा टू-पोर्ट नेटवर्क के इंटरकनेक्शन के लिए पूर्ण प्रतिक्रियाओ को समझाना।

Part B- Content of the Course भाग ब पाठ्यक्रम - की विषयवस्तु		
Total No. of Lectures-Tutorials-Practical (in hours per week):60 L-T-P: 2-0-0 व्याख्यानों- ट्यूटोरियल-प्रायोगिक कक्षाओ की कुल संख्या (प्रति सप्ताह घंटे) : 60 L-T-P: 2-0-0		
Unit	**Topics**	**No. of Lectures**

1	**Basic Circuit Concepts:** Voltage and Current Sources, Resistors: Fixed and Variable resistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel. **Inductors:** Fixed and Variable inductors, Self and mutual inductance, Faraday's law and Lenz's law of electromagnetic induction, Energy stored in an inductor, Inductance in series and parallel, testing of resistance and inductance using multimeter. **Capacitors:** Principles of capacitance, Parallel plate capacitor, Permittivity, Definition of Dielectric Constant, Dielectric strength, Energy stored in a capacitor, Air, Paper, Mica, Teflon, Ceramic, Plastic and Electrolytic capacitor, Construction and application, capacitors in series and parallel, factors governing the value of capacitors, testing of capacitors using multimeter. **आधारभूत परिपथ की अवधारणा:** विभव तथा धारा स्रोत, प्रतिरोध: स्थाई तथा अस्थाई प्रतिरोध, निर्माण तथा विशेषताये, प्रतिरोध की कलर कोडिंग, प्रतिरोधो का श्रेणी तथा समान्तर क्रम। **प्रेरक:** स्थाई तथा अस्थाई प्रेरक, स्व तथा अन्योन्य प्रेरकत्व, फैराडे का नियम और इलेक्ट्रोमैग्नेटिक इंडक्शन का लेन्ज का नियम, प्रेरक में ऊर्जा संग्रहण, प्रेरकत्व का श्रेणी तथा समान्तर क्रम, मल्टीमीटर का प्रयोग कर प्रतिरोधों तथा प्रेरकत्वो का परिक्षण। **संधारित्र:** संधारित्र का सिद्धांत, समानांतर प्लेट संधारित्र, परावैद्युतांक, पारद्युतिक स्थिरांक की परिभाषा, डाइइलेक्ट्रिक स्ट्रेंथ, कैपेसिटर में स्टोर एनर्जी, एयर, पेपर, मीका, टेफ्लॉन, सिरेमिक, प्लास्टिक और इलेक्ट्रोलाइटिक कैपेसिटर, कंस्ट्रक्शन एंड एप्लीकेशन, कैपेसिटर इन सीरीज़ और समानांतर , कैपेसिटर के मूल्य को नियंत्रित करने वाले कारक, मल्टीमीटर का उपयोग करके कैपेसिटर का परीक्षण।	13
2	**Circuit Analysis:** Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh Analysis, Star-Delta Conversion. **DC Transient Analysis:** RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial Current, Time Constant, RL and RC Circuits with Sources, DC Response of Series RLC Circuits. **परिपथ विश्लेषण:** किरचॉफ धारा नियम(KCL), किरचॉफ विभव नियम (KVL), नोड विश्लेषण, मेंश विश्लेषण, स्टार डेल्टा परिवर्तन। **डी. सी. क्षणिक विश्लेषण:** आरसी परिपथ प्रांरभिक चार्ज के साथ चार्जिंग तथा डिस्चार्जिंग, प्रारंकिक धारा के साथ आरएल परिपथ, टाइम कॉन्स्टेंट, सोर्स के साथ आरएल तथा आरसी परिपथ, श्रेणी आरएलसी परिपथ का डीसी प्रतिक्रिया।	13
3.	**AC Circuit Analysis:** Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. Voltage-Current relationship in Resistor, Inductor and Capacitor, Phasor, Complex Impedance, **Power in AC Circuits:** Instantaneous Power, Average Power, Reactive Power, Power Factor. Sinusoidal Circuit Analysis for RL, RC and RLC Circuits. Resonance in Series and Parallel RLC Circuits, Frequency Response of Series and Parallel RLC Circuits, Quality (Q) Factor and Bandwidth. Passive Filters: Low Pass, High Pass, Band Pass and Band Stop. **प्रत्यावर्ती परिपथ विश्लेषण:** साइनोसोडल विभव एवं धारा, पीक, पीक से पीक, वर्ग माध्य	18

	मूल और, औसत मान, प्रतिरोध में विभव धारा संबंध, प्रेरक और संधारित्र फेजर, जटिल प्रतिबाधा। **प्रत्यावर्ती परिपथ में शक्ति:** तात्कालिक शक्ति, औरस शक्ति, प्रतिक्रिया शील उर्जा, शक्ति घटक, RL, RC, एंव RLC परिपथ के लिए साइनोसोडल परिपथ विश्लेषण RLC परिपथ में श्रेणी एवं समान्तर अनुनाद, आरएलसी परिपथ का श्रेणी एवं समान्तर आवृत्ति प्रतिक्रिया, गुणवत्ता कारक एवं बैंडविड्थ, पैसिव फिल्टर, लो-पास, हाई-पास, बैंड पास एवं बैंड स्टाप।	
4	**Network Theorems:** Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Millman's Theorem, Maximum Power Transfer Theorem. AC circuit analysis using Network theorems. **Two Port Networks:** Impedance (Z) Parameters, Admittance (Y) Parameters, Transmission (ABCD) Parameters. **नेटवर्क प्रमेय:** ड्यूलिटी का सिद्धांत, सुपर पोजीशन प्रमेय, थिवेनिन प्रमेय, नॉर्टन प्रमेय, रिसिप्रोसिटी प्रमेय, मिलीमेंस प्रमेय, उच्च ऊर्जा स्थानांतरण प्रमेय, नेटवर्क प्रमेयो द्वारा प्रत्यावर्ती परिपथ धारा परिपथ का विश्लेषण। **दो पोर्ट नेटवर्क:** इंपेडेंस पैरामीटर, एडमिटेंस पैरामीटर, ट्रांसमिशन (ABCD) पैरामीटर।	16

Keywords/Tags:

Part C-Learning Resources
भाग स - अनुशंसित अध्ययन संसाधन

Text Books, Reference Books, Other resources
पाठय पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

1.Suggested Readings:
अनुशंसित सहायक पुस्तकें / ग्रन्थ/अन्य पाठय संसाधन/पाठय सामग्री

1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill, 2004
2. M. Nahvi and J. Edminister, Electrical Circuits,, Schaum's Outline Series, Tata McGraw Hill, 2005
3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education, 2004

Other Resources:

1. Doug Lowe, Electronics All-in-One for Dummies, Wiley, 2nd Ed, 2017

2. Suggestive digital platforms web links
अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक

National Digital Library: https://ndl.iitkgp.ac.in/
Lectures: https://ocw.mit.edu/index.htm,
Videos: https://www.youtube.com/c/mitocw/search?query=circuit%20theory

Part D-Assessment and Evaluation
भाग द - अनुशंसित मूल्यांकन विधियां

Suggested Continuous Evaluation Methods:
अनुशंसित सतत मूल्यांकन विधियाँ:
Maximum Marks: 100
अधिकतम अंक: 100
Continuous Comprehensive Evaluation (CCE): 25 marks End Term Exam (ETE): 75 marks

सतत व्यापक मूल्यांकन(CCE) अंक: 25		मुख्य सिद्धांत परीक्षा(ETE) अंक: 75
Internal Assessment: आंतरिक मूल्यांकन : Continuous Comprehensive Evaluation (CCE):25 सतत व्यापक मूल्यांकन (CCE):	Class Test Assignment/Presentation	15 10 =25
External Assessment: End Term Exam Section :75 Time: 02.00 Hours विश्वविद्यालय परीक्षा 75 समय 02: 00 घंटे	**Section(A):** Three Very Short Question (50 Words Each) **(अनुभाग-अ):** तीन अति लघु प्रश्न (प्रत्येक 50 शब्द) **Section (B):** Four Short Questions (200 Words Each) **(अनुभाग-ब):** चार लघु प्रश्न (प्रत्येक 200 शब्द) **Section(C):** Two Long Questions (500 Word Each) **(अनुभाग-स):** दो दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	03 x 03 = 9 04 x 09 =36 02 x 15 =30 Total 75

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics
Syllabus Session 2021-22

Class: B.Sc. I Sem **Marks: 75 + (CCE) 25 = 100**
Subject: Electronics **Credit: 2**
Paper: Practical (Minor)
Title of Paper: Basic Circuit Theory and Network Analysis Lab

Code of the Paper: P2

Part A: Introduction		
1	Pre-requisite (if any)	To study this course, a student must have had the subject Science in class 12th. इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है। **This course can be opted as an elective by the student of follow subjects: NA**
2	Course Objectives	To verify various network theorem, law's, basic electronics circuit and their frequency response.
	Course Learning Outcomes	**On completion of this course, learners will be able to:** 1: Verify the network theorems and operation of typical electrical and electronic circuits. नेटवर्क प्रमेयों की एवं विशिष्ट इलेक्ट्रिकल तथा इलेक्ट्रॉनिक्स परिपथों के संचालन कि पुष्टि करना।
		2: Choose the appropriate equipment for measuring electrical quantities and verify the same for Different circuits. इलेक्ट्रिकल इकाइयों को मापने के लिए उपयुक्त उपकरण को चुनना तथा उक्त उपकरण द्वारा विभिन्न परिपथों में सामान इकाइयों का मापन करना।
		3: Prepare the technical report on the carried-out experiments. किये गए प्रयोगों कि तकनीकी रिपोर्ट का निर्माण करना।

Part B- Content of the Course
भाग ब - पाठयक्रम की विषयवस्तु

Total No. of Lectures-Tutorials-Practical (in hours per week):60 L-T-P: 2-0-0

S.No.	Topics	No. of Lectures
1	**1. Familiarization with** a) Resistance in series, parallel and series - Parallel. b) Capacitors & Inductors in series & Parallel. c) Multimeter - Checking of components. d) Voltage sources in series, parallel and series — Parallel **e)** Voltage and Current dividers	10

2	Measurement of Amplitude, Frequency & Phase difference using CRO	4
3	Verification of Kirchoff's Law	4
4	Verification of Norton's theorem	4
5	Verification of Thevenin's Theorem	4
6	Verification of Superposition Theorem	4
7	Verification of the Maximum Power Transfer Theorem	4
8	RC Circuits: Time Constant, Differentiator, Integrator	4
9	Designing of a Low Pass RC Filter and study of its Frequency Response	4
10	Designing of a High Pass RC Filter and study of its Frequency Response	4
11	Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width	14

Keywords/Tags:

Part C-Learning Resources
भाग स - अनुशंसित अध्ययन संसाधन

Text Books, Reference Books, Other resources
पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

Suggested Readings:
अनुशंसित सहायक पुस्तकें / ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री

1. D C. Tayal, Basic Circuit theory and Network Analysis, Himalayan Publishing House, 2018
2. S P Chandra, B shashikala, Electronics Laboratory Primer, S. Chand & Co, 2008
3. Harnam Singh, P. S. Hemne, Practical Physics, S Chand & Co, 2000.

Suggestive digital platforms web links
National Digital Library: **https://ndl.iitkgp.ac.in/**

Suggested equivalent online courses:
अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रम:
1. http://vlabs.iitb.ac.in/vlabs-dev/labs/network_lab/labs/explist.php
2. https://vlab.amrita.edu/index.php?sub=1 &brch=75

Part D-Assessment and Evaluation
भाग द - अनुशंसित मूल्यांकन विधियां

Suggested Continuous Evaluation Methods:
अनुशंसित सतत मूल्यांकन विधियाँ:

Internal Assessment आंतरिक मूल्यांकन	**Marks** अंक	**External Assessment** बाह्य मूल्यांकन	**Marks** अंक
Class Interaction/ Quiz कक्षा में संवाद/प्रश्नोत्तरी	**10**	Viva Voce on Practical प्रायोगिक मौखिक वायवा	**15**
Attendance उपस्थिति	**5**	Practical Record File प्रायोगिक रिकार्ड फाइल	**10**
Assignments (Charts/Model Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial visit) असाइनमेंट (चार्ट/मॉडल/सेमिना र/ग्रामीण सेवा/प्रौद्योगिकी प्रसार/भ्रमण	**10**	Table work/ Experiments टेबल वर्क/प्रयोग	**50**

/प्रयोगशाला भ्रमण/ औद्योगिक यात्रा)			
Total	25		75
Any remarks/ suggestions:			

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics
Syllabus Session 2021-22

Class: B.Sc. I Sem **Marks: 40 + (CCE)10 =50**
Subject: Electronics **Credit: 2**

Paper: Open Elective
Title of Paper: Introduction of Electronics Components and Network

Code of the Paper: O108-I

Part A: Introduction		
1	Pre-requisite (if any)	To study this course, a student must have had the subject Science in class 12th इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है।
2	Course Objectives	To know the basic knowledge of electronic components (Active & Passive), circuits, laws of current and voltage and circuit theorems.
	Course Learning Outcomes	1: Study circuits in a systematic manner suitable for analysis and design. परिपथ के परिक्षण तथा निर्माण के लिए सुव्यवस्थित तरीके से अध्ययन करना।
		2: Understand how to formulate circuit analysis problems in a mathematically tractable way with an emphasis on solving linear systems of equations. समीकरणों की रैखिक प्रणालियों को प्रमुखता से हल करने के साथ परिपथ को गणितीय तरीके से समस्याओं परिक्षण कैसे करते हैं, समझना।
		3: Analyze the electric circuit using network theorems. नेटवर्क प्रमेयों का उपयोग करके विद्युत परिपथो का परिक्षण करना।

Part B-Content of the Course

भाग ब - पाठ्यक्रम की विषयवस्तु

Total No. of Lectures-Tutorials-Practical (in hours per week): L/T: 30

व्याख्यानों-ट्यूटोरियल -प्रायोगिक कक्षाओ की कुल संख्या(प्रति सप्ताह घंटे) : L/T: 30

Unit	Topics	No. of Lectures
1	**Basic Circuit Concepts:** Resistors: Fixed and Variable resistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel. **Inductors:** Fixed and Variable inductors, Concept of Self and mutual inductance, Inductance in series and parallel. **Capacitors:** Principles of capacitance, Parallel plate capacitor, Energy stored	8

	in a capacitor, capacitors in series and parallel. **आधारभूतपरिपथकीअवधारणा:** प्रतिरोध: स्थाई तथा अस्थाई प्रतिरोध, निर्माण तथा विशेषताये, प्रतिरोध की कलर कोडिंग, प्रतिरोधो का श्रेणी तथा समान्तरक्रम। **प्रेरक:**स्थाई तथा अस्थाई प्रेरक, स्व तथा अन्योन्य प्रेरकत्व, प्रेरक में ऊर्जा संग्रहण, प्रेरकत्व का श्रेणी तथा समान्तरक्रम । **संधारित्र:** संधारित्र का सिद्धांत, समानांतर प्लेट संधारित्र, कैपेसिटर में स्टोर एनर्जी, कैपेसिटर इन सीरीज़ और समानांतर ।	
2	**Circuit Analysis:** Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh Analysis. **परिपथविश्लेषण:**किरचॉफ धारा नियम (KCL), किरचॉफ विभव नियम (KVL), नोड विश्लेषण, मेंश विश्लेषण।	**8**
3.	**AC Circuit Analysis:** Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. **Passive Filters:** Low Pass, High Pass, Band Pass and Band Stop. **प्रत्यावर्तीपरिपथविश्लेषण:**साइनोसोडल विभव एवं धारा,पीक, पीक से पीक, वर्ग माध्य मूल और, औसत मान । **पैसिव फिल्टर:** लो-पास, हाई-पास, बैंडपास एवं बैंडस्टाप।	**8**
4	**Network Theorems:** Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem. **नेटवर्कप्रमेय:** थिवेनिन प्रमेय, नॉर्टन प्रमेय, उच्च ऊर्जा स्थानांतरण प्रमेय, ।	**6**
Keywords/Tags:		
Part C-Learning Resources भाग स – अनुशंसित अध्ययन संसाधन		
Text Books, Reference Books, Other resources पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन		
Suggested Readings: अनुशंसित सहायक पुस्तकें / ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री		

1. Malvino A.P., *Electronic Principles*, Tata Me Graw Hill pub, 7th Ed., 2017
2. Mehta V.K., Principles of Electronics, S. Chand & Co, 2007
3. S.M. Sze, Physics of Semiconductor Devices: Physics and Technology, 2nd Edition, Wiley India edition, 2008.
4. Theraja B.L., Basic Electronics Solid State, S. Chand & Company Ltd.
5. Sedha R.S., A Text Book of Applied Electronics, S. Chand & Company Ltd.

2 Suggestive digital platforms web links

अनुशंसित डिजिटल प्लेटफॉर्म वेबलिंक

National Digital Library: https://ndl.iitkgp.ac.in/

Learning Management System (MPDHE): https://www.eshiksha.mp.gov.in/mpdhe/

Suggested equivalent online courses:

1.https://www.coursera.org/

2. Lectures: MIT open courseware, MIT Course Number 6.012

https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-fall-2009/lecture-notes/

3. NPTEL E-Learning Courses: https://nptel.ac.in/courses/117/102/117102061/

Part D- Assessment and Evaluation

भाग द – अनुशंसित मूल्यांकन विधियां

Suggested Continuous Evaluation Methods:

अनुशंसित सतत मूल्यांकन विधियॉ:

Maximum Marks: 50, अधिकतम अंक :50

Continuous Comprehensive Evaluation (CCE) : 10 marks End Term Exam (ETE) : 40 marks

सतत व्यापक मूल्यांकन (CCE) अंक : **10** मुख्य सिद्धांत परीक्षा(ETE)अंक40 :

Internal Assessment: Continuous Comprehensive Evaluation (CCE):10 सतत व्यापक मूल्यांकन (CCE) :	Class Test Assignment/Presentation	10
External Assessment: आकलन University Exam Section :40 Time: 02.00 Hours विश्वविद्यालय परीक्षा 40 समय : 02: 00 घंटे	**Section(A):** Four Short Questions (200 Words Each) **(अनुभाग-अ):** चार लघु प्रश्न (प्रत्येक200 शब्द) **Section (B):** Four Long Questions (500 Word Each) **(अनुभाग-ब):** चार दीर्घ उत्तरीय प्रश्न(प्रत्येक500 शब्द)	04 x 02 =08 04 x 08 = 32 Total: 40
Any remarks/ suggestions:		

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics
Syllabus Session 2021-22

Class: B.Sc. I Sem **Marks: 50**
Subject: Electronics **Credit: 2**
Paper: Practical (Open Elective)
Title of Paper: Introduction of Electronics Components and Network Lab

Code of the Paper: OP-I

Part A Introduction		
1	Pre-requisite (if any)	To study this course, a student must have had the subject Science in class 12th. इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है।
2	Course Objectives	To verify various network theorem, law's, basic electronics circuit and their frequency response.
	Course Learning Outcomes	**On completion of this course, learners will be able to:** 1: Verify the network theorems and operation of typical electrical and electronic circuits. नेटवर्क प्रमेयों की एवं विशिष्ट इलेक्ट्रिकल तथा इलेक्ट्रॉनिक्स परिपथों के संचालन कि पुष्टि करना।
		2: Choose the appropriate equipment for measuring electrical quantities and verify the same for Different circuits. इलेक्ट्रिकल इकाइयों को मापने के लिए उपयुक्त उपकरण को चुनना तथा उक्त उपकरण द्वारा विभिन्न परिपथों में सामान इकाइयों का मापन करना ।
		3: Prepare the technical report on the carried-out experiments. किये गए प्रयोगों कि तकनीकी रिपोर्ट का निर्माण करना ।

Part B- Content of the Course		
Total No. of Lectures- Tutorials- Practical (in hours per week) : 30 L-T-P: 0-0-2		
Unit	**Topics**	**No. of Hours**
1	1. Identification/checking of different types of components (10 components) using Multimeter	4
	2. Measurement of Amplitude, Frequency & Phase difference using CRO	4
	3. Verification of Kirchoff's Law	4
	4. Verification of Norton's theorem	4
	5. Verification of Thevenin's Theorem.	4

	6. Verification of the Maximum Power Transfer Theorem	4
	7. Designing of a Low Pass RC Filter.	3
	8. Designing of a High Pass RC Filter.	3

Keywords/Tags:

Part C-Learning Resources
भागस – अनुशंसित अध्ययन संसाधन

Text Books, Reference Books, Other resources
पाठ्य पुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

Suggested Readings:
अनुशंसित सहायक पुस्तकें / ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्यसामग्री

1. S P Chandra, B shashikala, Electronics Laboratory Primer, S. Chand & Co. 2008
2. Harnam Singh, P.S. Hemne, Practical Physics, S Chand & Co, 2000

Suggestive digital platforms web links
अनुशंसित डिजिटल प्लेटफॉर्म वेबलिंक
National Digital Library:**https://ndl.iitkgp.ac.in/**

Suggested equivalent online courses:
अनुशंसित सम कक्षा ऑनलाइन पाठ्यक्रम:
Virtual Lab:http://vlabs.iitkgp.ac.in/be/

Part D-Assessment and Evaluation
भाग द – अनुशंसित मूल्यांकन विधियां

Suggested Continuous Evaluation Methods: अनुशंसित सतत मूल्यांकन विधियाँ:

External Assessment बाह्यमूल्यांकन	**Marks** अंक
Viva Voce on Practical प्रायोगिक मौखिक वायवा	**10**
Practical Record File प्रायोगिक रिकार्ड फाइल	**20**
Table work/ Experiments टेबलवर्क/प्रयोग	**20**
Total	**50**

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics

PART A: Introduction			
Program: UG/Certificate	**Class: B.Sc.**	**Semester-II**	**Session: 2021-22**
Subject: **Electronics**			
1.	Course Code	**S2-07-I**	
2.	Course Title	**Basic Circuit Theory and Network Analysis**	
3.	Course Type (Core Course/Open Elective/Generic Elective/ Vocational	**Core (Major)**	
4.	Pre-Requisite (if any)	To study this course, a student must have had the subject Science in class 12th इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है। **This course can be opted as an elective by the student of follow subjects: NA**	
5.	Course Learning Outcomes(CLO)	**Objective:** To know the basic knowledge of electronic components (Active & Passive), circuits, laws of current and voltage and circuit theorems.	
		1: Study circuits in a systematic manner suitable for analysis and design. परिपथ के परिक्षण तथा निर्माण के लिए सुव्यवस्थित तरीके से अध्ययन करना।	
		2: Understand how to formulate circuit analysis problems in a mathematically tractable way with an emphasis on solving linear systems of equations. समीकरणों की रैखिक प्रणालियों को हल करने प्रमुखता के साथ परिपथ को गणितीय तरीके से समस्याओं परिक्षण कैसे करते हैं, समझाना।	
		3: Analyze the electric circuit using network theorems. नेटवर्क प्रमेयों का उपयोग करके विद्युत परिपथो का परिक्षण	

		करना ।	
		4: Determine Sinusoidal steady state response. साइनोसॉइडल स्थिर अवस्था प्रतिक्रिया ज्ञात करना ।	
		5: Evaluate the two-port network parameters with an ability to find out two-port network parameters & overall response for interconnection of two-port networks. टू-पोर्ट नेटवर्क पैरामीटर्स को समझने के साथ टू-पोर्ट नेटवर्क पैरामीटर्स का पता लगाना तथा टू-पोर्ट नेटवर्क के इंटरकनेक्शन के लिए पूर्ण प्रतिक्रियाओ को समझाना ।	
6.	Credit Valne	**4 credits**	
7.	Total Marks	Max. Marks: 40 **(CCE)** + **60 (End Semester or (Theory Exam) External Evaluation Total = 100 Marks**	**Min. Passing Marks: 35**

PART B: Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): **L-T-P (4-0-0)**

Total No. of Lectures: 60 **L**

Paragraph	Topics	No. of Lectures
1	**Basic Circuit Concepts:** Voltage and Current Sources, Resistors: Fixed and Variable resistors, Construction and Characteristics, Color coding of resistors, resistors in series and parallel. **Inductors:** Fixed and Variable inductors, Self and mutual inductance, Faraday's law and Lenz's law of electromagnetic induction, Energy stored in an inductor, Inductance in series and parallel, testing of resistance and inductance using multimeter. **Capacitors:** Principles of capacitance, Parallel plate capacitor, Permittivity, Definition of Dielectric Constant, Dielectric strength, Energy stored in a capacitor, Air, Paper, Mica, Teflon, Ceramic, Plastic and Electrolytic capacitor, Construction and application, capacitors in series and parallel, factors governing the value of capacitors, testing of capacitors using multimeter. **आधारभूत परिपथ की अवधारणा:** विभव तथा धारा स्रोत, प्रतिरोध: स्थाई तथा अस्थाई प्रतिरोध, निर्माण तथा विशेषताये, प्रतिरोध की कलर कोडिंग, प्रतिरोधो का श्रेणी तथा समान्तर क्रम। **प्रेरक:** स्थाई तथा अस्थाई प्रेरक, स्व तथा अन्योन्य प्रेरकत्व, फैराडे का नियम और इलेक्ट्रोमैग्नेटिक इंडक्शन का लेन्ज का नियम, प्रेरक में ऊर्जा संग्रहण, प्रेरकत्व का श्रेणी तथा समान्तर क्रम, मल्टीमीटर का प्रयोग कर प्रतिरोधों तथा प्रेरकत्वो का परिक्षण।	12

	संधारित्र: संधारित्र का सिद्धांत, समानांतर प्लेट संधारित्र, परावैद्युतांक, पारद्युतिक स्थिरांक की परिभाषा, डाइइलेक्ट्रिक स्ट्रेंथ, कैपेसिटर में स्टोर एनर्जी, एयर, पेपर, मीका, टेफ्लॉन, सिरेमिक, प्लास्टिक और इलेक्ट्रोलाइटिक कैपेसिटर, कंस्ट्रक्शन एंड एप्लीकेशन, कैपेसिटर इन सीरीज़ और समानांतर , कैपेसिटर के मूल्य को नियंत्रित करने वाले कारक, मल्टीमीटर का उपयोग करके कैपेसिटर का परीक्षण।	
2	**Circuit Analysis:** Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node Analysis, Mesh Analysis, Star-Delta Conversion. परिपथ विश्लेषण: किरचॉफ धारा नियम(KCL), किरचॉफ विभव नियम (KVL), नोड विश्लेषण, मेंश विश्लेषण, स्टार डेल्टा परिवर्तन।	10
3	**DC Transient Analysis:** RC Circuit- Charging and discharging with initial charge, RL Circuit with Initial Current, Time Constant, RL and RC Circuits with Sources, DC Response of Series RLC Circuits. **AC Circuit Analysis:** Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. Voltage-Current relationship in Resistor, Inductor and Capacitor, Phasor, Complex Impedance, **डी. सी. क्षणिक विश्लेषण:** आरसी परिपथ प्रारंभिक चार्ज के साथ चार्जिंग तथा डिस्चार्जिंग, प्रारंकिक धारा के साथ आरएल परिपथ, टाइम कॉन्स्टेंट, सोर्स के साथ आरएल तथा आरसी परिपथ, श्रेणी आरएलसी परिपथ का डीसी प्रतिक्रिया। **प्रत्यावर्ती परिपथ विश्लेषण:** साइनोसोडल विभव एवं धारा, पीक, पीक से पीक, वर्ग माध्य मूल और, औसत मान, प्रतिरोध में विभव धारा संबंध, प्रेरक और संधारित्र फेजर, जटिल प्रतिबाधा।	10
4	**Power in AC Circuits:** Instantaneous Power, Average Power, Reactive Power, Power Factor. Sinusoidal Circuit Analysis for RL, RC and RLC Circuits. Resonance in Series and Parallel RLC Circuits, Frequency Response of Series and Parallel RLC Circuits, Quality (Q) Factor and Bandwidth. Passive Filters: Low Pass, High Pass, Band Pass and Band Stop. **प्रत्यावर्ती परिपथ में शक्ति:** तात्कालिक शक्ति, औरस शक्ति, प्रतिक्रिया शील उर्जा, शक्ति घटक, RL, RC, एंव RLC परिपथ के लिए साइनोसोडल परिपथ विश्लेषण RLC परिपथ में श्रेणी एवं समान्तर अनुनाद, आरएलसी परिपथ का श्रेणी एवं समान्तर आवृत्ति प्रतिक्रिया, गुणवत्ता कारक एवं बैंडविड्थ, पैसिव फिल्टर, लो-पास, हाई-पास, बैंड पास एवं बैंड स्टाप।	14
5	**Network Theorems:** Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Millman's Theorem, Maximum Power Transfer Theorem. AC circuit analysis using Network theorems. **Two Port Networks:** Impedance (Z) Parameters, Admittance (Y) Parameters, Transmission (ABCD) Parameters.	14

	नेटवर्क प्रमेय: ड्यूलिटी का सिद्धांत, सुपर पोजीशन प्रमेय, थिवेनिन प्रमेय, नॉर्टन प्रमेय, रिसिप्रोसिटी प्रमेय, मिलीमेंस प्रमेय, उच्च ऊर्जा स्थानांतरण प्रमेय, नेटवर्क प्रमेयो द्वारा प्रत्यावर्ती परिपथ धारा परिपथ का विश्लेषण। **दो पोर्ट नेटवर्क:** इंपेडेंस पैरामीटर, एडमिटेंस पैरामीटर, ट्रांसमिशन (ABCD) पैरामीटर।	

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings
Textbooks: At least Five 1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill, 2004 2. M. Nahvi and J. Edminister, Electrical Circuits,, Schaum's Outline Series, Tata McGraw Hill, 2005 3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education, 2004 4. R.S Sedha, A Textbook of Applied Electronics, S. Chand Publication. 5. B. Grob, Basic Electronics, Tata McGraw Hill ,2000.
National Digital Library: https://ndl.iitkgp.ac.in/ Lectures: https://ocw.mit.edu/index.htm, Videos: https://www.youtube.com/c/mitocw/search?query=circuit%20theory
Suggested equivalent online courses

PART D: Assessment and Evaluation				
Internal Assessment: Continuous Comprehensive Evaluation (CCE): **40 Marks** Shall be based on allotted assignments and Class Tests. The division of marks is as follows:			**External Evaluation (Theory Exam):** End Semester Exam: **60 Marks** **Time: 2 hours**	
A. Submission of Assignment followed by Presentation			**Section (A):** 05 MCQ Questions	05 x 01 = **05 Marks**
B. Class Test	Best two test Marks 20 Marks	Best two test Marks **40**		
Test I (Written test)	20 Marks	**Marks**	**Section (B):** Five Short Questions (200 Words Each)	05 x 05= **25 Marks**

Test II (Written test)	20 Marks		**Section (C):** Two Long Questions (500 Words Each)	02 x 15= **30 Marks**
Test III (Quiz/ Seminar/ Assignment)	20 Marks			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics

PART A: Introduction			
Program: UG	**Class: B.Sc.**	**Year: Semester II**	**Session: 2021-22**
Subject: **: Practical**			
1.	Course Code	**S2-07-P(I)**	
2.	Course Title	**Basic Circuit Theory and Network Analysis Lab**	
3.	Course Type (Core Course/ Open Elective/ Generic Elective/ Vocational	**Practical (Major)**	
4.	Pre-Requisite (if any)	To study this course, a student must have had the subject Science in class 12th. इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है। **This course can be opted as an elective by the student of follow subjects: NA**	
5.	Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to:**	
		1: Verify the network theorems and operation of typical electrical and electronic circuits. नेटवर्क प्रमेयों की एवं विशिष्ट इलेक्ट्रिकल तथा इलेक्ट्रॉनिक्स परिपथों के संचालन कि पुष्टि करना।	
		2: Choose the appropriate equipment for measuring electrical quantities and verify the same for Different circuits. इलेक्ट्रिकल इकाइयों को मापने के लिए उपयुक्त उपकरण को चुनना तथा उक्त उपकरण द्वारा विभिन्न परिपथों में सामान इकाइयों का मापन करना।	
		3: Prepare the technical report on the carried-out experiments. किये गए प्रयोगों कि तकनीकी रिपोर्ट का निर्माण करना।	

6.	Credit Value	**2 Credits**	
7.	Total Marks	Max. Marks: **40+60**	**Min. Passing Marks: 35**

PART B: Content of the Course	
Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P 0+0+2=2	
Total No. of Lab hours: 30 Hrs. (2 hours per week)	
Lab Assignments	**No. of Lab (Hours)**
1. Familiarization with a) Resistance in series, parallel and series - Parallel. b) Capacitors & Inductors in series & Parallel. c) Multimeter - Checking of components. d) Voltage sources in series, parallel and series — Parallel **e)** Voltage and Current dividers	**8**
2. Measurement of Amplitude, Frequency & Phase difference using CRO	2
3. Verification of Kirchoff's Law	2
4. RC Circuits: Time Constant, Differentiator, Integrator	2
5. Designing of a Low Pass RC Filter and study of its Frequency Response	2
6. Designing of a High Pass RC Filter and study of its Frequency Response	2
7. Study of the Frequency Response of a Series LCR Circuit and determination of its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width	**8**
8. Verification of Norton's theorem	2
9. Verification of Thevenin's Theorem.	2
10. Verification of Superposition Theorem	2
11. Verification of the Maximum Power Transfer Theorem	2
PART C: Learning Resources	
Textbooks, Reference Books, Other Resources	
Suggested Readings	

1. D C. Tayal, Basic Circuit theory and Network Analysis, Himalayan Publishing House, 2018 2. S P Chandra, B shashikala, Electronics Laboratory Primer, S. Chand & Co, 2008 3. Harnam Singh, P. S. Hemne, Practical Physics, S Chand & Co, 2000.	
Suggestive digital platform web links 1. National Digital Library: **https://ndl.iitkgp.ac.in/**	
PART D: Assessment and Evaluation	
Internal Assessment (A):	**40 marks**
Lab Record/Class interaction/quiz	15 marks
Attendance in the Lab	05 marks
Assignments (Industrial Training (10 hours)/Mini Project (project demo + report))	20
End Sem External Evaluation (B) :	**60 marks**
Viva Voce on Practical	10 marks
Practical Record File	10 marks
Experiments	40 marks
Total Marks (A+B)	**100** marks
Any remarks/suggestions: •	

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics

PART A: Introduction			
Program : UG/Certificate	**Class: B.Sc.**	**Semester-II**	**Session: 2021-22**
Subject: **Electronics**			
1.	Course Code	**S2-07-M**	
2.	Course Title	**Semiconductor Devices**	
3.	Course Type (Core Course/Open Elective/Generic Elective/ Vocational	**Core (Minor)**	
4.	Pre-Requisite (if any)	To study this course, a student must have had the subject Science in class 12th. इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है। …….. This course can be opted as an elective by the student of following subjects: NA	
5.	Course Learning Outcomes(CLO)	**Objective:** To know the basic knowledge of semiconducting material and devices.	
		1: Analyze the behaviour of semiconductor materials अर्धचालक पदार्थों के व्यवहार का वर्णन करना।	
		2: Reproduce the I-V characteristics of diode/BJT/MOSFET devices डायोड/BJT/ मॉसफेट युक्तियों का I-V अभिलाक्षणिक आरेखित करना	
		3: Apply standard devices models to explain/ calculate critical internal parameters of semi-conductor devices. अर्धचालक युक्तियां पर मानक युक्ति मॉडल को प्रदान कर वर्णित करना तथा उनके महत्वपूर्ण मापदंडो का पता करना।	

		4: Categorize the behaviour and characteristics of power devices, such as, SCR/UJT, etc. पावर युक्तियां जैसे SCR/UJT आदि के व्यवहार तथा अभिलाक्षणिक का वर्णन करना।	
6.	Credit Value	**4 credits**	
7.	Total Marks	Max. Marks: 40 **(CCE) + 60 (End Semester or (Theory Exam) External Evaluation Total = 100 Marks**	**Min. Passing Marks: 35**

PART B: Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): **L-T-P (4-0-0)**

Total No. of Lectures: 60 **L**

Paragraph	Topics	No. of Lectures
1	**Semiconductor Basics:** Introduction to Semiconductor Materials, Crystal Structure, Planes and Miller Indices, Energy Band in Solids, Concept of Effective Mass, Density of States. Carrier Concentration at Normal Equilibrium in Intrinsic Semiconductors. Derivation of Fermi Level for Intrinsic & Extrinsic Semiconductors, Donors, Acceptors, Dependence of Fermi Level on Temperature and Doping Concentration, Temperature Dependence of Carrier Concentrations. Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Carrier Injection, Generation and Recombination Processes, Continuity Equation. **सेमीकंडक्टर आधारभूत:** सेमीकंडक्टर मैटेरियल्स का परिचय, क्रिस्टल स्ट्रक्चर, प्लेन और मिलर इंडेक्स, ठोस में उर्जा बैंड, प्रभावी द्रव्यमान की अवधारणा, सघनता की अवस्था । आंतरिक अर्धचालकों में सामान्य साम्यावस्था पर वाहक सांद्रता । अर्धचालकों में आंतरिक और बाह्य के लिए फर्मी स्तर की व्युत्पत्ति। दाता, ग्राही । तापमान और डोपिंग पर फर्मी स्तर की निर्भरता, वाहक सांद्रता की तापमान निर्भरता। वाहक परिवहन घटना :वाहक ड्रिफ्ट, विचलता, प्रतिरोधकता, हॉल प्रभाव, विसरण क्रिया, आइंस्टीन संबंध, धारा सघनता समीकरण, वाहक अन्तःक्षेपण , जनरेशन तथा रेकोम्बिनेशन की अवधारणा, सातत्य समीकरण	**12**
2	**P-N Junction Diode:** Formation of Depletion Layer, Space Charge at a junction, Derivation of Electrostatic Potential Difference at Thermal Equilibrium, Depletion Width and Depletion Capacitance of an Abrupt junction. Concept of Linearly Graded junction, Derivation of Diode Equation, and I-V Characteristics, Zener Diode, Zener and Avalanche junction Breakdown Mechanism. LED, Tunnel diode, Varactor diode,	**12**

	Solar cell, Schottky Diode: working, circuit symbol, characteristics and applications. **पीएन संधि डायोड:** PN संधि डायोड अवक्षय परत का निर्माण, संधि पर स्पेस चार्ज, तापीय साम्यावस्था पर इलेक्ट्रोस्टेटिक विभवान्तर के सूत्र व्युत्पत्ति, अब्रप्ट जंक्शन कि अवक्षय चौड़ाई तथा अवक्षय संधारित्र, रेखीय ग्रेडेड संधि की अवधारणा, डायोड समीकरण की व्युत्पत्ति तथा धारा-विभव अभिलाक्षणिक, जेनर डायोड, जेनर तथा ऐवेलॉन्ची भंजन, LED, टनल डायोड, वैरेक्टर डायोड, सोलर सेल, शॉर्टकी डायोड: प्रतीक, कार्यविधि , अभिलाक्षणिक तथा अनुप्रयोग.	
3	**Bipolar Junction Transistors (BJT):** PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Base Transport Factor, Current Gain, Energy Band Diagram of Transistor in Thermal Equilibrium, Quantitative Analysis of Static Characteristics (Minority Carrier Distribution and Terminal Currents). Base-Width Modulation, Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations. Metal Semiconductor Junctions: Ohmic and Rectifying Contacts. **द्विध्रुवी जंक्शन ट्रांजिस्टर (BJT):** PNP और NPN ट्रांजिस्टर, ट्रांजिस्टर की क्रिया की अवधारणा, उत्सर्जक दक्षता, आधार ट्रांसपोर्ट गुणांक, धारा लाभ, तापीय साम्यावस्था में ट्रांजिस्टर का ऊर्जा बैंड चित्र, स्थैतिक विशेषताओं मात्रात्मक विश्लेषण (अल्पसंख्याक आवेश वाहको का वितरण तथा टर्मिनल धारा), बेस विड्थ माड्यूलेशन, कार्यप्रणाली, उभयनिष्ठ आधार, उभयनिष्ठ उत्सर्जक, उभयनिष्ठ संग्राहक अभिविन्यासओ की इनपुट तथा आउटपुट अभिलाक्षणिक, धातु अर्धचालक संधि: ओमिक तथा रेक्टिफाइंग कॉन्टैक्ट्स।	**12**
4	**Field Effects Transistors:** JEET, Construction, Idea of Channel Formation, Pinch-OFF and Saturation Voltage, Current-Voltage Output Characteristics. MOSFET, type of MOSFETs, Circuit Symbols, Working and Characteristic curves of Depletion type MOSFET (both N channel and P channel). Complimentary MOS (CMOS). **क्षेत्र प्रभाव ट्रांजिस्टर: JFET,** संरचना, चैनल निर्माण की अवधारणा, पिंच-ऑफ तथा संतृप्ति विभव, धारा विभव आउटपुट अभिलाक्षणिक। **MOSFET, MOSFETs** के प्रकार। परिपथ प्रतीक, डिप्लेशन टाइप **MOSFET** (N चैनल तथा P चैनल) तथा एन्हेंस्मेंट टाइप **MOSFET** (N चैनल तथा P चैनल) कि कियाविधि तथा अभिलाक्षणिक । कॉम्प्लीमेंट्री MOS (CMOS).	**12**
5	**Power Devices: UJT:** Basic construction and working, Equivalent circuit, intrinsic Standoff Ratio, Characteristics and relaxation oscillator-expression. **SCR:** Construction, Working and Characteristics, Triac, Diac, IGBT, MESFET: circuit symbols, basic constructional features, operation and	**12**

	application. **पॉवर युक्तियाँ: UJT**: आधारभूत संरचना तथा कार्यविधि, समतुल्य परिपथ, इंट्रिंसिक स्टैंडऑफ अनुपात, रिलेक्सेशन दोलित्र का समीकरण तथा अभिलाक्षणिक। **SCR:** संरचना, कार्यविधि तथा अभिलाक्षणिक, Triac, Diac, IGBT, MESFET: परिपथ, प्रतीक, आधारभूत संरचना, कार्यविधि तथा अनुप्रयोग।	

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Textbooks: At least Five

1. Malvino A.P., *Electronic Principles*, Tata Me Graw Hill pub, 7th Ed., 2017
2. Mehta V.K., Principles of Electronics, S. Chand & Co, 2007
3. S.M. Sze, Physics of Semiconductor Devices: Physics and Technology, 2nd Edition, Wiley India edition, 2008.
4. B.L. Theraja, Basic Electronics: Solid State, S. Chand Publication,2005.
5. R.S Sedha, A Textbook of Applied Electronics, S. Chand Publication,2017.

National Digital Library: https://ndl.iitkgp.ac.in/
Lectures: https://ocw.mit.edu/index.htm,
Videos: https://www.youtube.com/c/mitocw/search?query=circuit%20theory

Suggested equivalent online courses

1. https://www.coursera.org/
2. Lectures: MIT open courseware, MIT Course Number 6.012
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-fall-2009/lecture-notes/
3. NPTEL E-Learning Courses: https://nptel.ac.in/courses/117/102/117102061/

<table>
<tr><th colspan="5">PART D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Internal Assessment: Continuous Comprehensive Evaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Tests. The division of marks is as follows:</td><td colspan="2">External Evaluation (Theory Exam):
End Semester Exam:
60 Marks
Time: 2 hours</td></tr>
<tr><td colspan="2">A. Submission of Assignment followed by Presentation</td><td rowspan="5">Best two test Marks 20 Marks

Best two test Marks 40 Marks</td><td rowspan="3">Section (A): 05 MCQ Questions</td><td rowspan="3">05 x 01 = 05 Marks</td></tr>
<tr><td>B. Class Test</td><td>Best two test Marks 20 Marks</td></tr>
<tr><td>Test I (Written test)</td><td>20 Marks</td></tr>
<tr><td>Test II (Written test)</td><td>20 Marks</td><td>Section (B): Five Short Questions (200 Words Each)</td><td>05 x 05= 25 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td><td>Section (C): Two Long Questions (500 Words Each)</td><td>02 x 15= 30 Marks</td></tr>
<tr><td colspan="2">Total Internal Assessment (Theory) Marks (A+B)</td><td>40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+C)</td><td>60 Marks</td></tr>
</table>

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics

PART A: Introduction			
Program: UG	**Class: B.Sc.**	**Year: Semester II**	**Session: 2021-22**
Subject: **: Practical**			
1.	Course Code	**S2-07-P(M)**	
2.	Course Title	Semiconductor Devices Laboratory	
3.	Course Type (Core Course/ Open Elective/ Generic Elective / Vocational	Practical (Minor)	
4.	Pre-Requisite (if any)	To study this course, a student must have had the subject Science in class 12th इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को 12 वी कक्षा में विज्ञान विषय का होना आवश्यक है। **This course can be opted as an elective by the students of following subjects.**	
5.	Course Learning Outcomes (CLO)	**On completion of this course , learners will be able to:**	
		1. Examine the characteristics of basic semiconductor devices. आधारभूत अर्धचालक युक्तिओं के अभिलाक्षणिक की जांच करना।	
		2. Perform experiments for studying the behaviour of semiconductor devices for circuit design applications. सर्किट डिजाइन अनुप्रयोगों के लिए, अर्धचालक उपकरणों के व्यवहार का अध्ययन करने के लिए प्रयोग करना।	
		3. Calculate various device parameters values from their I-V characteristics. **I-V** अभिलाक्षणिक माध्यम से युक्तिओं के विभिन्न मापदण्डों के मानों को परिकलित करना।	

		4. Interpret the experimental data for better understanding the device behaviour. युक्तियों के व्यवहार को सुव्यवस्थित तरीक़े से समझने के लिए प्रयोगात्मक डेटा की व्याख्या करना।	
6.	Credit Value	**2 Credits**	
7.	Total Marks	Max. Marks: **40+60**	**Min. Passing Marks: 35**

PART B: Content of the Course	
Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P 0+0+2=2	
Total No. of Lab hours: 30 Hrs. (2 hours per week)	
Lab Assignments	**No. of Lab (Hours)**
1. Study of the I-V Characteristics of Diode – Ordinary and Zener Diode 2. Study of I-V Characteristics of LED 3. Study of the I-V Characteristics of the CE configuration of BJT and obtain r_i, r_o, β 4. Study of the I-V Characteristics of the Common Base Configuration of BJT and obtain r_i, r_o, α 5. Study of the I-V Characteristics of the Common Collector Configuration of BJT and obtain voltage gain, ri and ro 6. Study of the I-V Characteristics of the UJT 7. Study of the I-V Characteristics of the SCR 8. Study of the I-V Characteristics of the JFET 9. Study of the I-V Characteristics of the MOSFET 10. Study of Characteristics of Solar Cell 11. Study of Hall Effect	30
PART C: Learning Resources	
Textbooks, Reference Books, Other Resources	
Suggested Readings	

अनुशंसित सहायक पुस्तकें / ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री 1. S P Chandra, B shashikala, Electronics Laboratory Primer, S. Chand & Co. 2008 2. Harnam Singh, P.S. Hemne, Practical Physics, S Chand & Co, 2000	
Suggestive digital platform web links अनुशंसित डिजिटल प्लेटफॉर्म वेब लिंक National Digital Library: **https://ndl.iitkgp.ac.in/**	
PART D: Assessment and Evaluation	
Internal Assessment (A):	**40 marks**
Lab Record/Class interaction/quiz	15 marks
Attendance in the Lab	05 marks
Assignments (Industrial Training (10 hours)/Mini Project (project demo + report))	20
End Sem External Evaluation (B) :	**60 marks**
Viva Voce on Practical	10 marks
Practical Record File	10 marks
Experiments	40 marks
Total Marks (A+B)	**100** marks
Any remarks/suggestions: •	

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics

PART A: Introduction			
Program : UG/Certificate	**Class: B.Sc.**	**Semester-II**	**Session: 2021-22**
Subject: **Electronics**			
1.	Course Code	S2-07-O	
2.	Course Title	**Basics of Semiconductor Devices**	
3.	Course Type (Core Course/Open Elective/Generic Elective/ Vocational	Generic Elective	
4.	Pre-Requisite (if any)	To study this course, a student must have had the subject Science in class 12th. इस पाठ्यक्रम का अध्ययन करने के लिए विद्यार्थियों को **12** वी कक्षा में विज्ञान विषय का होना आवश्यक है।	
5.	Course Learning Outcomes(CLO)	**Objective:** To know the basic knowledge of electronic components (Active & Passive), circuits, laws of current and voltage and circuit theorems.	
		1: Analyze the behavior of semiconductor materials अर्धचालक पदार्थों के व्यवहार का वर्णन करना।	
		2: Reproduce the I-V characteristics of diode/ BJT/MOSFET devices डायोड/**BJT**/ मॉसफेटयुक्तियों का **I-V** अभिलाक्षणिक आरेखित करना।	
		3: Apply standard devices models to explain/ calculate critical internal parameters of semi-conductor devices. अर्धचालक युक्तियां पर मानक युक्ति मॉडल को प्रदान कर वर्णित करना तथा उनके महत्वपूर्ण मापदंडो का पता करना।	
6.	Credit Value	**4 credits**	

7.	Total Marks	Max.Marks: 40 (CCE) + 60 (End Semester or (Theory Exam) External Evaluation Total = 100 Marks	Min. Passing Marks: 35

PART B: Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): **L-T-P (4-0-0)**

Total No. of Lectures: 60 **L**

Paragraph	Topics	No. of Lectures
1	**Semiconductor Basics:** Introduction to Semiconductor Materials, Types of Semiconductors, Donors, Acceptors, Introduction: Fermi Level, Carrier Drift, Mobility, Resistivity, Diffusion Process, Current Density, Carrier Generation and Recombination Process. **सेमीकंडक्टर आधारभूत**: सेमीकंडक्टर मैटेरियल्स का परिचय, अर्धचालकों के प्रकार , दाता, ग्राही, फर्मीस्तर, वाहक ड्रिफ्ट, विचलता, प्रतिरोधकता, विसरण क्रिया, धारा सघनता, वाहक जनरेशन तथा रेकोम्बिनेशन की अवधारणा।	**12**
2	**P-N Junction Diode:** Formation of Depletion Layer, Space Charge at a junction, I-V Characteristics, Zener Diode, Zener and Avalanche junction Breakdown Mechanism. LED, Tunnel diode: working, circuit symbol, characteristics and applications. **पीएन संधि डायोड: PN** संधि डायोड अवक्षय परत का निर्माण, संधि पर स्पेस चार्ज, धारा-विभव अभिलाक्षणिक, जेनर डायोड, जेनर तथा ऐवेलॉन्ची भंजन, **LED,** टनल डायोड: प्रतीक ,कार्यविधि, अभिलाक्षणिक तथा अनुप्रयोग.	**12**
3	**Bipolar Junction Transistors (BJT):** PNP and NPN Transistors, Basic Transistor Action, Emitter Efficiency, Base Transport Factor, Current Gain, Base-Width Modulation, Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations. **द्विध्रुवी जंक्शन ट्रांजिस्टर (BJT): PNP** और **NPN** ट्रांजिस्टर, ट्रांजिस्टर की क्रिया की अवधारणा, उत्सर्जक दक्षता, आधार ट्रांसपोर्ट गुणांक, धारा लाभ, बेस विड्थ माड्यूलेशन, कार्यप्रणाली, उभयनिष्ठआधार, उभयनिष्ठउत्सर्जक, उभयनिष्ठ संग्राहक अभिविन्यासओ की इनपुट तथा आउटपुट अभिलाक्षणिक।	**12**
4	**Field Effects Transistors:** JEET, Construction, Idea of Channel Formation, Working of JFET, Current-Voltage Output Characteristics. MOSFET, type of MOSFETs, Circuit Symbols, Working and	**12**

	Characteristic curves of Depletion type MOSFET (both N channel and P channel). क्षेत्र प्रभाव ट्रांजिस्टर: **JFET,** संरचना, चैनल निर्माण की अवधारणा, पिंच-ऑफ तथा संतृप्ति विभव, धारा विभव आउटपुट अभिलाक्षणिक। **MOSFET, MOSFETs** के प्रकार। परिपथ प्रतीक ,डिप्लेशनटाइप **MOSFET(N** चैनल तथा **P** चैनल) तथा एन्हेंस्मेंट टाइप **MOSFET (N** चैनलतथा **P** चैनल) कि कियाविधि तथा अभिलाक्षणिक।	
5	**Power Devices: UJT:** Basic construction and working, Equivalent circuit, intrinsic Standoff Ratio, Characteristics and relaxation oscillator-expression. **SCR:** Construction, Working and Characteristics, Triac, Diac: circuit symbols, basic constructional features, operation and application. **पॉवर युक्तियाँ: UJT:** आधारभूत संरचना तथा कार्यविधि, समतुल्य परिपथ, इंट्रिंसिक स्टैंडऑफ अनुपात, रिलेक्सेशन दोलित्र का समीकरण तथा अभिलाक्षणिक। **SCR:** संरचना, कार्यविधि तथा अभिलाक्षणिक, Triac, Diac: परिपथ, प्रतीक, आधारभूत संरचना, कार्यविधि तथा अनुप्रयोग।	**12**
PART C: Learning Resources		
Textbooks, Reference Books, Other Resources		
Suggested Readings		
Textbooks: At least Five 1. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill, 2004 2. M. Nahvi and J. Edminister, Electrical Circuits,, Schaum's Outline Series, Tata McGraw Hill, 2005 3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education, 2004 4. B.L. Theraja, Basic Electronics: Solid State, S. Chand Publication, 2005. 5. R.S. Sedha, A Textbook of Applied Electronics, S. Chand Publication, 2017.		
National Digital Library: https://ndl.iitkgp.ac.in/ Lectures: https://ocw.mit.edu/index.htm, Videos: https://www.youtube.com/c/mitocw/search?query=circuit%20theory		
Suggested equivalent online courses		

<table>
<tr><th colspan="5">PART D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Internal Assessment: Continuous Comprehensive Evaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Tests. The division of marks is as follows:</td><td colspan="2">External Evaluation (Theory Exam):
End Semester Exam:
60 Marks
Time: 2 hours</td></tr>
<tr><td colspan="2">A. Submission of Assignment followed by Presentation</td><td rowspan="5">Best two test Marks 40
Marks</td><td rowspan="2">Section (A): 05 MCQ Questions</td><td rowspan="2">05 x 01 = 05 Marks</td></tr>
<tr><td>B. Class Test</td><td>Best two test Marks 20 Marks</td></tr>
<tr><td>Test I (Written test)</td><td>20 Marks</td><td>Section (B): Five Short Questions (200 Words Each)</td><td>05 x 05= 25 Marks</td></tr>
<tr><td>Test II (Written test)</td><td>20 Marks</td><td>Section (C): Two Long Questions (500 Words Each)</td><td>02 x 15= 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td><td></td><td></td></tr>
<tr><td colspan="2">Total Internal Assessment (Theory) Marks (A+B)</td><td>40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+C)</td><td>60 Marks</td></tr>
</table>

Govt. Holkar (Model Autonomous) Science College, Indore									
Name of Department									
Syllabus Session 2021-22									
Programme : B.Sc.								**Class : B.Sc II YEAR**	
Paper	Title of the paper	Paper Code	**Theory**					**Practical**	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -1	**Digital Electronics and Microprocessor**	207-I	40	28	10	3	33	50	17
Paper -2	**Operational Amplifier and Instrumentation**	207-II	40		10	3			

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics
Syllabus Session 2021-22

उच्च शिक्षा विभाग, मध्यप्रदेश शासन
स्नातक कक्षाओं के लिए वार्षिक पाठ्यक्रम केन्द्रीय अध्ययन
मण्डल द्वारा अनुशंसित तथा मध्यप्रदेश के राज्यपाल द्वारा अनुमोदित
(शैक्षणिकसत्र 2018-2019 सेलागू)

Class: B.Sc. II Year **Max Marks: 40 + (CCE)10 = 50**
Subject: Electronics **Paper: I**
Title of Paper: Digital Electronics & Microprocessor **Code of the Paper: 207-I**

Objectives:

1. To know about working and designing of digital circuit.
2. To know the Basics of microprocessor 8085.
3. To learn the assembly programming.

Course Outcomes: After the completion of course, students will be able to

1. Design the any kind of combinational circuit.
2. Design the sequential circuits.
3. Teach the working phenomenon of A/D and D/A converters.
4. Write the assembly language programs.
5. Interface the devices with Microprocessor 8085.

Unit I: Logic Gates: Basic Logic Gates – Symbols and truth tables of AND, OR, NOR,NAND, NOR, XOR and XNOR logic Gates, Positive and Negative logic, Transistorised Circuits of Basic Logic Gates.

Arithmetic Circuits: Half Adder and Full Adder, Boolean Laws, De'Morgan's Theorems, Karnaugh Map Simplification upto 4 variables.

Flip Flops: RS Flip Flop, D Flip Flop, J K Flip Flop, Positive and Negative triggered Flip Flop, JK Master Slave Flip Flop. Elementary idea of MUX, DMUX, encoder and decoder circuits.

इकाई– एक : लॉजिक गेट्स : मूल लॉजिक गेट्स AND, OR, NOR,NAND, NOR, XOR and XNOR गेट्स के सांकेतिक चिन्ह एंव सत्यता सारणी, धनात्मक एंव ऋणात्मक लॉजिक, मूल गेट्स के ट्रांजिस्टर परिपथ।
आंकिक परिपथ : हाफ ऐडर एंव फुल ऐडर, बूलियन के नियम, डीमॉगन्स प्रमेय, कारनॉफ चित्र का सरलीकरण (चार चरो तक)।

फ्लिप फ्लाप्स : आर.एस. फ्लिप फ्लाप्स, जे.के. फ्लिप फ्लाप्स, धनात्मक व ऋणात्मक ट्रिगर्ड, जे.के. मास्टर स्लेव फ्लिप फ्लाप्स। MUX, DMUX , एनकोडर और डीकोडर परिपथ की प्रारंभिक अवधारणा।

UNIT-II: Logic Families: Classification of logic families, Definition of fan-in, fan-out, noise immunity, Propagation delay time, Various Logic Families- RTL, DTL, TTL, ECL, CMOS.

Counter and Registers: Ripple counter, synchronous Counter, up-Down Counter, Decade Counter, Buffer Register, Shift Registers-Types and Uses.

इकाई– दो : लॉजिक फेमिलीज : लॉजिक फेमिलीज का वर्गीकरण फेन इन–फेन आउट की परिभाषा, नॉइस इम्यूनिटी, प्रोपेगेशन डिले समय, विभिन्न लॉजिक फेमिलीज– RTL, DTL, TTL, ECL, CMOS.

काउन्टर एंव रजिस्टर : रिपिल काउन्टर, सिंकोनस काउन्टर, अप–डाअन काउंटर, डिकेड काउंटर, बफर रजिस्टर, शिफ्ट रजिस्टर – प्रकार एंव उपयोग।

UNIT-III: D/A and A/D Converter: D/A converters: Binary Weighted Resistor method, R-2R Ladder method, A/D Converters: Counter Method, Dual Ramp method, Successive Approximation Method.

Memories: Volatile and Non-volatile memories, Read only memory (ROM), PROM, EPROM, EEPROM, Random Access Memory.

इकाई–तीन : **D/A** एंव **A/D** रूपांतरक: **D/A** रूपांतरक, बाइनरी वेटेड रजिस्टर विधि, R-2R लेडर विधि, **A/D** रूपांतरक कांउटर विधि, डुअल रेम्प विधि, क्रमागत संन्निकट विधि।
मेमोरीज: वोलाटाइल एंव नॉन वोलाटाइल मेमोरीज, ROM, PROM, EPROM, EEPROM, रेन्डम एक्सेस मेमोरी।

UNIT-IV : Introduction to Microprocessor: Pin Out diagram of Microprocessor INTEL 8085, Microprocessor 8085 Architecture -Bus Organization Addressing modes, Memory organization, General purpose Registers, Stack Pointer and Program Counter, Status flags.

Instruction Set of Microprocessor 8085: Types of Instructions, Data transfer, Arithmetic, Logical, Branching & Looping, Stack, I/O & machine control instructions.

Programming-Basic Straight line programming (Addition, Subtraction, Multiplication and Division)

इकाई–चार : माइक्रोप्रोसेसर की प्रस्तावना : इन्टेल 8085 माइक्रोप्रोसेसर का पिन आउट डाइग्राम, 8085 माइक्रोप्रोसेसर की अद्योसंरचना, बस आर्गनाइजेशन, ऐड्रेसिगं मोड, मेमोरी आर्गनाइजेशन, रजिस्टर्स का सामान्य उद्देश्य, स्टेक पॉइन्टर एंव प्रोग्राम काउन्टर, स्टटेस फ्लेग्स।

माइक्रोप्रोसेसर 8085 के निर्देश समूह : निर्देशों के प्रकार, डाटा ट्रांसफर, आंकिक,तार्किक, ब्राचिंग एंव लूपिंग, स्टेक, इनपुट/आउटपुट एंव मशीन कन्ट्रोल निर्देश,

प्रोग्रामिंग–मूल सरल रेखीय प्रोग्राम (योग, घटाना, गुणा एव भाग)।

UNIT-V : Interfacing and Interfacing Devices: Introduction to Interfacing with microprocessor 8085, Interfacing with ROM, Interfacing with RAM, Input/ Output Interfacing Internal Architecture and pin out diagram of the 8155/8156 and 8355/8755 multipurpose programmable Devices.
Personal Computers: Introduction to Personal Computer, Classification and Architecture (Block Diagram only), Input and Output Devices.

इकाई–पॉच: इन्टरफेसिंग एंव इन्टरफेसिंग युक्तियॉ : माइक्रोप्रोसेसर 8085 की इन्टर फेसिंग की प्रस्तावना, रोम के साथ इन्टरफेसिंग, रेम के साथ इन्टरफेसिंग, इनपुट/आउटपुट इन्टरफेसिंग आन्तरिक अद्योसंरचना एंव 8155/8156 एंव 8355/8755 का पिन आउट डाइग्राम्स, बहुउद्देशी प्रोग्रामेबल युक्तियॉ।
पर्सनल कम्प्यूटर: पर्सनल कम्प्यूटर की प्रस्तावना, वर्गीकरण एंव अद्योसंरचना (केवल ब्लॉक डाइग्राम), इनपुट एंव आउटपुट युक्तियॉ।

Reference Books:

1. Digital Principles and Applications: Malvino and Leach
2. Digital Electronics and Microcomputer: R. K. Gaur
3. Fundamentals of Microprocessors and Microcomputers: B. Ram
4. Microprocessor Architecture, Programming and Applications: R. S. Gaonkar

5. Digital Computer Electronics - Malvino
6. Digital Electronics - R.P. Jain, Tata McGraw Hill

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics
Syllabus Session 2021-22

उच्च शिक्षा विभाग, मध्यप्रदेश शासन
स्नातक कक्षाओं के लिए वार्षिक पाठ्यक्रम केन्द्रीय अध्ययन
मण्डल द्वारा अनुशंसित तथा मध्यप्रदेश के राज्यपाल द्वारा अनुमोदित
(शैक्षणिकसत्र 2018-2019 से लागू)

Class: B.Sc. II Year **Max Marks: 40 + (CCE) 10 = 50**

Subject: Electronics **Paper: II**

Title of Paper: Operational Amplifier and Instrumentation **Code of the Paper: 207-II**

Objectives:

1. Understand the operational amplifier.
2. Study the measuring instruments.
3. To gain knowledge on Bio-medical instruments.

Course Outcomes: After the completion of course, Students will be able to

1. Analyze the parameters of Op-Amp.
2. Design the applications of Op-Amp.
3. Illustrate the behaviour of CRO & LCD.
4. Demonstrate Electronic measurement equipments.
5. Understand the mechanism of life saving biomedical instruments.

UNIT-I: Differential Amplifier: Emitter coupled differential amplifier and its different configurations, DC and AC analysis, Voltage Gain, Input and Output Impedance of difference amplifier.
Operational Amplifier: Block diagram of Ideal Operational amplifier, Equivalent circuit of an Op-Amp, symbol, Integrated circuits, Pin -out configuration of IC 741. Inverting and Non Inverting Amplifiers.
Parameters of Op Amp: Input offset voltage, Input Bias current, Differential Input resistance, Common Mode Rejection Ratio (CMRR), Slew rate, Large signal voltage gain, Output Resistance.

इकाई– एक: डिफरेन्शियल एम्लीफायर : उत्सर्जक युगमित डिफरेन्शियल एम्लीफायर एंव उनके विभिन्न अभिविन्यास, डी. सी. एंव ए.सी. विश्लेषण, विभव लाभ, डिफरेन्शियल एम्लीफायर की निवेशी एंव निर्गत प्रतिबाधा।
ऑपरेशनल प्रवर्धक : आदर्श ऑपरेशनल प्रर्वधक का ब्लॉक डाइग्राम, ऑपरेशनल एम्लीफायर (आपेम) का समतुल्य परिपथ, इंटीग्रेटेड सर्किट, आई.सी.741 का पिन आउट अभिविन्यास, इनवर्टिंग एंव नॉन इनवर्टिंग प्रर्वधक।
ऑपरेशनल एम्लीफायर के प्रचालक: निवेशी ऑफसेट वोल्टेज, निवेशी अभिनत धारा, डिफरेन्शियन निवेशी प्रतिरोध, उभयनिष्ठ विधा निरस्ती अनुपात (CMRR), स्लयू रेट, लार्ज सिंग्नल विभव लाभ, निर्गत प्रतिरोध।

UNIT-II: Applications of Op-Amp: Adder, Subtractor, Integrator, Differentiator and Comparator Instrumentation Amplifier: construction and working.
Active Filters: Elementary idea of Active Filters, Butterworth & Chebyshev response, First order Low pass, High pass & Band pass. Butterworth filters: working and frequency response.

Signal Generators: Sweep Frequency generator, Pulse and Square wave generator, Astable Multivibrator using transistors, IC 555 timer for square and triangular wave generator, Block diagram of Function generator, IC 8038 as complete function generator.

इकाई– दो: ऑपरेशनल प्रर्वधक के अनुप्रयोग : एडर, सब्ट्रेक्टर, समाकलित, अवकलित एंव कम्परेटर।
इंन्सट्रूमेन्टेशन प्रर्वधक : संरचना एंव कार्यविधि।
सक्रिय फिल्टर्स: सक्रिय फिल्टर्स की मूल अवधारणा, बटरवार्थ एंव शैबीशेव अनुक्रिया, प्रथम कोटि निम्न पारक, उच्च पारक एंव बैण्ड पारक।
बटरवार्थ फिल्टर: कार्यविधि एव आवृति अनुक्रिया।
सिग्नल जनित्र: स्वीप आवृत्ति जनित्र, पल्स एंव वर्ग तरंग जनित्र, ट्रांजिस्टर युक्त एस्टेबल मल्टीवाइब्रेटर, IC 555 का उपयोग कर वर्ग एंव त्रिभुजाकार तंरग जनित्र, फलन जनित्र का ब्लॉक डाइग्राम, 8038 के द्वारा पूर्ण फलन जनित्र।

UNIT-III: Cathode Ray Oscilloscope: Block diagram of a CRO, Basic operation, Electrostatic focusing, Electrostatic deflection, Screen for CRT, Horizontal deflection system, Vertical deflection system Lissajous Figures, Frequency and Phase measurement using CRO.
Liquid Crystal Displays: Liquid Crystal, Modes of Operation, Operation of twisted nematic LCD, Operating characteristics of LCD, Liquid Crystal Materials, construction and advantages of LCD.

इकाई– तीन : कैथोड किरण कम्पनदर्शी : सी.आर.ओ का ब्लॉक डाइग्राम, मूल संचालन, विद्युतस्थैत, फोकसिंग विद्युतस्थैत विक्षेपण, कैथोड किरण ट्यूब मे परदा, क्षेतिज विक्षेपण तंत्र, उर्ध्वाधर विक्षेपण तंत्र, लिसाजू आकृतियॉ, कैथोड किरण कम्पनदर्शीकी सहायता से आवृति एंव कला मापन।
लिक्विड किस्टल डिस्प्ले : लिक्विड किस्टल, प्रचालन की विधाऐं, ट्विस्टेड निमेटिक एल.सी.डी., एल.सी.डी. के क्रिया अभिलाक्षणिक गुण, लिक्विड किस्टल डिस्प्ले की संरचना एंव लाभ।

UNIT-IV : Measuring Instruments: Q Meter-Basic Circuits: measuring method in series and parallel connections, Electronic Voltmeter, DC Voltmeter, AC Voltmeter, Digital Voltmeter -Integrating type, Staircase Ramp, Sample and Hold circuits.
Multimeters: Analog Multimeter- Voltage, Current and Resistance measurement, Digital Multimeter, Voltage, Current and Resistance measurement, Comparison between Analog and Digital Multimeter, Elements of Electronic Counter, Universal Counter, Measurement modes-Frequency, Time interval and Period measurement.

इकाई–चार : मापन यंत्र: क्यू मीटर–प्राथमिक परिपथ : श्रेणी एंव समानांतर संयोजन में मापन विधियॉ, इलेक्ट्रॉनिक वोल्टमीटर, डी.सी. वोल्टमीटर, ए.सी. वोल्टमीटर, डिजिटल वोल्टमीटर समाकलित प्रकार, स्टेयरकेस रेम्प, सेम्पल एंव होल्ड परिपथ।
मल्टीमीटर : एनालॉग मल्टीमीटर–विभव, धारा एंव प्रतिरोध मापन, डिजिटल मल्टीमीटर– विभव, धारा एंव प्रतिरोध मापन, एनालॉग एंव डिजिटल मल्टीमीटर की तुलना, इलेक्ट्रोनिक गणक के मूल तत्व, सार्वत्रिक गणक, मापन विधाऐं–आवृत्ति, समयान्तराल एंव काल मापन।

UNIT-V : Biomedical Instrumentation: ECG Fundamentals- Electrodes, Block Diagram of ECG machine, ECG Leads, Direct Writing Recorder, Inkjet recorder, Multi-channel ECG Machines, Cardiac Monitor, Cardiac Monitor Using Digital Memory.
X-Ray Machine: Production of X-rays, X-ray machine, High Voltage Generator, High Frequency Generators, High Tension Cable.
Risks Related to Some Toxic Substances in PCs and mobile phones, Dimension of the Problem in developing and developed countries, Examining E-Waste Related Regulations/ policy and infrastructure in India, Legal and Professional aspect of e waste.

इकाई–पॉच : बायोमेडिकल इंस्ट्रूमेन्टेशन : **ECG** के मूल तंत्र–इलेक्ट्रोड, ई.सी.जी. मशीन का ब्लॉक आरेख, ई.सी.जी. लीड्स, डायरेक्ट राइटिंग रिकार्डर, इंकजेट रिकार्डर, बहुचेलन ई.सी.जी. मशीनें, कार्डियक मॉनीटर, डिजिटल मेमोरी प्रयुक्त कार्डियक मॉनीटर

एक्सरे मशीन : एक्स किरणों का उत्पादन, एक्स किरण मशीन, उच्च विभव जनित्र, उच्च आवृत्ति का जनित्र, हाई टेशन केबल पीसी और मोबाइल में कुछ विषाक्त पदार्थों से संबंधित जोखिम, विकासशील और विकसित देशों में समस्या के पहलू, भारत मे ई–वेस्ट संबंधित विनियम / नीति और बुनियादी ढांचे की जांच करना, ई कचरे का कानूनी और व्यावसायिक पहलू

Reference Books:

1. Electrical & Electronic Measurements and Instrumentation: A.K. Sawhney
2. Electronic Instrumentation & Measurement: Helfrick and Cooper
3. Electronic Devices & Circuits: Y.N. Bapat
4. Operational Amplifier and Linear Circuits: R. Gaikwad
5. Handbook of Biomedical Instrumentation : R. S. Khandpur (Tata McGraw Hill)

B.Sc. II YEAR ELECTRONICS
EL-2103 PRACTICALS

Max. Marks: 50
Time: 3 Hrs.

SPECIAL NOTES

1. Do any sixteen experiments.
2. The students are required to calculate the error involved in a particular experiment (percentage error).
3. Any other experiments of similar Standard may also be incorporated.

4 . For giving marks under Lab Record department will maintain practical assessment record by using the following procedure:-

(a.) Each student has to perform a minimum number of experiments prescribed in the syllabus.

(b.) After the completion of a practical the teacher concerned will check the note- book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitute the lab record.

(c.) To complete the final marks for lab. Record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained will be divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.

(d.) The lab record register will be presented to the external practical examiners for lab record marks. The external examiners will verify the record randomly.

NOTE
Distribution of Marks:
Experiment =25
Viva Voce =15
Lab Record = 10

Total = 50

B. Sc. II Year
Experiments List

Digital Electronics

1. Verification of truth table of Basic logic Gates AND, OR, NOT, NAND, NOR, XOR and XNOR using ICs 74XX.
2. Implement all gates through universal logic gates.
3. Verification of De' Morgan's Theorems using logic gates.
4. Realization of Boolean Circuits.
5. Study of Half and Full adder.
6. Study of Encoder and Decoder.
7. Study of Multiplexer and Demultiplexer.
8. Study of R-S Flip-Flop.
9. Study of D Flip-Flop using R-S/J-K Flip-Flop.
10. Study of J-K Flip-Flop.

Microprocessor 8085

11. Write a Program in Assembly language for: (8 bits Numbers)
    (I) Addition (III) Multiplication
    (II) Subtraction (IV) Division
12. Write a program in Assembly language for BCD addition.
13. Write a program in Assembly language for 16 bits addition and subtraction.
14. Find 1's & 2's Complement of Numbers.
15. Addition of two strings of numbers placed in memory location.
16. Write a program in Assembly language for Microprocessor 8085:
    (I) Largest No. finding (II) Smallest No. finding
17. Write a program in Assembly language for Microprocessor 8085:
    (I) Data Block Transfer (II) Data Block Interchange

Op amp and Instrumentation

18. Study of Operational Amplifier in Inverting and Non Inverting mode.
19. Study of Operational Amplifier as an Adder.
20. Study of Operational Amplifier as a Subtractor.
21. Study of Operational Amplifier as Integrator and differentiator.
22. Study of the first order Low pass & High pass Butterworth Active Filters.
23. Measurement of amplitude, frequency and phase difference using CRO.
24. Study of 555 Timer as Triangular wave generator.
25. Study of 555Timer as Square wave generator.

Note: - A student is required to do at least 16 experiments

Govt. Holkar (Model Autonomous) Science College, Indore									
Name of Department									
Syllabus Session 2021-22									
Programme :B.Sc.							Class :B.Sc IIIYEAR		
Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -1	**Thyristors, IC Technology, Microprocessor And Electrical Motors**	307-I	40	28	10	3	33	50	17
Paper -2	**Communication Electronics**	307-II	40		10	3			
Internship			Report	Viva	max	Minimum			
			50	50	100	33			

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Electronics
Syllabus Session 2021-22
उच्च शिक्षा विभाग, मध्यप्रदेश शासन
स्नातक कक्षाओं के लिए वार्षिक पाठ्यक्रम केन्द्रीय अध्ययन
मण्डल द्वारा अनुशंसित तथा मध्यप्रदेश के राज्यपाल द्वारा अनुमोदित
(शैक्षणिक सत्र 2019-2020 से लागू)

Class: B.Sc. III Year **Max Marks: 40 +(CCE)10 = 50**

Subject: Electronics **Paper: I**

Title of Paper: Thyristors, Ic Technology, Microprocessor and Electrical Motors **Code of The Paper**: 307-I

Objective:
1. To give exposure on power and electrical devices.
2. To understand basics of IC technology and microprocessor.

Course Outcomes: After the completion of course, student will be able to:

1. Relate the importance of power devices in the field of high power electronics.
2. Plan various methods used to fabricate Integrated chips.
3. Categorize the application of power devices.
4. Design and work with Electrical Motors.
5. Summarize 8086 microprocessor and write its Programming.

Unit I : Power Devices : UJT : Structural Description and working and Characteristic Curve of Unijuction Transistor (UJT), UJT as a relaxation Oscillator.
SCR: Structural description, working and Characteristics Curve of Silicon Controlled Rectifier, two Transistor Analogy of SCR, Forward and Reverse Blocking States, Triggering Methods. Construction, Working and Characteristics curves of DIAC and TRIAC, TRIAC as a switch.

इकाई–एक : पॉवर युक्तियॉं : U.J.T. ; एकल संधि ट्रांजिस्टर की संरचना विवरण, कार्यविधि तथ अभिलाक्षणिक वर्क, रिलेक्सेशन दोलित्र के रूप में U.J.T.
S.C.R. ; सिलिकोन कन्ट्रोल दिष्टकारी का संरचना विवरण, कार्यविधि तथा अभिलाक्षणिक वर्क, S.C.R. की द्वि ट्रांजिस्टर एनालॉजी, अग्र एवं पश्च ब्लॉकिगं अवस्थाएँ, ट्रिगरिंग विधियॉं, DIAC एवं TRIAC की संरचना, कार्यविधि एवं अभिलाक्षणिक वक। स्विच के रूप में TRIAC .

Unit II: Applications of SCR: SCR as a statics AC switch, Phase Controlled Rectification, Half Wave and Full wave Rectifiers using SCR with resistive, capacitive and inductive load.
Power Inverters using SCR: with and without reactive feedback.

इकाई–दो : SCR के अनुप्रयोग : स्थैतिक ए.सी. स्विच के रूप में SCR, कलानियंत्रित दिष्टकरण, SCR का प्रतिरोधक, संधारितों तथा प्रेरकत्व लोड के साथ अर्द्धतरंग एवं पूर्ण तरंग दिष्टकारी।
SCR युक्त पॉवर इनवर्टर ; प्रतिघाती पुर्ननिवेश तथा गैर प्रतिघाती पुर्ननिर्वेशी।

Unit III: IC Technology : Refining and growth of Silicon Crystals : Production of electronic grade silicon, Crystal growth apparatus, Silicon Wafer Preparation: Ingot Trimming and Slicing, Wafer Polishing and Cleaning, Wafer Processing Considerations, Diffusion of Dopant Impurities, Diffusion Systems, Ion Implantation, Ion Implantation System, Properties of Ion Implantation, Thermal Oxidation: Utility of Thermal

Oxidation, Photolithography Process steps, Idea of relative plasma etching, Chemical Vapour Deposition: Epitaxial deposition

इकाई–तीन : IC टेक्नालॉजी : सिलिकॉन किस्टलों का परिष्करण एवं निर्माण : इलेक्ट्रानिक ग्रेड सिलिकॉन का उत्पादन, किस्टल निर्माण उपकरण, सिलिकॉन वेफर निर्माण : इन गॉट ट्रिमिंग तथा स्लाइसिंग, वेफर पॉलीशिगं तथा क्लीनिगं, वेफर प्रोसेसिंग के घटक, अपमिश्रण अशुद्धियों का विसरण, विसरण तंत्र। आयन आरोपण, आयन आरोपण तंत्र, आयन आरोपण के गुण। तापीय आक्सीकरण : तापीय आक्सीकरण का उपयोग, फोटोलीथोग्राफी प्रकिया के स्तर, रिलेटिव प्लाज्मा ऐचिंग की अवधारणा, रासायनिक वाष्प डिपोजीशन, एपिटेक्सियल डिपाजीशन।

Unit IV: INTEL 8086 Microprocessor : Register Organization of INTEL 8086, Architecture, Pinout Description of 8086, Physical Memory Organization, General Bus Operation, I/O Addressing Capability, Minimum and Maximum modes. **Addressing Modes of 8086, Instruction set of 8068:** Data Copy/Transfer Instructions, Arithmetic and Logical Instructions, Branch Instructions, Loop Instructions, Machine Control Instructions, Shift and Rotate Instructions. Simple Programs for arithmetic operations.

इकाई–चार : इंटेल 8086 माइक्रोप्रोसेसर : INTEL 8086 का रजिस्टर संगठन, आर्कीटेक्चर, 8086 का पिनआउट विवरण, फिजीकल मेमोरी संगठन, सामान्य बस प्रचालन, I/O एड्रेसिंग क्षमता, न्यूनतम एवं अधिकतम विधाऐं, 8086 की एड्रेसिंग विधाऐं, 8086 के निर्देश सेट : डाटा कॉपी / ट्रांसफर निर्देश, आंकिक एवं तार्किक निर्देश, ब्रांच निर्देश, लूप निर्देश, मशीन नियंत्रक निर्देश, शिफ्ट तथा रोटेट निर्देश, आंकिक ऑपरेशन के लिए सामान्य प्रोग्राम।

Unit V: Electrical Motors: Types of motors, DC Motor : Design and Working Principles; Induction motors: Idea or rotating magnetic field. Starting and Rotating Torque, Slip Asynchronous Motor, Equivalent circuit of an induction motor. Synchronous motor: principle of operation. Single phase induction motor: different circuits to make itself starting.

इकाई–पॉच : विद्युत मोटर : मोटर के प्रकार, दिष्टधारा मोटर : संरचना तथा कार्यविधि सिद्धांत, प्रेरण मोटर्स : घूर्णीय चुम्बकीय क्षेत्र की अवधारणा, प्रारम्भिक तथा घूर्णीय बल–आघूर्ण, स्लिप, अतुल्य कालिक मोटर, प्रेरकत्वी मोटर का समतुल्य परिपथ, तुल्य कालिक मोटर : प्रचालन का सिद्धांत, एकल कला, प्रेरकत्वी मोटर : इसे स्वचलित बनाने हेतु विभिन्न परिपथ।

Reference Books:

1. Power Electronics by P.C. Sen; Publishers: Tata McGraw Hill Publishing Company, New Delhi.
2. An Introduction to Thyristors and Their Applications by M. Ramamoorty; Publishers: Affiliated East-West Press Pvt. Ltd., New Delhi
3. Integrated Circuits by K. R. Botkar; Publishers: Khanna Publishers, Delhi.
4. Advanced Microprocessors and Peripherals by A.K.Ray and K.M.Bhurchandi; Publishers: Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. Electrical Technology by B.L. Theraja; Vol. 1 and 2, Publisher: S. Chand and Company Ltd.
6. Op-Amp and Integrated Circuits by Ramakant A. Gaikwad; Publishers: Prentice Hall of India Pvt. Ltd., New Delhi.
7. Power electronics by P.S. Bimbhra; Publishers: Khanna Publihsres, Delhi.
8. Microprocessors and Interfacing by Douglas V. Hall; Publishers: Tata McGraw Hill Publishing Company Ltd., New Delhi.

Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Electronics
Syllabus Session 2021-22
उच्च शिक्षा विभाग, मध्यप्रदेश शासन
स्नातक कक्षाओं के लिए वार्षिक पाठ्यक्रम केन्द्रीय अध्ययन
मण्डल द्वारा अनुशंसित तथा मध्यप्रदेश के राज्यपाल द्वारा अनुमोदित
(शैक्षणिक सत्र 2019-2020 से लागू)

Class: B.Sc. III Year **Max. Marks 40 + (CCE)10 = 50**

Subject: Electronics **Paper: II**

Title of Paper: Communication Electronics **Code of The Paper**: 307-II

Objective: To give exposure on the field of Communication Electronics.

Course Outcomes: After the completion of course, student will be able to

1. Classify on types of noise and radio wave propagation.
2. Correlate various generation techniques in modulation and demodulation of signals.
3. Interpret the idea and working of both Antenna and Television.
4. Categorize the concepts of mobile communication and fiber optics.
5. Infer wireless concepts.

Unit I: Noise: Thermal Noise, Shot Noise, Partition Noise, Low Frequency and transit time noise, Generation and Recombination Noise, Equivalent Noise Resistance, Signal-to-noise ratio, Noise Factor, Noise Temperature.
Radio Wave Propagation: Introduction, Propagation in Free Space, Tropospheric Propagation, Ionopheric Propagation, Surface Wave, HF and VHF propagation, Ground wave, Sky wave and Space wave propagation, Dead zones, skip distance, Maximum usable Frequency, Stratification on Ionosphere.

इकाई–एक शोर : उष्मीय शोर, शॉट शोर, पार्टीशन शोर, निम्न आवृत्ति एवं दमन समय शोर, उत्पादन एवं संयोजन शोर, संमतुल्य शोर प्रतिरोध, सिग्नल शोर निष्पत्ति, शोर घटक, शोर ताप।
रेडियो तरंग संचरण : प्रस्तावना, मुक्त आकाश में संचरण, टोपोस्फेरिक संचरण, आयन मण्डलीय संचरण, पृष्ठीय तरंग, उच्च आवृत्ति एवं अति उच्च आवृत्ति संचरण, भूस्तरीय तरंग, आकाशी तरंग एवं आकाशीय तरंग संचरण, डेड जोन, मूक अन्तराल, अधिकतम उपयोगी आवृत्ति, आयन मण्डल का स्तरीयकरण।

Unit II: Modulation: Principle of Modulation, Amplitude Modulation: Principle and waveform, Modulation Index, Derivation for the modulated wave and modulation index, Linear and Square Modulation, Balanced Modulator, Single side band transmission: advantages, disadvantages and methods of generation. Elements of Frequency and Phase Modulation, Frequency spectrum of FM waves. Phase modulation; Modulation Indices.

इकाई–दो : माडुलन : माडुलन का सिद्धांत, आयाम माडुलन : सिद्धांत एवं तरंगरूप, माडुलन सूचकांक, माडुलित तरंग तथा माडुलित सूचकांक के लिए व्यजंक की उत्पत्ति, रेखीय एंव वर्ग माडुलक, संतुलित माडुलक, एकल पार्श्व बैण्ड प्रेषण : लाभ, हानि एवं उत्पादन की विधियॉं।
आवृत्ति एवं कला माडुलन के तत्व, आवृत्ति माडुलित तरंगों का आवृत्ति वर्णक्रम, कला माडुलन : माडुलन सूचकांक।

Unit III: Generation of Frequency Modulation: Direct and Indirect Methods; Varactor Diode and FET circuits. FM Demodulation: Foster Seelay Discriminator and Radio Detector.
Pulse Modulation, Pulse Transmission, Pulse Amplitude Modulation, Pulse Position and Pulse Width Modulation, Time Division Multiplexing. Frequency Division Multiplexing.
Pulse Code Modulation: Block diagram of PCM, Transmitting and receiving Systems of PCM.

इकाई–तीन : आवृत्ति माडुलेशन की उत्पत्ति : प्रत्यक्ष एवं अप्रत्यक्ष विधियॉं, वेरिक्टर डायोड एवं एफ.ई.टी. परिपथ, एफ.एम. डिमोडुलेशन : फोस्टर सीले, डिस्किमिनेटर एवं रेशो डिटेक्टर।

पल्स माडुलेशन, पल्स ट्रांसमीशन, पल्स आयाम माडुलेशन, पल्स पोजीशन एवं पल्स चौडाई माडुलेशन, टाइम डिवीजन, मल्टीप्लेक्सिंग, आवृत्ति विभाजित मल्टीप्लेक्सिंग।
पल्स कोड माडुलेशन : पी.सी.एम. का ब्लाक डायग्राम, ट्रासमीटिगं एवं रिसीविगं सिस्टम्स।

Unit IV: Antenna: Antenna Equivalent Circuits, Radiation Fields, Polarization, Isotropic Radiator, Power Gain, Effective area, Half Wave Dipole, Vertical Antenna, Folded Elements, Loop and ferrite core receiving antennas, YAGI Antenna, non-resonant antenna, driven arrays, parasitic arrays, Microwave antenna.
Television Engineering: Characteristics of Human Eye, Persistence of Vision and Flicker, Scanning, Process, Interlaced Scanning, Composite Video Signal, Vestigial Sideband Signal, Standard Channel
Characteristics. Block diagram of TV Transmitter and Receiver.

इकाई–चार : एन्टीना : एन्टीना समतुल्य परिपथ, विकिरण क्षेत्र, ध्रुवण, आइसोट्रोपिक रेडिएटर, शक्ति लाभ, प्रभावित क्षेत्र, अर्धतरंग द्विध्रुव, उर्ध्वाधर एन्टीना, फोल्डेड तत्व, लूप एवं फेराइट कोर रिसीविगं एन्टीना, यागी एन्टीना, नॉन रेजोनेन्ट एन्टीना, ड्रिविन एरेस, पेरासिटिक एरेस, सूक्ष्म तरंग एन्टीना।
टेलीवीजन यांत्रिकी : मानव क्षेत्र अभिलक्षण, दृष्टि एवं फ्लिकर का स्थायित्व, स्केनिगं प्रकिया, इन्टरलेज्ड स्केनिगं, संयुक्त वीडियों सिग्नल, वेसटीजियल साइड बैण्ड सिग्नल, स्टेण्डर्ड चेनल अभिलक्षण, टी.वी. प्रेषित्र एवं अभिग्राही का ब्लाक डायग्राम।

Unit V: Fiber Optic Communication: Introduction to Optical Fibers, Principles of Light Transmission in a Fiber: Propagation within a Fiber, Effect of Index profile on Propagation, Modes of propagation Number of Modes supported by a fiber; Losses in Fiber. Dispersion, Light Sources for Optical Fibers, Photo Detectors, Connector and Slices.
Wireless Communication System: Introduction to Cellular Telephony, Cells, Frequency Re-use Principle, Transmission, Reception, Handoff, Roaming, Generations of Cellular Telephony; Global System for Mobile Communication (GSM): Introduction, Switching System, Base Station System, Operation and Support System, GSM Specifications. VSAT.
Radiation Effects on human:- Short-term effects, Long-term effects, Exposure levels, Exposure limit guidelines, WHO response.

इकाई–पॉंच : फाइवर आप्टिक कम्यूनिकेशन : फाइवर आप्टिक की प्रस्तावना, फाइवर में प्रकाश प्रेक्षण का सिद्धांत, फाइवर में संचरण, संचरण पर इंडेक्स प्रोफाइल का प्रभाव, संचरण की विधाएं, फाइवर सहायक विधाओं के प्रकार, फाइवर में हानियॉं, विक्षेपण प्रकाशीय फाइवर के लिए प्रकाश स्त्रोत, फोटो डिटेक्टर, कनेक्टर एवं स्लाइसेस।
वायरलेस कम्यूनिकेशन सिस्टम : सेल्यूलर टेलीफोनी की भूमिका, सेल्स, आवृत्ति पुर्नउपयोगी सिद्धांत, संप्रेक्षण, अभिग्रहण, हेण्ड ऑफ, रोमिगं, सेल्यूलर टेलीफोनी का उत्पादन, मोबाइल कम्यूनिकेशन के लिए वैश्विक तंत्र (GSM) : प्रस्तावना, स्विचिंग सिस्टम, बेस स्टेशन सिस्टम, ऑपरेशन एवं सपोर्ट सिस्टम, जी.एस.एम. के विनिर्देश (Specification), व्ही.एस.ए.टी.।

मानव पर विकिरण का प्रभावः– अल्पकालिक प्रभाव और दीर्घ कालिक प्रभाव, एक्सपोजर का स्तर, एक्सपोजर सीमा दिशानिर्देश, WHO की प्रतिक्रिया।

Reference Books:

1. Electronic Communications by Roddy and Coolen; Publishers: Prentice Hall of India, New Delhi.
2. Monochrome and Colour Television by R. R. Gulati; Publishers: New Age International Publishers, New Delhi.
3. Data Communications and Networking by Behrouz A. Forouzan; Publishers: Tata McGraw Hill Publishing Company, New Delhi
4. Electronic Communication Systems by George Kennedy; Publishers: Tata McGraw Hill Publication Company, New Delhi
5. Modern Digital and Analog Communication Systems : B.P. Lathi

B.Sc. III YEAR ELECTRONICS
PRACTICALS

Max. Marks: 50
Time: 3 Hrs.

SPECIAL NOTES

1. Do all experiments.
2. The students are required to calculate the error involved in a particular experiment (percentage error).
3. Any other experiments of similar Standard may also be incorporated.
4. For giving marks under Lab Record college/department will maintain practical assessment record by using the following procedure:-

   (a) Each student has to perform a minimum number of experiments prescribed in the syllabus.

   (b) After the completion of a practical the teacher concerned will check the note- book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitute the lab record.

   (c) To complete the final marks for lab. Record a separate register for each class of B.Sc. will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practical's will be recorded. While taking the final average the total marks obtained will be divided by the total no. of required practical's, instead of the number of practical's performed by the student. This record will be signed by the concerned teacher.

   (d) The lab record register will be presented to the external practical examiners for lab record marks. The external examiners will verify the record randomly.

NOTE
Distribution of Marks:
Experiment = 25
Viva Voce = 15
Lab Record = 10

Total = 50

B. Sc. III Year
Experiments List

1. Study of SCR Characteristics.
2. Study of DIAC and TRIAC characteristics.
3. Study of UJT Characteristics.
4. Study of UJT as relaxation oscillator.
5. Assembly language programming to perform basic arithmetic operations using INTEL 8086 microprocessor.
6. Assembly language programming for the summation of two data series using INTEL 8086 microprocessor.
7. Assembly language programming for finding the squares of the elements of a series using call procedure.
8. A.I.P using Macros.
9. Study of Amplitude Modulation and Demodulation.
10. Study of frequency Modulation and Demodulation.
11. Study of Time Division Multiplexing and Frequency Division Multiplexing.
12. Study of Pulse Code Modulation.
13. Study of Optical Fiber Communication.
14. Study of various sections of Television receiver.

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Fisheries

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

B.Sc. Fisheries 2021-22 Syllabus

1.1.3 Details of Course offered by the institution that focus on employability/internship/skill development during the year

	Name of the course	Course code	Activities/Content with a direct bearing on Employability/ Entrepreneurship/ Skill development	Link to the relevant document
B.Sc. I Sem	**Fish Introduction and Culture (Major)**	**F1-FISH-1T**	**Unit -1** **Fish Introduction and Classification:** 1. Fisheries and its history 1.1. Importance of Fish and Fisheries and its history 2. Adaptation of Fishes for aquatic life 2.1 Morphological adaptations 2.2 Anatomical adaptations 2.3 Physiological adaptations 3. Classification (Berg) 3.1 Classification of Pisces up to its classes 3.2. Classification of class Elasmobranchii and Holocephali up to its order 3.3. Classification of class Dipnoi and Teleostomi up to its order **Unit-2** **Identification and characteristics of Common Fishes** **1.** Identification 1.1. Basic Morphological characters of Fishidentification **2.** Fresh water Edible Fishes: Systematic position,Habit, Habitat, Characteristics and Economic Importance of- *2.1.* Major Carps: *Catla catla, Labio rohita, Cirrhinus mrigala,Cyprinus carpio* *2.2.* Minor Carps:*Labeo fimbriatus, Cirrhinus reba* *2.3.* Live Fishes:*Heteropneustes fossilus, Clarias batrachus, Channa punctatus, Channa marulius, Anabas testudineus* *2.4.* Cat Fishes:*Mystus singhala, Mystusaor, Pungasius pungasius* *2.5.* Miscellaneous:*Notopterus notopterus, Mastacembalus armatus* **Unit-3** **Carp Culture** 1. Carp Culture 1.1. Importance 1.2. Quality of culturable fishes 1.3. Species for composite fish culture	

			2. Types of Ponds 2.1. Breeding pond 2.2. Nursery Pond 2.3. Rearing Pond 3. Maintenance of Ponds 3.1. Preparation and manuring of ponds 3.2. Maintenance of temperature and **pH** 3.3. Maintenance of hardness, turbidity, alkalinity and dissolved oxygen **Unit-4** **Plankton, Aquatic Plants and Other Fishes** 1. Plankton 1.1. Definition of plankton 1.2. Types of zooplankton 1.3. Types of Phytoplankton 1.4. Plankton and their role in Fish culture 2. Aquatic plants of Fish Pond 2.1. Important aquatic plants 2.2. Importance of aquatic plants 3. Predatory and Weed Fishes 3.1. Predator Fishes 3.2. Weed Fishes 4. Exotic Fishes 4.1. Types of Exotic fishes 4.2. Importance of Exotic fishes 5. Larvivorous Fish 5.1. Larvivorous Fish species 5.2. Importance of Larvivorous Fish **Unit – 5** **Aquarium and its Maintenance** 1. Aquarium 1.1. Introduction and Importance of Aquarium 1.2. Types of Aquarium 2. Requisition for Fabrication of Aquarium 3. Aquarium Fishes 4. Aquatic plants 5. Breeding of Aquarium Fishes 5.1. Caring of eggs and young-ones 5.2. Breeding of Gourami and Gold Fishes	

B.Sc. I Sem	**Fish Introduction and Culture (Minor)**	**F1-FISH-2T**	**Unit -1** **Fish Introduction and Classification:** 2. Fisheries and its history 1.2. Importance of Fish and Fisheries and its history 2. Adaptation of Fishes for aquatic life 2.1 Morphological adaptations 2.2 Anatomical adaptations 2.3 Physiological adaptations 3. Classification (Berg) 3.1 Classification of Pisces up to its classes 3.2. Classification of class Elasmobranchi and Holocephali up to its order 3.3. Classification of class Dipnoi and Teleostomi up to its order **Unit-2** **Identification and characteristics of Common Fishes** 2. Identification 2.1. Basic Morphological characters of Fishidentification **3.** Fresh water Edible Fishes: Systematic position,Habit, Habitat, Characteristics and Economic Importance of- *3.1.* Major Carps: *Catla catla, Labio rohita, Cirrhinus mrigala,Cyprinus carpio* *3.2.* Minor Carps:*Labeo fimbriatus, Cirrhinus reba* *3.3.* Live Fishes:*Heteropneustes fossilus, Clarias batrachus, Channa punctatus, Channa marulius, Anabas testudineus* *3.4.* Cat Fishes:*Mystus singhala, Mystusaor, Pungasius pungasius* *3.5.* Miscellaneous:*Notopterus notopterus, Mestacemballus armatus* **Unit-3** **Carp Culture** 2. Carp Culture 1.4. Importance 1.5 Quality of culturable fishes 1.6 Specie s for composite fish culture 4. Types of Ponds 4.1. Breeding pond 4.2. Nursery Pond 4.3. Rearing Pond 5. Maintenance of Ponds 5.1. Preparation and manuring of ponds	

			5.2. Maintenance of temperature and **pH** 5.3. Maintenance of hardness, turbidity, alkalinity and dissolved oxygen **Unit-4** **Plankton, Aquatic Plants and Other Fishes** 2. Plankton 2.1. Defintion of plankton 2.2. Types of zooplankton 2.3. Types of Phytoplankton 1.4. Plankton and their role in Fish culture 6. Aquatic plants of Fish Pond 2.1. Important aquatic plants 2.2. Importance of aquatic plants 7. Predatory and Weed Fishes 3.1. Predator Fishes 3.2. Weed Fishes 8. Exotic Fishes 8.1. Types of Exotic fishes 8.2. Importance of Exotic fishes 9. Larvivorous Fish 9.1. Larvivorous Fish species 9.2. Importance of Larvivorous Fish **Unit – 5** **Aquarium and its Maintenance** 6. Aquarium 6.1. Introduction and Importance of Aquarium 6.2. Types of Aquarium 7. Requisition for Fabrication of Aquarium 8. Aquarium Fishes 9. Aquatic plants 10. Breeding of Aquarium Fishes 5.1. Caring of eggs and young-ones 5.2. Breeding of Gourami and Gold Fishes	
B.Sc. II Sem	**Anatomy and Biology of Finfish (Major)**	**F2-FISH-1T**	**Unit-1** **Anatomy and biology of finfish:** **1. Historical background & fishery science** 1.1. Historical background of fishery science 1.2. Importance of fishery sciences	

			2. Internal anatomy of fin fish 2.1. Introduction to anatomy 2.2. Functions of different internal organs 2.3. Positions of different organs **3. Integument of fish** 3.1. Structure and function of skin or integument 3.2. Histology of integument **4. Scales of fishes** 4.1. Development of placoid scales 4.2. Structure of placoid scales 4.3. Structure of non-placoid scales **Unit-2** **Locomotion, skeletal system & digestive system** **1. Locomotion** 1.1. Types of fins 1.2. Mechanism of locomotion **2. Skeletal system (Teleost fish)** 2.1. Axial Skeleton: vertebral column, skull 2.2. Appendicular skeleton: pectoral girdle, pelvic girdle **3. Digestive system and associated digestive glands of teleost.** 3.1. Alimentary canal (eg Labeo) 3.2. Digestive glands (eg Labeo) **Unit-3** **Respiratory system in fishes** **1. Gill's structure and types** 1.1. Holobranch, hemi branch and pseudo branch 1.2. Structure and functions of gills 2.1. Modifications in skin, buccopharynx, alimentary canal, air bladder and opercular cavity. 2.2. Origin & significance of air breathing organs. **3.Circulatory system of teleost:** 3.1. Structure and function of heart 3.2. Afferent and efferent branchial vessels **4.Circulatory system of scoliodon:** 4.1. Structure of heart 4.2. Difference between teleostean and elasmobranch heart	

			Unit-4 **Nervous system in fishes:** **1. Nervous system:** 1.1. Structure of brain 1.2. Structure of spinal cord 1.3. Cranial and spinal nerves **2. Excretory system** 2.1. Structure of kidney 2.2. Types of kidney 2.3. Structure and function of nephron 2.4. Difference between nephron of fresh water and marine fishes **Unit-5** **Reproductive system, parental care** 1. Reproductive system of elasmobranch (Scoliodon) and teleost (Labeo)fishes 1.1. Male reproductive system 1.2. Female reproductive system 2. Breeding 2.1. Maturations 2.2. Spawning 2.3. Fecundity and gonadosomatic index 3. Fertilization 3.1. Development 3.2. Hatching 4. Age and growth determination 5. Parental care 5.1. Direct 5.2. Indirect	
B.Sc. II Sem	**Anatomy and Biology of Finfish (Minor)**	**F2-FISH-21**	**Unit-1** **Anatomy and biology of finfish:** **5. Historical background & fishery science** 1.3. Historical background of fishery science 1.4. Importance of fishery sciences **6. Internal anatomy of fin fish** 2.4. Introduction to anatomy 2.5. Functions of different internal organs 2.6. Positions of different organs. **7. Integument of fish**	

			3.3. Structure and function of skin or integument. 3.4. Histology of integument. **8. Scales of fishes** 8.1. Development of placoid scales. 8.2. Structure of placoid scales. 8.3. Structure of non-placoid scales. **Unit-2** **Locomotion, skeletal system & digestive system** **4. Locomotion** 4.1. Types of fins. 4.2. Mechanism of locomotion. **5. Skeletal system (Teleost fish)** 5.1. Axial Skeleton: vertebral column, skull. 5.2. Appendicular skeleton: pectoral girdle, pelvic girdle. **6. Digestive system and associated digestive glands of teleost.** 6.3. Alimentary canal (eg Labeo) 6.4. Digestive glands (eg Labeo) **Unit-3** **Respiratory system in fishes** **2. Gill's structure and types** 2.1. Holobranch, hemi branch and pseudo branch. 2.2. Structure and functions of gills. 2.3. Modifications in skin, buccopharynx, alimentary canal, air bladder and opercular cavity. 2.4. Origin & significance of air breathing organs. **5.Circulatory system of teleost:** 5.1. Structure and function of heart. 5.2. Afferent and efferent branchial vessels. **6.Circulatory system of scoliodon:** 6.1. Structure of heart. 6.2. Difference between teleostean and elasmobranch heart. **Unit-4** **Nervous system in fishes:** **3. Nervous system:** 3.1. Structure of brain. 3.2. Structure of spinal cord.	

			3.3. Cranial and spinal nerves. **4. Excretory system** 4.1. Structure of kidney. 4.2. Types of kidney. 4.3. Structure and function of nephron. 4.4. Difference between nephron of fresh water and marine fishes. **Unit-5** **Reproductive system, parental care** 6. Reproductive system of elasmobranch (Scoliodon) and teleost (Labeo)fishes 6.1. Male reproductive system. 6.2. Female reproductive system. 7. Breeding. 7.1. Maturations. 7.2. Spawning. 7.3. Fecundity and gonadosomatic index. 8. Fertilization. 8.1. Development. 8.2. Hatching. 9. Age and growth determination. 10. Parental care. 10.1. Direct. 10.2. Indirect.	
B.Sc. IInd Year	**Aquaculture Fish Disease & Prawn Culture**	**213 - I**	**Unit – I** i) Aquaculture - Definition, History, Scope and Importance. ii) Status of aquaculture in different countries with special reference to India. iii) Monoculture. iv) Composite fish culture. v) Construction and maintenance of fish farm. vi) Pearl culture. **Unit – II** i) Semi-intensive and intensive fish culture. ii) Air-breathing fish culture. iii) Pen culture. iv) Cage culture. v) Sewage fed fish culture. vi) Dry & wet bundh techniques, Induced breeding hypophysation techniques.	

			Unit – III i) Food of fishes (Basic food, secondary food, incidental food, obligatory food, artificial and natural food) ii) Feeding habits of spawn, fry and fingerlings. iii) Food and feeding habits & its analysis. iv) Stimuli of feeding. v) Food quality. **Unit – IV** i) Symptoms of fish disease. ii) Fungal diseases. iii) Bacterial diseases. iv) Protozoan diseases. v) Viral diseases. vi) Diseases caused by Helminthes, Annelids and Crustaceans. **Unit – V** i) Distribution and identification of important commercial species of prawn. ii) Breeding and culture of fresh water prawns. iii) Polyculture of prawn. iv) Production of prawn seed (In Hatchery). v) Nursery and rearing pond management for Prawn culture. vi) Life cycle of fresh water prawn.	
B.Sc. IInd Year	**Aquarium fishes, Ichthyology & Post harvest techniques**	**213 - II**	**Unit – I** i) Design and Construction of home aquarium with special reference to material used, wooden and metal frames, frame less tanks, sealants and gums etc. ii) Design and construction of public freshwater and marine aquaria. iii) Design and construction of public Brackish water aquaria. iv) Selection of aquarium fishes. v) Taxonomy and biology of fresh water aquarium fishes. vi) Taxonomy and biology of marine water aquarium fishes. **Unit – II** i) Cleaning of aquarium. ii) Maintenance of water quality in aquarium. iii) Heating and Lighting. iv) Filtration in aquarium. v) Equipments related to aquarium – Aerator, Filters, Hand nets, thermometer and others. vi) Setting of aquarium – Use of gravel/ pebbles, plants, ornamental objects.	

			Unit – III i) Origin and evolution of fishes. ii) Fish design and locomotion in fishes. iii) Electric organ of fishes. iv) Accessory respiratory organs of fishes. v) Fecundity of cultivable fish species. **Unit – IV** i) Hill stream adaptation in fishes. ii) Migration in fishes. iii) Parental care in fishes. iv) Poisonous and venomous fishes. v) Air bladder and its functions. **Unit – V** i) Principle and importance of fish preservation. ii) Fish decomposition (spoilage). iii) Traditional and advanced methods of fish preservation including their merits and demerits – Sun drying, Salting, Pickling, Smoking, Chilling, Frying and Canning. iv) Processing and preservation of fish. Fish meal, fish oils, fish glue, fish flour, fish mince, fish manure, fish protein, fish roe, fish isinglass etc.	
B.Sc. III Year	**Fisheries Economics & Extension Education**	**313 - I**	**Unit – I** i) Biochemical composition of raw fishes. ii) Nutritional value of raw fish, preserved fish and processed fish. iii) Sanitation in fish processing plants. iv) Quality control of fresh and processed fish and fishery products. v) Characteristics of fish goods and their valuation. **Unit – II** i) Fish marketing system. ii) Factors affecting fish marketing. iii) Important fresh water food fishes. iv) Important marine water food fishes. **Unit – III** i) Planning and financing schemes for fisheries. ii) Role of fishery extension community development.	

			iii) Transportation of Fishes. iv) Fishery Co-operatives – aims, principle, legal status. **Unit – IV** i) Overseas markets for diversified products. ii) Govt. assistance in fisheries sector. iii) Normal cost structure of fish marketing channel and stages of fish marketing, flow of fish products and money. iv) Career opportunities in fisheries. **Unit – V** i) Economics of Fish Farm. ii) Role of Fisheries Sector in India's Economic Development. iii) Extension education (objective & principles). iv) Fish Farmer development agencies. v) Marine product export development authority of India.	
B.Sc. III Year	**Limnology and Fish Productivity**	**313 – II**	**Unit-1** i) Limnology – Definition, historical development and scope. ii) Lakes their origin and classification. iii) Types of Ponds. iv) Physical parameters of water. v) Chemical parameters of water. **Unit-2** i) Primary productivity of Fish pond and their relation to Fish culture. ii) Plankton and its role in fish culture. iii) Aquatic weeds and their control. iv) Ecological classification of aquatic fauna higher aquatic plants and their significance. v) Aquatic macrophytes. **Unit-3** i) Methods of water quality testing BOD and COD.	

			ii) Sewage – Definition, composition and its treatment. iii) Reservoir Fisheries. iv) Freshwater Ecosystem. v) Azolla and Aquaculture. **Unit-4** i) Various morphometric parameters and zonation of sea and lake. ii) Lentic Fisheries resources of India. iii) Lotic fishery resources of India. iv) Role of oxygen in freshwater. v) Larvivorous fishes and their relation to public health. **Unit-5** i) Aquatic pollution causes and types. ii) Common effect of aquatic pollution on fish fauna and flora. iii) Predatory Fishes. iv) Fish production in pond and its management. v) Indian cultivable fishes and their crop potential in India.	

M.Sc. Fisheries 2021-22 Syllabus

1.1.3 Details of Course offered by the institution that focus on employability/internship/skill development during the year

	Name of the course	Course code	Activities/Content with a direct bearing on Employability/ Entrepreneurship/ Skill development	Link to the relevant document
M.F.Sc. I Sem	Paper - 1 Finfish and Shellfish Biology	F-11	**Unit-I : Diversity and Distribution** 1) Diversity and distribution of freshwater and marine fishes, crustaceans and molluscs. 2) Morphometric and meristic characters of fishes, crustaceans and molluscs. 3) General account of agnatha, holocephali and diponi. 4) Determination of age, growth and length-weight relationship in fishes. Migration in fishes and Adaptation in Fishes. **Unit-II : Digestive System** 1) Structure and physiology of digestive system and associated glands of fishes and prawns. 2) Food and feeding habits of fishes and prawns. 3) Qualitative and quantitative estimation of gut contenes, gestro-somatic and hepato-somatic indices in fishes. 4) Digestion of carbohydrates, proteins and lipids in fishes. **Unit-III : Respiratory and Circulatory System** 1) Structure and physiology of respiratory system of fish and prawns. 2) Accessory respiratory organs in fishes. 3) Structure and physiology of circulatory system of fishes and prawns. 4) Structure of blood of fishes and its function. **Unit-IV: Reproductive System and Excretory System** 1) Structure and physiology of reproductive system of fishes and prawn Reproductive Behavoiur of fishes, Sex determination in Fishes.	

			2) Gonado-somatic index, gametogenesis, ovulation, fertilization and embryonic and post-embryonic development in fishes and prawns. 3) Structure and Physiology of Excretory system of fishes and prawns. 4) Osmoregulation and its endocrine control in fishes **Unit-V : Nervous System and Endocrine glands** 1) Structure and function of nervous system and sense organs in fishes and prawns. 2) Structure and function of endocrine glands of fishes and Neuroendocrine system of Prawns. 3) Webarian ossicles and sound production in fishes. 4) Biorhythms-circadian, circannual, lunar, tidal. Ecological significance of biorhythms and bioluminescence in fishes.	
M.F.Sc. I Sem	Paper – 2 Fish breeding and hatchery technology.	F-12	**Unit-I: Broodstock Management** 1)Role of extrinsic and intrinsic factors in the regulation of fish and prawn reproduction. 2)Maintenance of brooders and maturity assessment in fishes and prawns. 3)Transportation of broodstock of fish and prawns. 4)Use of special diets for broodstock development. 5)Hormones and anesthesia used in fish and prawn breeding. **Unit-II: Breeding Technology** 1)Induced breeding in fishes (Dry bundh, Bangla bundh, Hypophysation, stripping etc.) 2)Various synthetic compounds, their chemical composition and mechanism of action in fish breeding. 3)Evaluation of carp milt, volume of milt, spermatocrit value, sperm count value, motility value, utilization of cryopreserved milt. 4)Hybridization in fishes, its merits and demerits. **Unit-III: Hatchery Technology**	

			1)Site selection and construction of fish and prawn hatcheries. 2)Types of hatcheries and their operation. 3)Construction of tanks and their management. 4)Stocking density, survival rate and harvesting of post-larvae 5) Transportation of fish and prawn seed. **Unit IV: Water Quality Management** 1) Source of water: river, reservoir and underground water. 2) Aeration: Types of aeration, their advantages and disadvantages. 3) Monitoring of water quality for hatchery operation and larval rearing of fish and prawn. 4) Nutritional requirement of fish larvae in relation to water quality. 5) Measures to check disease in hatcheries. **Unit-V: Ornamental Fishes** 1) Types of ornamental fishes (freshwater and marine), their breeding behavior and biology. 2) Oviparous, ovo-viviparous and viviparous fishes, parental care. 3) Maintenance of brood fish, various methods of breeding of aquarium fishes. 4) Aquarium manufacturing and their accessories. Setting and maintenance of freshwater and marine aquria.	
M.F.Sc. I Sem	Paper – 3 Aquaculture	F-13	**Unit-I : Aquafarm Engineering** 1) Definition, history and scope of Aquaculture. 2) Selection of site, designing, layout and construction of aquafarms, soil properties, types of ponds, orientation, shape, size and depth of ponds, design of embankments, water supply and drainage system- open channels, inlet structures, drainage and sluices. 3) Design and construction of hatcheries – carp hatcheries, prawn hatcheries, catfish hatcheries; physical, biological and mechanical filters. 4) Aeration – principles, requirements, types and designs of aeration equipment.	

			5) Aquaculture apparatus – pumps, (types, design and selection of pumps), automatic feeders, demand feeders and weed control apparatus. **Unit-II : Pond Management** 1) Preparation and management of nursery, rearing and stocking ponds. 2) Types of Aquatic weeds, algal blooms, insects, predatory and weed fishes and their control. 3) Fertilizers – types, (organic, inorganic and biofertilizers) doses and methods of their application. 4) Feeding strategies and growth monitoring. 5) Physic-chemical parameters and their importance in relation to fish health monitoring. **Unit-III : Freshwater Aquaculture** 1) Culturable species of fish and shellfish. Identification of different developmental stages of finfish and shellfish of commercially important species. 2) Methods of carp culture – history, present status and global scenario. Status of carp culture in India. 3) Methods of catfish culture – present status, global scenario and problems and prospects of catfish culture, culture of Magur and Singhi in India. 4) Methods of coldwater fish culture – present status and global scenario of coldwater fish culture, culture of trout and mahaseer in India. 5) Methods of prawn culture – present status and global scenario of *Macrobrachium rosenbergii* and *M. malcolmsonii* culture. **Unit-IV : Mariculture** 1) Brackishwater culture in India, culturable species of finfish and shellfish and their seed production. 2) Mariculture in India, culturable species of finfish and shellfish and their seed production.	

			3) Extensive, modified extensive, semi-intensive, intensive and super-intensive shrimp culture. 4) Fish culture in Lagoons (Pulicat and Chilka) and backwaters. 5) Propagation of seaweeds of commercial importance. (*Glasilaria, Sargasum,* red algae etc.) **Unit-V :Aquaculture System** 1) Culture System – mono, poly and composite; semi-intensive, intensive, super-intensive, cage, pen and raceway cultures. 2) Integrated fish culture – paddy/cattle/poultry/duck/piggery-cum-fish culture etc. and their role in the development of rural economy. 3) Sewage – fed – fish culture – quality of sewage, sewage treatment, fish species, culture methods and constraints. 4) Pearl culture – pearl forming species (Oysters and mussels), nature and artificial pearl formation. 5) Design and construction of cages, pens, flow-through and recirculatory systems.	
M.F.Sc. I Sem	Paper – 4 Fish Nutrition and Feed Technology	F-14	**Unit-I : Biomolecules** 1) Carbohydrates – monosaccharide's, polysaccharides, oligosaccharides, their structure and functions. 2) Lipids – fatty acids, phospholipids, cholesterol and steroids, their structure, functions, oxidation and synthesis. 3) Proteins – amino acids their structure and functions. 4) Nucleic acids – Purines and pyramidines, their structure and functions. 5) Enzymes – classification, structure, functional relationship, kinetics, inhibitors, ecoenzymes and co-factor. **Unit-II : Nutritional Requirements** 1) Carbohydrates – source and functions, gross energy requirement and factors altering energy requirements. 2) Lipids – sources and functions, essential fatty acids, phospholipids and steroids lipids requirements, negative aspects of lipids.	

			3) Proteins – source and functions, nitrogen balance, amino acids and their quantitative requirements. 4) Vitamins – water and fat soluble vitamins, functions, deficiency, hypo and hyper-vitaminosis. 5) Minerals – importance, deficiency and hyper dosage syndromes. 6) Nutritional requirements of larvae, adults and broodstock. **Unit-III : Feed Formulation** 1) Feed formulation strategies and methods, types of feed and their ingredients, (conventional and non-conventional). 2) Antinutritional factors in feed ingredients and their effects on finfish and shellfish, methods of removal of antinutrients. 3) Binders, antioxidents, attractants, mould inhibitors and anabolic agents. 4) Formulation of feed for larvae, fry, fingerlings, adult and brood stock. 5) Micro-particulate and micro-encapsulated diets. 6) Formulation of nutritionally balanced and cost effective diets. **Unit-IV : Feed Manufacture** 1) Feed manufacture process – types of machinery, feed mills and their management. 2) Processing and manufacture of different types of feeds. 3) Farm made aqua feeds, probiotics. 4) Extrusion feed technology – principles, machineries and processing. 5) Quality control, feed storage, feeding strategies, ration and frequency and dispensing methods. **Unit-V : Live Feed Culture** 1) Natural food organisms, their culture and importance. 2) Azolla culture – taxonomy and distribution, composition, environmental factors, growth and production and its role as a biofertilizer.	

			3) Rotifer culture – methods, media, species, factors affecting production and its applications. 4) Artemia culture – taxonomy, distribution, collection method, lifecycle and culture. 5) Microalgal culture – methods, culturable species (*Spirulina, Chlorella, etc.)*, factors affecting production and its application.	
M.F.Sc. II Sem	Paper - 1 Fisheries Resource Management	F-21	**Unit-I : Inland Fisheries Resources** 1) Inland fisheries resource of India and scope for their exploitation and production. 2) River systems – Major river systems (Ganga, Brahamputra,Indus, Narmada, Tapti, East and West coast rivers) and their fisheries. 3) Lakes – Origin, classification, distribution, ecology and fisheries with special reference to Upper and Lower lakes, Dal lake and Bhimtal. 4) Reservoirs – Large, medium and small reservoirs of India (Govind Sagar, Hirakund, Mettur, Rehand and Nagarjuna Sagar), their ecology and fisheries. Fish ways, fish passes and fish ladders, measures to increase the production of reservoirs. 5) Recent advancements in reservoir management and present status of reservoirs of M.P. (Newly constructed Reservoirs of Narmada,Gandhi Sagar, Tawa, Bargi, Halali). **Unit-II : Brackishwater Fisheries Resources** 1) Brackishwater resources of India and scope for their exploitation and production. 2) Brackishwater lakes (Chilka and Pulicat), their ecological characteristics (soil, water and biota) and fisheries. Impact of Aquatic pollutions on fish health and fisheries with special reference to Ganga and Narmada rivers and Chilka lake. 3) Estuaries – Origin, distribution and classification, scope for exploitation and production. 4) Fisheries of estuaries – Hoogly-Matlah, Godavari, Krishna, Adyar and Vellar. 5) Backwater fisheries with special reference to Kerala.	

			Unit-III : Marine Fisheries Resources 1) Marine fisheries resources, scope for their exploitation and production. 2) Coastal capture fisheries – inshore and offshore fisheries of Indian ocean. Exclusive Economic Zone (EEZ). 3) Fisheries of important finfishes – Sardine, Indian mackerel, Bombay duck, Tuna, Pomfret, Perches and Mullets. 4) Fisheries of important shellfishes – Shrimps (white & tiger), Lobsters, Crabs and Molluscs (Pearl oysters and edible oysters). 5) Fisheries of minor groups of fishes – Eels, catfishes, silver bellies, ribbon fishes, seer fishes, elasmobranches and soles. **Unit-IV : Coldwater Fisheries Resources and Remote Sensing** 1) Important coldwater fishes of India (indigenous and exotic) and their distribution. 2) Mahaseer and trout fisheries and their importance. 3) Remote sensing – Concepts and principles, Remote sensing sensors. Optical methods. 4) Satellite measurements of temperature (via. Thermal I.R.). Visual interpretation of remotely sensed data and interpretation of microwave measurements (geographic currents, waves and surface winds). **Unit-V : Fisheries resource Management and Conservation** 1) Anthropogenic activities and their effects on fisheries. 2) Threatened and endangered fish species of India. 3) Measures for management and conservation. 4) Laws for safeguarding biodiversity and management.	
M.F.Sc. II Sem	Paper – 2 Harvest And Post Harvest Technology	F-22	**Unit-I : Fishing Crafts** 1) Different types of traditional and mechanical vessels and their operations. 2) Fishing craft materials (wood, steel, FRP and ferrocement), boat designing, construction and maintenance, prevention from fauling and wood borers.	

			3) Different types of deck equipment (derricks, boom, Gallows blocks), lifting gears (winches, power block, hauler, wire rope etc.). 4) Fish finding equipment (sonar, ecosounder, ecofinder, net zoned) and application of satellite imaging, inboard and outboard motors (OBM) and their operations. 5) Basic principles of navigation and seamanship. Reading tide tables, compass and signaling. Use of radar and radio telephone, global positioning system (GPS). **Unit-II : Fishing Gears** 1) Different types of gear materials – twine, rope, yarn, mesh size regulation. 2) Design and fabrication of fishing gears. 3) Principles and operations of different gears of inland water (hook and line, gill net, drag net, cast net and fishing traps). 4) Principles and operations of different gears of marine water (Shore seine, purse seine, boat seine, trawl net and jigging), modernization of fishing methods; Turtle Exclusive Device (TED). **Unit-III : Biochemical Composition and Fish Spoilage** 1) Chemical composition of fish and shrimp – moisture, ash, carbohydrates, proteins and lipids and their estimation. 2) Rigor mortis – freshness test, biochemical change and spoilage. 3) Role of microbes in food spoilage, microbial analysis of (*Vibrio, Salmonella,Shigella, Staphylococcus etc.*) *fish and fish products.* 4) Fish food poisoning – characteristics and chemical features of food poisoning caused by *Vibrio, Salmonella, Brucella, Shigella and Staphylococcus sp.* 5) Study of psychrophyllic and mesophyllic microbes (bacteria and fungi) of processed fish and fish products. **Unit-IV : Preservation Technology**	

			1) Methods of fish preservation – drying, smoking, chilling, freezing, salting and canning. Handling and transportation of fresh fish. 2) Methods of ice production, storage and calculation of ice requirement for fish storage. 3) Freezing methods – Air-blast, plate freezer and cryogenics, freezing curve, flow chart, grading, packing and storage of frozen products, drip loss and thawing of frozen fish. 4) Canning – with special reference to tuna, mackerel etc., types of cans, polypacks and bases (brine, oil, sauce etc.), canning of freshwater fish. **Unit-V : Quality Assurance** 1) Composition of the muscle proteins and their role in emulsification and elasticity formation. Factors influencing elasticity formation and theories of gel formation. 2) Minced meat from different varieties of freshwater and marine fishes. Improvement of colour of meat by blanching and certain additives. 3) Value added prodects – fish fingers, fish flakes, soup, powder, breaded and battered minced products etc. 4) Byproducts – fish meal, fish oil, isinglass, fish finrays, chitosan, surgical sutures and other byproducts. 5) Standards of sanitation and hygiene, concepts of food safety in fish industry. Hazard Analysis and Critical Control Point (HACCP). Quality control system, various national and international standards on fishery products (BS-5750 and ISO 9000).	
M.F.Sc. II Sem	Paper – 3 Aquatic Biology	F-23	**Unit-I : Freshwater and Marine Ecology** 1) Definition, principles and role of ecology in Aquatic ecosystem. 2) Abiotic and biotic characteristics of freshwater, brackishwater and marine environment. 3) Adaptations in fishes. 4) Oceanography in relation to fishery science.	

			5) Chemical composition of seawater, waves, tides and influence of tides on fishery. **Unit-II : Productivity** 1) Primary productivity, gross and net productivity, qualitative and quantitative analysis of plankton. 2) Plankton and their role in Aquatic ecosystem in relation to fisheries. 3) Benthos and macrovegetations – types and their role in Aquatic ecosystem. 4) Methods of collection, preservation and identification of major types of benthos and macrovegetations of freshwater. **Unit-III: Trophic Dynamic Ecology** 1) Energy flow, ecological efficiency, ratios within trophic levels, organic particulate matters and their role in productivity. 2) Influence of physical factors of the sea on the transformation of matter in marine environment. 3) Food web structure, utilization and transfer of energy from one trophic level to other. 4) Food conversion and its application to ecology. 5) The biomass and trophic dynamism in pelagic communities. **Unit-IV : Aquatic Microbiology** 1) Types of microbes – non-cellular, prokaryotic and eukaryotic microbes and their structure. 2) Isolation, culture and identification techniques of microbes and their enumeration methods (SPC, MPN, TCC and biomass determination). 3) Microbial physiology – Diffusion, osmosis, transport (active and passive) and group translocation, microbial nutrients and culture media (Natural, synthetic and differential media). 4) Factors affecting growth of microbes, population growth curve, its mathematical expression and microbial control (physical and chemical).	

			5) Cynobacteria and antagonistic characteristics of microbes and their evaluation. **Unit-V : Aquatic Pollution** 1) Waste waters and their treatment (Primary, Secondary and Tertiary). 2) Determination of Biological and Chemical Oxygen Demand (BOD & COD). 3) Pollutants- Sewage, pesticides, oils, metals, radioactive wastes, Biomedical wastes etc. Common transport processes of pollutants in Aquatic Environment, dispersal of pollutants, algal blooms and their management. Methods of pollution surveys. 4) Biodegradable materials (cellulose, hemicelluloses, lignin, xenobiotics and recalcitrant) and their degradation. 5) Types of pollutions and measures for their abatement.	
M.F.Sc. II Sem	Paper – 4 Fish Health Management	F-24	**Unit-I : Disease Diagnosis** 1) Stress Physiology: stress response, stress hormones and stress adaptations in fishes. 2) Epizootiological, post-mortem and clinical diagnosis. 3) Bacteriological methods of fish disease diagnosis. 4) Mycotic methods of fish disease diagnosis. 5) Histopathological, immune-histopathological and haematological methods of fish disease diagnosis. **Unit-II : Non Infectious Disease** 1) Nutritional fish diseases – symptoms, diagnosis and remedial measures. 2) Neoplastic fish diseases – classification, origin, diagnosis, types and factors involved and their possible control. 3) Protozoan fish diseases – symptoms, classification, distribution, life cycle of potent parasitic fish protozoans and their remedial measures. 4) Crustacean fish diseases – symptoms, classification, distribution and life cycle of potent crustacean parasites and their remedial measures.	

			5) Helminth fish diseases – symptoms, classification, distribution and life cycle of potene parasitic fish helminthes and their remedial measures. **Unit-III : Microbial Disease** 1) Viral pathogens of finfish and shellfish, their general biology and taxonomy, isolation and identification. 2) Bacterial fish diseases – bacterial pathogens, their characteristics and distribution, symptoms, prophylactic and therapeutic measures. 3) Fungal fish diseases – mycotic pathogen and their characteristics, life cycle of potent Aquatic fungi, symptoms prophylactic and therapeutic measures. 4) Microbial and parasitic diseasesb of shellfish and their control. 5) Aquatic pathogens in relation to human health (zoonosis) EUS and WSS. 6) Mode of transmission of microbial diseases. **Unit-IV : Fish Immunology** 1) Immune system – Non-specific (innate immune response) and specific immune systems, cellular and molecular interaction. 2) Structure, type and function of fish immunoglobulin and theories of antibody formation. 3) Antigenicity, precipitation, agglutination, immobilization and autoimmunity. 4) Hybridoma technology – mono and polyclonal antibodies and their applications, antagonism and antimicrobial agents. 5) Haematopoetic tissue, primary and secondary lymphoid organs, inflammation, encytation and granuloma formation. **Unit-V : Fish Vaccination** 1) General principles of fish vaccination and optimizing factors for vaccination.	

			2) Strategies for fish vaccination, production of non-adjuvant (live or dead), vaccines and their applications, route of vaccine administration. 3) Adjuvants – present scenario of adjuvants and their role in immunomodulation of fish, production of adjuvant vaccine. 4) Present status and future prospects of phage therapy in Aquaculture.	
M.Sc. III Sem	Paper -1 : Fisheries Economics and Marketing	F-31	**Unit – I** 1. Nature and Scope of natural resource economics. 2. Bio-economics, analysis of fisheries Growth, Development, and natural resource interrelationships. 3. Pricing and optimal resource use over time under different market situation. 4. Role of market structure, interest rate and property rights in fisheries exploitation. **Unit – II** 1. Fishery resource management policies – markets, taxes, subsidies. 2. Permits, direct controls. Distributional effect of fisheries development. 3. Nature and Scope of aquaculture economics. 4. Production principles, Factor effecting product, cost principles. **Unit – III** 1. Product- product and law of comparative advantage. 2. Law of equimarginal returns, returns to scale and farm size. 3. Homogeneous production, functions, cobb Douglas and quadratic production functions. 4. Risk and uncertainty, strategies for meeting risks and uncertainty. **Unit – IV** 1. Economics of intensive, semi intensive aquaculture 2. Role of Marketing in fisheries and aquaculture Markets over space in tramarket price relationships. 3. Market structure, conduct and performance. 4. Developing marketing mix product, pricing, place and promotion. Fisheries marketing orgtanization.	

			Unit – V 1. Nature and scope of socio-economic analysis. 2. Meaning and measurement of socio-economic variables. 3. Factors determining development. 4. Role of sociology in the process of fisheries development, study of socio-economic problems.	
M.Sc. III Sem	Paper -2 : Basics of Computer Application	F-32	**Unit – I** 1. History of Computer 2. Types of computers – Mini and mainframes. 3. Computer Generations. 4. Concept of input, Processing and output. **Unit – II** 1. Input, Output Devices. 2. Introduction of Operating Systems. 3. MS DOS and its command. 4. Window Operating Systems. **Unit – III** 1. Introduction to MS Office. 2. MS Word. 3. MS Excel. 4. MS PowerPoint. **Unit – IV** 1. Computer Network and it's Types. 2. Network Topology. 3. Network devices and Types of Connection. 4. Types of Communication Media. **Unit – V** 1. Application of Computerized information and data analysis in Fisheries.	

			2. Introduction to E-mail and Internet. 3. Binary Number System. 4. Introduction of Web Pages Websites.	
M.Sc. III Sem	Paper -3(a): Ecotoxicology & Pollution	F-33	**Unit – I** 1. Ecotoxicology- the study of pollutants in the ecosystems. 2. Effect on individual organisms, indicator species. 3. Prediction of ecological effects. 4. Experimental ecosystem modification, comprehensive ecosystems analysis. **Unit – II** 1. Monitoring effects of pesticides, oil, heavy metal, organic and inorganic waste on fishes, crustacean and molluscan. 2. Influence of environmental conditions on the toxicity of pollutants. 3. Acute toxicity & chronic toxicity problem. 4. Toxicity assessment with pesticides & heavy-metals. **Unit – III** 1. Pollution – Definition, Sources- sewage, industrial wastes, pesticides, oils, metals, thermal and others. 2. Effects of pollution on fish, shellfish and fish food organisms. 3. Pollution in Inland waters, estuaries and coastal environment and their management. 4. Study of different physico - chemical parameters and biota from polluted environments like sewage, industrial effluents. **Unit – IV** 1. Environmental hazard evaluation and prediction. 2. Aerobic and anaerobic decomposition of organic matter systems and their impact on nutrient regeneration. 3. Eutrophication due to sewage pollution, BOD and COD as tools to asses organic load of a systems. 4. Types of industrial effluents and their treatments.	

			Unit – V 1. Biological indicators of pollution in natural waters. 2. Infectious agents commonly present in polluted ecosystem. 3. Biomagnification and bioconcentration. 4. Biochemical pathway of degradation.	
M.Sc. III Sem	Paper -3(b): Ornamental Fisheries	F-OE	**Unit – I** 1. Aquarium and its various types. 2. Construction of Aquarium. 3. Setting up of Aquarium. 4. Importance of Aquarium Keeping. 5. Food of Aquarium fishes. **Unit – II** 1. Source of Water, pH, Temperature, Heater, Thermometer, Lighting. 2. Dissolved Oxygen and Carbon dioxide. 3. Water Hardness Buffering capacity, salinity Dissolved Solids etc. 4. Types of filters used in Aquarium. 5. Aquarium tools. **Unit –III** 1. Family Cyprinidae- Barbs, Zebra Fish, Gold Fish etc. **2.** Family Anabentidae – Betta Splendens, Colisa Fasciatus, Helostoma temminkii etc. 3. Family Characidae- Cardinal Tetra, Head and Tail light tetra, Spotted Metynnis etc . 4. Family Poecilidae- Poecilia reticulata, Poecilia latipinna, Xiphophorus hellen etc . 5. Family Pomacanthidae- Pomacanthus annularis, Pomacanthus chrysurus, Pomacanthus imperator etc. **Unit – IV** 1. Breeding of ornamental fishes.	

			2. Selection of species, factor responsible for successful breeding and spawning. 3. Breeding requirements. 4. Breeding techniques. **Unit – V** 1. Major disease of ornamental fishes. 2. Aquatic plants for ornamental fishes. 3. Algal control in Aquarium. 4. Snail control in Aquarium.	
M.Sc. III Sem	Paper -4(a): Environmental Pollution Fish & Fishery	F-34	**Unit – 1** 1. Pollution Ecology: definition. 2. Sources of pollution: classification of pollutants, primary and secondary pollutants. 3. Air pollution: definition, sources, air pollutants and its effects on human health and atmosphere, control of air pollution. 4. Water Pollution: definition and sources, water pollutants and its effects, control of water pollution. **Unit - 2** 1. Noise pollution, sources, physiological and psychological effects of noise pollution, control measures of noise pollution. 2. Land pollution: definition, sources, effects and control of insecticide pollution. 3. Radioactive pollution: definition, sources, effects and control measures of radioactive pollution. **Unit - 3** 1. Biomedical waste: sources, effects and control measures. 2. Hazardous waste: definition, sources, effects. 3. Biological and general effects of pollutants on organism.	

			4. Bioassay studies: definition , purpose, methodology, calculation of LC50 value, significance. **Unit – 4** 1. Biogeochemical cycles; carbon dioxide, Nitrogen and Phosphorus. 2. Bioaccumulation and biomagnifications. 3. Biotransformation of xenobiotics. **Unit – 5** 1. Aqua culture: basic concept of fisheries, marine, inland and brackish water fisheries. 2. Indian major carps and their culture. fish, seed resources, transport. 3. Planning and management of freshwater fish farm. 4. Fishery economics and management: role of fishery co -operative societies.	
M.Sc. III Sem	Paper -4(b): Ecology of Culture systems	F-OE	**Unit – I** 1. Physical characteristics of water. Role of temperature, salinity, light, turbidity depth and wind in coastal water-bodies. 2. Circulation and mixing patterns in ponds. 3. Density dependent factors and carrying capacity in aquatic systems. 4. Effects of monsoon on open sea and pond culture system. **Unit – II** 1. Chemical characteristic of water, coastal ecosystem analysis. 2. Carbon dioxide system, dissolved oxygen, hydrogen ion concentration. 3. Nitrogen and phosphorus cycles and organic cycling in coastal culture ecosystems. sediment :- water interactions. 4. Classification:- physical and chemical properties of soil/sediment, sedimentation process, alkalinity, hardness, COD, BOD.	

			Unit – III 1. Redox potential minerals and trace elements in culture ponds. 2. Primary and secondary production in coastal ecosystems. 3. Phytoplankton, benthic algae, primary production, estimation of primary production. 4. Pigment analysis, eutrophication, zooplankton, secondary production, limiting factors, ecological energetics and conversion ratio. **Unit – IV** 1. Microbiology of culture ecosystem, Classification of aquatic micro- organism, sampling, isolation and purification of major groups of microbes from culture systems. 2. Identification and enumeration of major microbial groups. 3. Types of bacteria, fungi, actinomycetes in culture system, growth and reproduction in bacteria. 4. Factors influencing microbial population, pathogenic bacteria, role of bacteria in regeneration of nutrient and hydrogen supplied production. **Unit – V** 1. Water quality management, nitrogen and ammonia toxicity, sledge accumulation. 2. Aerobic and anaerobic degradation of organic matter. 3. Sulphur cycle in pond bottom, effect of organic and inorganic fertilizers on pond productivity. 4. Optimum ecological factors and water quality management in culture systems.	
M.Sc. IV Sem	Paper -1: Fish Genetics And Biotechnology	F-41	**Unit – I** 1. Principles of genetics – Mendelism and gene inter actions. 2. Structure and evolution of fish chromosomes and Karyotypes. 3. Different techniques used in cytogenetics. 4. Sex linked genes, sex limited phenotypes. 5. Genetic Markers. **Unit – II**	

			1. Basic need for genetic improvement 2. Inbreeding and cross breeding- selection methods, basis of selection and its effects. 3. Hybridization in fishes. 4. Sex control, sex reversal, role of steroids in sex reversal. 5. Chromosomal manipulation – polyploidy, androgenesis, gynogenesis, cryopreservation of gametes. **Unit – III** 1. Principles of genetic engineering. 2. Recombinant DNA- construction of recombinant DNA gene cloning methods cloning vectors (plasmids, bacteriophage and cosmids) and restriction enzymes. 3. Isolation and synthesis of gene and gene transfer using vector and vectorless systems. 4. sequencing of nucleic acid by maxam gilbert and using sanger's method. 5. Southern, Northern and Western Blotting methods and PCR. **Unit – IV** 1. Isolation, purification and hybridization of DNA,RNA and their use in gene transfer. 2. Transgenic fish and shellfish – basic principles and their application in aquaculture. 3. Methods of gene transfer in sea urchin. 4. Mono sex culture. **Unit – V** 1. Introduction to cell culture, aseptic techniques and equipment required. 2. Cell – disaggregation and physical requirements for fish cell culture. 3. Primary cell culture, sub culture and fish cell line – advantages, disadvantages, characteristics and kinetics of fish cell lines and application of selected fish cell lines. 4. Culture media – serum, serum free and chemically defined media.	

M.Sc. IV Sem	Paper -2 Fish Nutrition and Feed Technology	F-42	**Unit – I** 1. Carbohydrates – monosaccharides, polysaccharides, oligosaccharides, their structure and functions. 2. Lipid – fatty acids, phospholipids, cholesterol and steroids their structure function oxidation and synthesis. 3. Proteins – amino acids their structure and function. 4. Nucleic acid – purines and pyrimidines their structure and function. 5. Enzymes – classification, structure, function relationship kinetics, inhibitors, coenzymes and co- factors. **Unit – II** 1. Lipids – Source and functions, essential fatty acids, phospholipids and steroids lipid requirements negative aspects of lipids. 2. Proteins – source and functions nitrogen balance, amino acids and their quantitative requirement. 3. Vitamins – Water and fat soluble vitamins, functions, deficiency, hypo and hyper vitaminosis. 4. Minerals: importance, deficiency and hyper dosage syndromes. 5. Nutritional requirements of larvae, adults and broodstock. **Unit – III** 1. Feed formulation strategies and methods, types of feed and their ingredients (conventional and non-conventional) 2. Antinutritional factors in feed ingredients and their effects on finfish and shellfish, methods of removals of antinutrients. 3. Binders, antioxidants, attractants, mould inhibitors and anabolic agents. 4. Formulation of feed for larvae, fry, fingerlings, adult and brood stock. 5. Formulation of nutritionally balanced and cost effective diets. **Unit – IV** 1. Feed manufacture processes – types of machinery, feed mills and their management. 2. Processing and manufacture of different types of feed. 3. Farm made aqua feeds, probiotics.	

			4. Extraction feed technology- principles, machinery and processing. 5. Quality control, feed storage feeding strategies ration and frequency and dispensing methods. **Unit – V** 1. Natural food organisms, their culture and importance. 2. Azolla culture – taxonomy and distribution, composition environmental factors, growth and production and its role as a biofertilizer. 3. Rotifer culture – methods, media, species, factors affecting production and its applications. 4. Artemia culture – taxonomy, distribution, collection methods, lifecycles and culture. 5. Microalgae culture – methods, culturable species spirulina, chlorella etc, factors affecting production and its applications.	
M.Sc. IV Sem	Paper -3(a): Fish Health Management	F-43	**Unit – I** 1. Principles of finfish and shellfish disease diagnosis. 2. Epizootiological, post- mortem and clinical diagnosis. 3. Bacteriological methods of fish disease diagnosis. 4. Mycotic mehods of fish disease diagnosis. 5. Histopathological, immuno – histopathological and hematological methods of fish disease diagnosis. **Unit – II** 1. Nutritional fish disease – symptoms, diagnosis and remedial measures. 2. Protozoan fish disease – symptoms, classification, distribution, life cycles of potent parasitic fish protozoans and their remedial measures. 3. Crustacean fish disease – symptoms, classification, distribution, and life cycles of potent crustacean parasites and their remedial measure. 4. Helminthes fish disease – symptoms, classification, distribution, and life cycles of potent crustacean parasites and their remedial measure. **Unit – III**	

			1. Viral pathogens of finfish and shellfish, their general biology and taxonomy, Isolation and Identification. 2. Bacterial fish disease – bacterial pathogens, their characterstics and distribution, symptoms, prophylactic and therapeutic measure. 3. Fungal fish disease – mycotic pathogens and their characteristic life cycle of potent aquatic fungi, symptoms, prophylactic and therapeutic measure. 4. Microbial, parasitic and shellfish diseases and their control. 5. Aquatic pathogens in relation to human health. **Unit – IV** 1. Immune system – non – specific (innate immune response) and specific immune systems, cellular and molecular interaction. 2. Structure, types and function of fish immunoglobin and theories of antibody formation. 3. Antigencity, precipitation, agglutination, immobilization and autoimmunity. 4. Hematopoietic tissue, primary and secondary lymphoid organs inflammation, encystation and granuloma formation. **Unit – V** 1. General principles of fish vaccination and optimizing factors for vaccination. 2. Strategies for fish vaccination, production of non – adjuvant (live or dead), vaccines and their applicatons, route of vaccine administration. 3. Adjuvants – present scenario of adjuvants and their role in immunomodulation of fish production of adjuvant vaccine. 4. Present status of and future prospects of phages therapy in aquaculture.	
M.Sc. IV Sem	Paper -3(b): Fishery technology and Fish pathology	F-OE	**Unit – 1** 1. Pond management (sitting construction and problems). 2. Gear and crafts in inland water. 3. Conservation of fish. Fish legislation and their importance. 4. Water pollution and inland fisheries. **Unit – 2**	

			1. Plankton in relation to fish production. 2. Culture of phytoplankton and zooplankton (Daphnia, Artemia, Moina). 3. Manufacture and maintenance of Aquarium. 4. Hybridization and transgenic fish. **Unit – 3** 1. Fish marketing - Marketing practices, information, marketing channels and systems. 2. Domestic and export marketing. 3. Sex control and sex reversal under condition and chromosome set manipulation in fish. 4. Gamete preservation, cryopreservation and its application. **Unit - 4** 1. Methods of curing and preservation of fish. 2. Refrigeration and freezing, Drying, Salting, Smoking, Canning. 3. Fish products and by - products: Fish body oil, Fish liver oil, Fish meal, Isinglass, Fish protein concentrate, Fish glue, Fish manure. 4. Fish pathology: Signs of sickness and effects on fish, Pathological procedure for diagnosis of fish diseases. **Unit – V** 1 Epizootic Ulcerative Syndrome (EUS): History and areas affected by EUS. 2 Spread of disease and fish species affected, Present state of knowledge of EUS. 3 Extension of range and human significance, Recommendations for treatment. 4 Socio-economic impact of EUS.	
M.Sc. IV Sem	Paper -4(a): Fisheries Economics and Extension	F-44	**Unit – I** 1. Definition and scope of economics in relation to fisheries.	

			2. Law of equimarginal returns, production, economics of composite, integrated, intensive and semi- intensive culture systems. 3. Role of economics in the study of resource and environmental problems. 4. Economics of fish hatcheries and grow-out. **Unit – II** 1. Law of demand and supply, price determination, price rise causes, consequences and remedies. 2. Markets – definition, functions, structure of fish markets in India. 3. Problems of fish marketing in India, export of fish and fishery products, trends and problems, role of MPEDA in export of fish and fishery products. 4. Economics of fish farm and it`s management. 5. Fish seed industry – production and marketing of fish and shell fish seed (spawn, fry, fingerling and PL- 20) in India. **Unit – III** 1. Administration – fishery administration at the centre and states, its functions and organizational set up. 2. Fisheries legislation of Government of India and different state, Historical background and present status of legislation. 3. Exclusive Economic Zone (EEZ) and Coastal Regulation Zone (CRZ), their effect in fishery economy. 4. Financial assistance – Financial assistance available to the fishery sector from government, commercial bank. 5. NABARD, Its structure and functions in relation to fisheries economics, co-operatives and other institutional organizations. **Unit – IV** 1. Historical perspective, concept, philosophy, principles and objectives of extension, collection of facts situation analysis and problem identification. 2. Importance of extension programme and characteristics of a good programme. 3. Participation of organizations and involvement of people in programme planning. 4. Leadership and team work in extension. **Unit – V**	

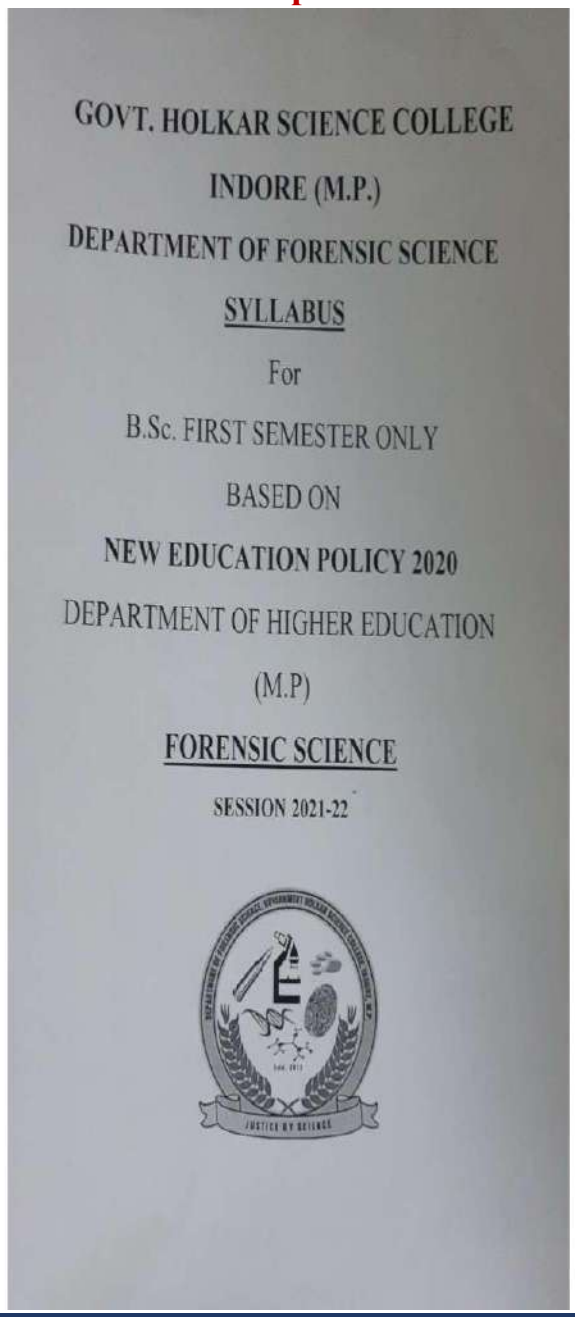
			1. Training strategy in transfer of technology in aquaculture, role of farmer, extension and research linkage. 2. Concept and function of communicator and his/her importance in extension work. 3. Communication models and channels in extension education and problem of communication – types and nature. 4. Role and effect of communication channels in extension education and problem of communication – types and nature.	
M.Sc. IV Sem	Paper -4(b): Nutritional Management in Aquaculture	F-OE	**Unit - 1** 1. Soil and water quality, sediment - water nutrient interactions. 2. Physical properties of soil. 3. Soil reaction, nutrient availability in relation to pond. 4. Productivity, factors influencing nutrient management. **Unit – 2** 1. Nutrient dynamics, significance of humus in aquatic ecosystem, fertilization. 2. Measures, Major and micronutrients, heavy metals and pesticides and their effects on fish Production. 3 Growth promoting hormones in fishes. 4. Primary productivity in fish pond. **Unit – 3** 1 Trophic components and pathways. 2 Interactions and production efficiencies, aquatic. 3 Macrophytes and biotic communities, classification and functional significance of Micro-organisms. **Unit – 4** 1. Microbial communities with reference to productivity and pollution. 2. kinetics of Bacterial populations in nutrient cycling, enumeration and identification of bacteria. 3. Estimation of bacterial biomass, microbial interactions and their role in organic production.	

			and decomposition. 4. Food chain in fish culture pond. 5. Food web in fish culture pond. **Unit – 5** 1. Fishery Survey Methods. 2. Methods of surveying the fishery resources – acoustic method, aerial method. 3. Survey of fish eggs and larvae, analyzing population features – growth mortality selection. 4. Organization of rational fishery management.	

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Forensic Science

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development



GOVT. HOLKAR SCIENCE COLLEGE

INDORE (M.P.)

DEPARTMENT OF FORENSIC SCIENCE

SYLLABUS

For

B.Sc. FIRST SEMESTER ONLY

BASED ON

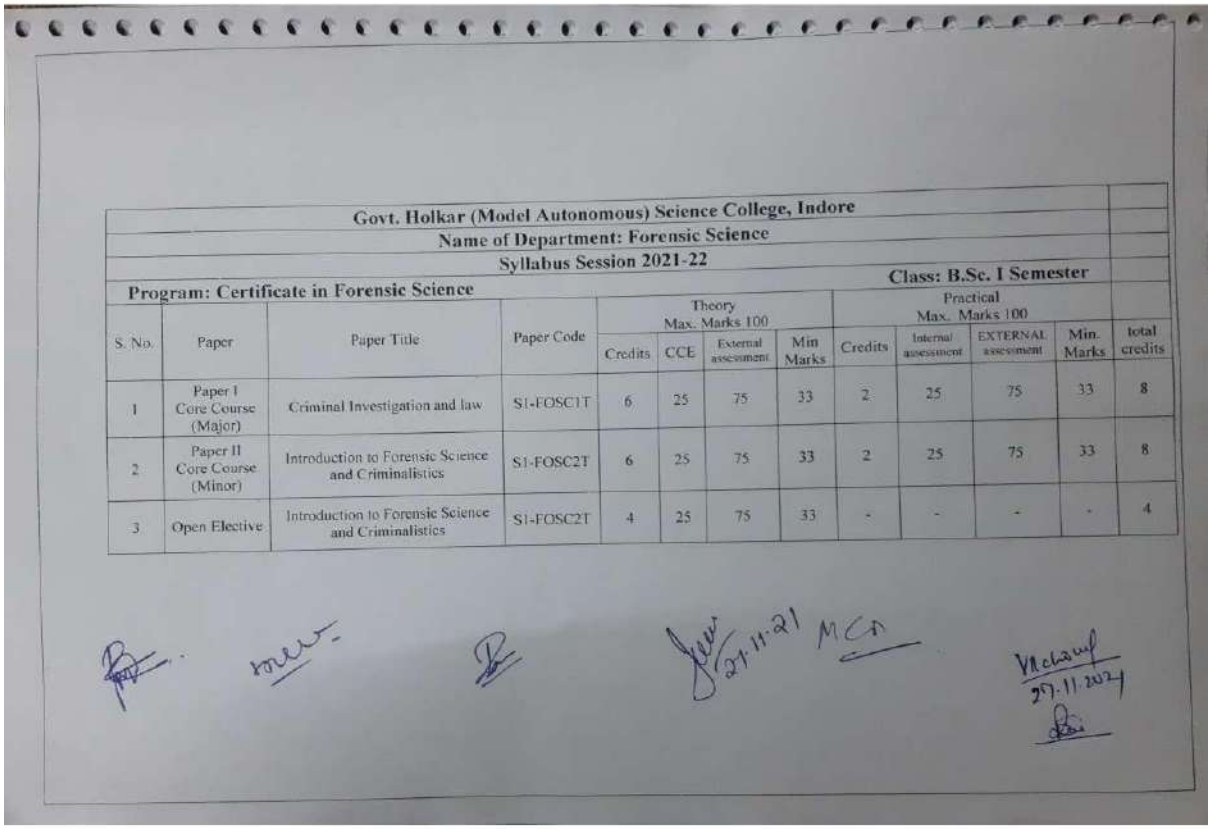
NEW EDUCATION POLICY 2020

DEPARTMENT OF HIGHER EDUCATION

(M.P)

FORENSIC SCIENCE

SESSION 2021-22



Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department: Forensic Science

Syllabus Session 2021-22

Program: Certificate in Forensic Science **Class: B.Sc. I Semester**

S. No.	Paper	Paper Title	Paper Code	Theory Max. Marks 100				Practical Max. Marks 100				total credits
				Credits	CCE	External assessment	Min Marks	Credits	Internal assessment	EXTERNAL assessment	Min. Marks	
1	Paper I Core Course (Major)	Criminal Investigation and law	S1-FOSC1T	6	25	75	33	2	25	75	33	8
2	Paper II Core Course (Minor)	Introduction to Forensic Science and Criminalistics	S1-FOSC2T	6	25	75	33	2	25	75	33	8
3	Open Elective	Introduction to Forensic Science and Criminalistics	S1-FOSC2T	4	25	75	33	-	-	-	-	4

27.11.21

27.11.2021

First Semester Syllabus for B.Sc 1 Year Forensic Science Course (Major)

Part A- Introduction			
Program: Certificate	Class: B.Sc	Semester: I	Session: 2021-22
Subject: Forensic Science			

1.	Course Code	S1-FOSC1T	
2.	Course Title	Criminal Investigation and Law (Paper 1)	
3.	Course Type: (Core Course/Elective/Generic elective/Vocational)	Core Course (MAJOR)	
4.	Pre-requisite (if any)	To Study this course, Student must be from Maths/Biology/Science background in 12th Class.	
5.	Course Learning Outcomes (CLO)	Learning Objectives: After studying this paper the students will know the following: a. The element of crime and its types b. Police organization at national and state level. c. Crime scene management protocol and its importance in criminal justice system d. Different law followed in criminal investigation. e. After the successfully completing the course, student will be able to join police service, private detective or security agency or start his/her own investigative agency.	
	Credit Value	6	
	Total Marks	Max. Marks: 25+75	Min. passing marks: 33

Part B- Content of the Course

Total no. of lectures (in hours per week): 2 hours per week

Total Lectures: 90

Unit	Topics	No. of lectures
I	**Crime:** Elements, nature, causes and consequences of crime. Definition, aims and scope of crime. Deviant behavior, hate crimes, organized crimes and public disorder, domestic violence and workplace violence, victimology, Juvenile delinquency, social change and crime, psychological disorders and criminality, Situational Crime Prevention. **Keywords:** Crime, Violence, Deviant behavior, Juvenile delinquency, psychological disorders	16
II	**Police organizations and FIR:** **State Police Forces:** State armed police forces, Home guards, Traffic police, CID, STF, Community Policing. **Central armed police forces**- BSF, CRPF, CISF, ITBP, NSG, Assam Rifle. **Investigation:** FIR, Case diary, Interrogation of suspects, Interview of witnesses, cognizable and non-cognizable offences, compoundable and non-compoundable offences, police custody & judicial custody, Bailable and non-bailable offences, procedure of filing charge sheet.	18
	Keywords: Police organizations, Central and State Police, CBI, NIA, RAW, CID, FIR, Case Diary, Police Custody, Bailable and Non-Bailable Offenses	
III	**Scene of Crime:** Introduction to Crime scene, Classifications of crime scenes securing and isolating the crime scene, Role of the first responding officer, Crime scene communication, Legal implications for Crime Scene Searches, Plan of action, Note taking, Crime scene search and Photography, Types of cameras, Number of photographs, Admissibility of photographs, Videography of the crime scene. **Keywords:** Scene, Searching methods, Photography, Videography	16
IV	**Indian Penal Code (1860):** **Pertaining to Offences against persons**- Sections 121A, 299, 300, 302, 304A, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362. Sections 375, 376 & 377 and their amendments. **IPC (1860):** Pertaining to Offences against property sections- 378, 383, 390, 391, 405, 415, 420, 441, 463, 497, 498A, 499, 503, 511. **Keywords:** IPC Sections, Offence against persons, Offences against property.	20
V	**Criminal Procedure Code and Indian Evidence Act:** **Criminal Procedure Code (1973):** Introduction and general idea of sections: 291-93, 154, 155, 156, 157, 158, 159, 160, 161, 162, 172, 173, 174, 175 and 176 **Indian Evidence Act (1872)**- Evidence and Rules of relevancy in brief, Expert witness, Cross Examination and Re-examination of Witnesses, Sections- 32, 41, 45, 46, 47, 57, 58, 60, 73,114(A) 135, 136, 137, 138, 141. **Keywords:** Criminal Procedure Code, Indian Evidence Act, Expert Witness, Cross examination.	20

Part C- Learning Resources

Textbooks, References Books, Other resources

Suggested readings:

1. Ahuja R. (2001). Criminology. India: Rawat Pub.
2. Aitken C.G.G. & Stoney D.A. (1991). The use of statistics in Forensic Science. England: Ellis Hardwood Limited
3. Bowen R.T. (2016). Ethics and the practice of Forensic Science. USA: CRC Press.
4. Burke R.H. (2013). An Introduction to Criminological Theory 4th edition UK: Routledge
5. Horsewell J. (2016). The practice of crime Scene Investigation. USA: CRC Press.
6. Indian Penal Code, Criminal procedure code, Indian Evidence Act.
7. James S.H. & Nordby J.J (2003). Forensic Science: an introduction to scientific and investigive techniques. USA: CRC Press.

Suggestive Digital platforms web Links:

Suggested Equivalent Online Course:

1. http://14.139.95/CEC/index.php/search_result
2. BSF- https://bsf.gov.in
3. CRPF- https://crpf.gov.in
4. CBI- https://cbi.gov.in/en-us/contact-Us
5. IB- https://www.nibindia.in/welcome
6. NIA- https://www.nia.gov.in

7. MP Police- https://www.mppolice.gov.in

Part D- Assessment and Evaluation

Suggested Continuous Evaluation methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25 Marks
University Exam (UE): 75 Marks

Internal assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	15 10
External Assessment: University Exam Section: 75 Time: 02:00 Hours	**Section(A):** Three Very Short Questions (50 words) **Section(B):** Four Short Questions (200 Words Each) **Section(C):** Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total = 75

Any Remarks/suggestions:

Assignments

1. Various aspects of Crime.
2. Different School of Criminology.
3. History of Police in India.
4. To Differentiate between Armed and Unarmed Security Agencies.
5. To Differentiate between indoor and outdoor Scene of crime.
6. Importance of still and movie photography at Scene of crime.
7. History of Indian Penal Code.
8. Role of Section 45 IEA in court proceeding.

Projects:

1. To prepare crime map based on region.
2. Hierarchical setup of state police.
3. Development of BPR&D.
4. List of Cognizable and Non-Cognizable Offences.
5. Crime Scene investigation for Murder.

Seminar topics:

1. Crime against Women or Children.
2. Hate Crime.
3. Victim societal relation.
4. Role of Police in crime solving.
5. Difference in the functioning of CBI and RAW.
6. Need for Police modernization.
7. Protection of scene of crime.
8. Search methods at scene of crime.
9. Importance of IPC in today's scenario.
10. Difference between CrPC and IEA.

Visit:
Visit to nearest Police Station/Real Crime Scene/Lower Court.

First Semester Syllabus for B.Sc. I Year Forensic Science Course (Practical)

Part A- Introduction

Program: Certificate	**Class:** B.Sc.	**Semester:** I	**Session:** 2021-22

Subject: Forensic Science

1.	Course Code	S1-FOSC1P
2.	Course Title	Crime Scene Management (Paper 1)
3.	Course Type: (Core Course/Elective/ Generic Elective/Vocational)	Core Course (PRACTICAL MAJOR)
4.	Pre- requisite (if any)	To study this course, student must be from Maths/Biology/Science background in 12th Class
5.	Course Learning Outcomes (CLO)	Learning objectives: After studying this paper the students will know the following: a. About crime scene and its preservation. b. Crime scene documentation procedures c. Different methods useds for search of crime scene d. Different methods used for Sketching of crime scene. e. Gaining hands on training will help the students to handle real crime scene and crime investigation
	Credit Value	2
	Total Marks	Max. Marks: 25+ 75 / Min. passing Marks 33

Part B – Content of the Course

Total No. of Lectures (in hours per week):(2 hours per week
Total Lectures: 30 hours

Unit	Topics	No. of Lectures
1.	Demonstration of crime scene management	
2.	Rough and final sketch of scene of crime	
3.	Photography of scene of crime through digital camera	
4.	Zonal method for searching of physical evidences at scene of crime	
5.	Spiral method for searching of physical evidences at scene of crime	
6.	Grid and strip method for searching of physical evidences at scene of crime	
7.	Wheel method for searching of physical evidences at scene of crime	
8.	Line method for searching of physical evidences at scene of crime	
9.	Sketching of outdoor scene of crime of homicide and suicide	
10.	Sketching of outdoor scene of crime of accidental case	
11.	Sketching of outdoor scene of crime of theft, dacoity and robbery	
12.	Sketching of outdoor scene of crime of suicide and murder	

Part C- Learning Resources

Text Books, Reference Books, Other resources

Suggested readings:

1. James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. New York, Taylor & Francis.
2. Saferstein R. (1995). Criminalistics – An Introduction to Forensic Science. USA, Prentice Hall Inc.

3. Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trails. India, Universal Law house.
4. Sharma J. D. (2011). Apradhon ka Vigyanik Anvedhan. India, Madhya Pradesh Hindi Granth Academy.

Suggestive digital platforms web links:

Suggested Equivalent online courses:

Part D – Assessment and Evaluation

Suggested Continuous Evaluation methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva Voce on Practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/ Model Seminar/ Rural service/ Technology Dissemination / Report of Excursion/ Lab Visits/ Survey / Industrial visit)	10	Table work / Experiment	50
TOTAL	25		75

Any remarks/ suggestions:

Assignments:
Drawing of rough sketch of indoor/outdoor scene of crime
Drawing of final sketch of indoor/outdoor scene of crime
Photography of the given scene of crime
Searching and labelling of physical evidences at scene of crime

---

First Semester Syllabus for B.Sc 1 Year Forensic Science Course (Minor)

Part A- Introduction

Program: Certificate	Class: B.Sc	Semester: 1	Session: 2021-22

Subject: Forensic Science

1.	Course Code	S1-FOSC2T
2.	Course Title	Introduction to Forensic Science and Criminalistics (Paper 2)
3.	Course Type: (Core Course/Elective/Generic elective/Vocational)	Core Course (MINOR)
4.	Pre-requisite (if any)	To Study this course, student must be from Maths/Biology/Science background in 12th Class.
5.	Course Learning Outcomes (CLO)	**Learning Objectives: After studying this paper the students will know the following:** a) Organizational setup of Forensic Science laboratories in India. b) The methods of securing, searching, and documenting crime scenes. c) Importance of physical evidence in criminal investigations. d) The art of collecting, packaging and labeling and forwarding different types of physical and trace evidence at crime scenes. e) After the successfully completing the course, student will be able to join forensic science laboratory, police service, private detective or security agency or start his/her own investigative agency.
	Credit Value	6
	Total Marks	Max. Marks: 25+75 / Min. passing marks:33

Part B- Content of the Course

Total no. of lectures (in hours per week): 2 hours per week
Total Lectures: 90

Unit	Topics	No. of lectures
I	**Forensic Science:** Forensic Science in India: History, organizational setup of forensic science laboratories, hierarchical set up of CFSL, State FSL, GEQDs, Fingerprint bureaus, LNJPNNICFS, Directorate of forensic science, mobile forensic laboratories, Police services at forensic laboratories, qualifications, Duties and code of conduct of forensic scientists at forensic science laboratory. **Keywords:** Forensic Science, CFSL, FSL Organization, Mobile forensic laboratories, Fingerprint Bureaus.	16
II	**Search and Seizures:** Section 42, 43, 44, 45, 50, 53, 57 and 58 of Criminal Procedure Code. **Physical Evidence:** Definition, Classification of Physical Evidences- on the basis of class, nature and size, different [illegible]	18

	evidences, Collection, Preservation, Packaging, Labelling, Sealing and Forwarding of Physical evidences, Chain of custody. **Keywords:** Search and seizure, Physical evidences, Chain of custody.	
III	**Searching, Collection, Packaging, Labeling and Forwarding of Biological Evidences from Scene of Crime:** Human or Animal blood, Dry and wet blood, Semen on undergarments, body or any other surfaces, Saliva Sample in Cigarette buds, Cup or Glass, bottles, Bite marks, etc. Vomit on cloths or any other surfaces, Stomach wash, Tears, Nails, Viscera including preservation and amount of organ, Hair & fibre, Botanical materials etc **Keywords:** Biological evidences, Blood, Semen, Saliva, Hair and Fiber	18
IV	**Searching, Collection, Packaging, Labeling and Forwarding of Chemical and Toxicological Evidences from Scene of Crime:** Cement, Mortar & Concrete, Explosive's material on various exhibits, and Arson evidence including Charred materials, Wood, Paper etc. Petroleum products, Drugs and Poisons, Viscera for Toxicological analysis, Blood for Drug and Poison analysis, Urine for drug and poison analysis etc. **Keywords:** Chemical evidences, Cement, Explosives, Drugs and Poison.	20
V	**Searching, Collection, Packaging, Labeling and Forwarding of Evidences related to Physics and Other impression from Scene of Crime:** Soil or Dust & paint chips, glass, fractured glass, colored glass, tool marks, skid marks and tyre marks on various surfaces, Digital evidences, Fingerprints (Visible, latent and plastic), footprints, documents, weapon, firearms, bullet, cartridge cases etc. **Keywords:** Physical evidences, Soil, Paint, Glass, Impressions, Tool marks.	18

Part C- Learning Resources

Textbooks, References Books, Other resources

Suggested readings:

1. Peter R. D. F. (1983). Forensic Science- An introduction to Criminalistics. USA, McGraw-Hill.
2. Saferstein R. (1995). Criminalistics- An Introduction to Forensic Science. USA, Prentice Hall Inc.
3. Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trials. India, Universal Law Publishing Company.
4. Sharma J.D. (1988). Vidhivigyan Avem Vish Vigyan. India, Hindi Granth Academy.
5. Sharma J.D. (2011). Apradhon ka Vigyanik Anveshan. India, Hindi Granth Academy.
6. Siegr J.A & Kathy M. (2006). Forensic Science: The Basics. USA, CRC Press.
7. Unnithan N.P (2013). Crime and Justice in India. India: SAGE Pub.

Suggestive Digital platforms web Links:

Suggested Equivalent Online Course:

1. http://www.coursera.org/learn/forensic-science
2. https://www.futurelearn.com/courses/introduction-to-forensic-science

Part D- Assessment and Evaluation

Suggested Continuous Evaluation methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 25 Marks University Exam (UE): 75 Marks		
Internal assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	15 10
External Assessment: University Exam Section: 75 Time: 02.00 Hours	**Section(A):** Three Very Short Questions (50 words) **Section(B):** Four Short Questions (200 Words Each) **Section(C):** Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total = 75

Any Remarks/suggestions:

Assignments:

1. History of Forensic Services in India.
2. Brief write-up on the development of GEQD in India.
3. Contribution of India in the field of fingerprint Classification.
4. Setup of State forensic science laboratory.
5. Setup Of Central forensic science laboratory.
6. Importance of location of physical evidence at a scene of crime.
7. Establishing Chain of Custody.
8. Importance of on-the-spot analysis of physical evidence at crime scene.
9. Importance of proper packaging and labeling of physical evidences.
10. Post mortem examination.

Projects:

1. Mobile FSL in India.
2. Hierarchial setup of CFSL or SFSL.
3. Development of DFS.
4. To prepare a list based on region for CFSL, SFSL, and RFSL.
5. Physical Evidences to be collected at a crime scene for Murder.

Seminar topics:

1. Need for Changes in model code of conduct for FSL Scientist.
2. Difference between CFSL and SFSL.
3. Role of GEQD.
4. The reason behind non-inclusion of fingerprint bureau with FSL.
5. Pros and Cons related privatization of FSL.
6. Standard rule form collection of physical evidences.
7. Modernization of FSL.
8. Why FSL should not be under Police Department.

Visit:

Visit to nearest Forensic Science Laboratory/Real Crime Scene/Mobile Crime Scene Unit.

Continuous Comprehensive Evaluation (CCE): 25 Marks University Exam (UE): 75 Marks		
Internal assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	15 10
External Assessment: University Exam Section: 75 Time: 02:00 Hours	**Section(A):** Three Very Short Questions (50 words) **Section(B):** Four Short Questions (200 Words Each) **Section(C):** Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total = 75

Any Remarks/suggestions:

Assignments

1. History of Forensic Services in India.
2. Brief write-up on the development of GEQD in India.
3. Contribution of India in the field of fingerprint Classification.
4. Setup of State forensic science laboratory.
5. Setup Of Central forensic science laboratory.
6. Importance of location of physical evidence at a scene of crime.
7. Establishing Chain of Custody.
8. Importance of on-the-spot analysis of physical evidence at crime scene.
9. Importance of proper packaging and labeling of physical evidences.
10. Post mortem examination.

Projects:

1. Mobile FSL in India.
2. Hierarchial setup of CFSL or SFSL.
3. Development of DFS.
4. To prepare a list based on region for CFSL, SFSL, and RFSL.
5. Physical Evidences to be collected at a crime scene for Murder.

Seminar topics:

1. Need for Changes in model code of conduct for FSL Scientist.
2. Difference between CFSL and SFSL.
3. Role of GEQD.
4. The reason behind non-inclusion of fingerprint bureau with FSL.
5. Pros and Cons related privatization of FSL.
6. Standard rule form collection of physical evidences.
7. Modernization of FSL.
8. Why FSL should not be under Police Department.

Visit:

Visit to nearest Forensic Science Laboratory/Real Crime Scene/Mobile Crime Scene Unit.

First Semester Syllabus for B.Sc I Year Forensic Science Course (Practical)

Part A- Introduction				
Program: Certificate	**Class: B.Sc**	**Semester: I**	**Session: 2021-22**	
Subject: Forensic Science				
1.	Course Code	S1-FOSC2P		
2.	Course Title	Physical Evidences (Paper2)		
3.	Course Type: (Core Course/Elective/Generic elective/Vocational)	Core Course (PRACTICAL – MINOR)		
4.	Pre-requisite (if any)	To Study this course, student must be from Maths/Biology/Science background in 12th Class.		
5.	Course Learning Outcomes (CLO)	**Learning Objectives: After studying this paper the students will know the following:** a. The element of crime and its types. b. Police organization at national and state level. c. Crime scene management protocol and its importance in Criminal Justice System. d. Different law followed in criminal investigation. e. After the successfully completing the course, student will be able to join Police Service, Private Detective or Security Agency or start his/her own Investigative Agency.		
	Credit Value	2		
	Total Marks	Max. Marks: 25+75	Min. passing marks:33	
Part B- Content of the Course **Total no. of lectures (in hours per week): 2 hours per week** **Total Lectures: 30**				

Unit	Topics	No. of lectures
1.	Collections, Packing, Labeling, and Forwarding of the physical evidences associated with Biological fluids and wet exhibits.	
2.	Collections, Packing, Labeling, and Forwarding of the physical evidences of Soil/dust and Glass materials.	
3.	Collections, Packing, Labeling, and Forwarding of the physical evidences of Hair and Fiber of human or animal origin.	
4.	Collections, Packing, Labeling, and Forwarding of the physical evidences of liquid materials and pharmaceutical products/drugs of abuse.	
5.	Collections, Packing, Labeling, and Forwarding of the physical evidences of Botanical material including plant parts or Diatoms.	
6.	Collections, Packing, Labeling, and Forwarding of the physical evidences of shell case/cartridge/bullet/pellets.	
7.	Collections, Packing, Labeling, and Forwarding of the physical evidences of charred documents, questioned documents etc.	
8.	To Know the basic steps of crime scene management followed by an investigator.	
9.	Preliminary Examination of Arson evidences.	
10.	Preliminary Examination of toxicological evidences.	
11.	Preliminary Examination of Blood Stains found on different surfaces like wall, glass, clothes and soil etc.	

12	Preliminary Examination of evidences found in Case of vitriolage.	

Part C- Learning Resources

Textbooks, References Books, Other resources

Suggested readings:

1. De F. & P.R. (1983) Forensic Science- An Introduction to Criminalistics, New York, McGraw-Hill
2. Horswell J. (2016). The Practice of Crime Scene Investigation, New York, CRC Press.
3. Nordby, James, S.H & J.J. (2003). Forensic Science: An Introduction to Scientific and Investigative Techniques, USA, CRC Press.
4. O'Hara & Osterber. (1949). An Introduction to Criminalistics, New York, the Macmillan Company.
5. Siegel J.A & Mirukovits K. (2006). Forensic Science: The Basics, New York, CRC Press.
6. B.B Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).

Suggestive Digital platforms web Links:

Suggested Equivalent Online Course:

1. http://14.139.13.95/CEC/index.php/search_result

Part D- Assessment and Evaluation

Suggested Continuous Evaluation methods:

Internal assessment	Marks	External Assessment	Marks
Class Interaction Quiz	10	Viva Voice on practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/Model Seminar/ Technology Dissemination/ Report of Exursion/ Lab Visits/ Survey/ Industrial visit)	10	Table Work/ Experiments	50
TOTAL	25		75

Any remarks/ suggestions:

Assignments:

Drawing of Rough sketch of indoor/outdoor scene of crime.
Drawing of Final sketch of indoor/outdoor scene of crime.
Photography of the given scene of crime.
Searching of Physical evidence at Scene of crime.
Labeling & Forwarding of the Physical Evidences.
Examination of Arson evidences.
Examination of Toxicological evidences.

First Semester Syllabus for B.Sc I Year Forensic Science Course

(Generic Open-Elective)

Part A- Introduction

Program: Certificate	Class: B.Sc	Semester: I	Session: 2021-22

Subject: Forensic Science

1.	Course Code	SI-FOSC2T	
2.	Course Title	Introduction to Forensic Science and Criminalistics (Paper 2)	
3.	Course Type: (Core Course/Elective/Generic elective/Vocational)	Generic open Elective	
4.	Pre-requisite (if any)	To study this course, student must be from Maths/Biology/Science background in 12th Class.	
5.	Course Learning Outcomes (CLO)	**Learning Objectives: After studying this paper the students will know the following:** a) Organizational setup of Forensic Science laboratories in India. b) The methods of securing, searching, and documenting crime scenes. c) Importance of physical evidence in criminal investigations. The methods of securing, searching, and documenting crime scenes. d) The art of collecting, packaging and labeling and forwarding different types of physical and trace evidence at crime scenes. e) After the successfully completing the course, student will be able to join forensic science laboratory, police service, private detective or security agency or start his/her own investigative agency.	
	Credit Value	4	
	Total Marks	Max. Marks: 25+75	Min. passing marks: 33

Part B- Content of the Course

Total no. of lectures (in hours per week): 2 hours per week

Total Lectures: 60

Unit	Topics	No. of lectures
I	**Forensic Science:** Forensic Science in India: History, Organizational setup of Forensic Science Laboratories, Hierarchical set up of CFSL, State FSL, GEQDs, Fingerprint Bureaus, LNJPNNICFS, Directorate of Forensic Science, Mobile Forensic Laboratories. Police Services at Forensic Laboratories, qualifications, Duties and Code of Conduct of Forensic Scientists at Forensic Science Laboratory. **Keywords:** Forensic Science, CFSL, FSL Organization, Mobile Forensic laboratories, Fingerprint Bureaus.	12
II	**Search and Seizures:**	

	Section 42, 43, 44, 45, 50, 53, 57 and 58 of Criminal Procedure Code. **Physical Evidence:** Definition, Classification of Physical Evidences- on the basis of class, nature and size, Different Search methods for Physical evidences, Collection, Preservation, Packaging, Labeling, Sealing and Forwarding of Physical evidences, Chain of Custody. **Keywords:** Search and Seizure, Physical evidences, Chain of Custody.	12
III	**Searching, Collection, Packaging, Labeling and Forwarding of Biological Evidences from Scene of Crime:** Human or animal blood, Dry and wet blood, Semen on undergarments, Body or any other surfaces, Saliva Sample in Cigarette buds, Cup or Glass, Bottles, Bite marks, etc. Vomit on cloths or any other surfaces, Stomach wash, Tears, Nails, Viscera including preservation and amount of organ, Hair & fibre, Botanical materials etc **Keywords:** Biological evidences, Blood, Semen, Saliva, Hair and Fiber	12
IV	**Searching, Collection, Packaging, Labeling and Forwarding of Chemical and Toxicological Evidences from Scene of Crime:** Cement, Mortar & Concrete, Explosive's material on various exhibits, and Arson evidence including charred materials, Wood, Paper etc. Petroleum products, Drugs and Poisons, Viscera for Toxicological analysis, Blood for Drug and Poison analysis, Urine for Drug and Poison analysis etc. **Keywords:** Chemical evidences, Cement, Explosives, Drugs and Poison.	12
V	**Searching, Collection, Packaging, Labeling and Forwarding of Evidences related to physics and other impression from Scene of Crime:** Soil or Dust & paint chips, glass, Fractured glass, Colored glass, Tool marks, Skid marks and Tyre marks on various surfaces, Digital evidences, Fingerprints (Visible, latent and plastic), Footprints, Documents, Weapon, Firearms, Bullet, Cartridge Cases etc. **Keywords:** Physical evidences, Soil, Paint, Glass, Impressions, Tool marks.	12

Part C- Learning Resources

Textbooks, References Books, Other resources

Suggested readings:

1. Peter R. D. F. (1983). Forensic Science- An introduction to Criminalistics. USA, McGraw-Hill.
2. Saferstein R. (1995). Criminalistics- An Introduction to Forensic Science. USA, Prentice Hall Inc.
3. Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trials. India, Universal Law Publishing Company.
4. Sharma J.D. (1988). Vidhivigyan Avem Vish Vigyan. India, Hindi Granth Academy.
5. Sharma J.D. (2011). Apradhon ka Vigyanik Anveshan. India, Hindi Granth Academy.
6. Siege J.A & Kathy M. (2006). Forensic Science: The Basics. USA, CRC Press.
7. Unnithan N.P (2013). Crime and Justice in India. India: SAGE Pub.

Suggestive Digital platforms web Links:

Suggested Equivalent Online Course:

1. http://www.coursera.org/learn/forensic-science
2. https://www.futurelearn.com/courses/introduction-to-forensic-science

Part D- Assessment and Evaluation

Suggested Continuous Evaluation methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25 Marks
University Exam (UE): 75 Marks

Internal assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	15 10
External Assessment: University Exam Section: 75 Time: 02:00 Hours	**Section(A):** Three Very Short Questions (50 words) **Section(B):** Four Short Questions (200 Words Each) **Section(C):** Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total = 75

Any Remarks/suggestions:

Assignments

1. History of Forensic Services in India.
2. Brief write-up on the development of GEQD in India.
3. Contribution of India in the field of fingerprint Classification.
4. Setup of State forensic science laboratory.
5. Setup OF Central forensic science laboratory.
6. Importance of location of physical evidence at a scene of crime.
7. Establishing Chain of Custody.
8. Importance of on-the-spot analysis of physical evidence at crime scene.
9. Importance of proper packaging and labeling of physical evidences.
10. Post mortem examination.

Projects:

1. Mobile FSL in India.
2. Hierarchical setup of CFSL or SFSL.
3. Development of DFS.
4. To prepare a list based on region for CFSL, SFSL, and RFSL.
5. Physical Evidences to be collected at a crime scene for Murder.

Seminar topics:

1. Need for Changes in model code of conduct for FSL Scientist.
2. Difference between CFSL and SFSL.
3. Role of GEQD.
4. The reason behind non-inclusion of fingerprint bureau with FSL.
5. Pros and Cons related privatization of FSL.
6. Standard rule form collection of physical evidences.
7. Modernization of FSL.
8. Why FSL should not be under police department.

Visit:
Visit to nearest Forensic Science Laboratory/Real Crime Scene/Mobile Crime Scene Unit.

GOVT. HOLKAR SCIENCE COLLEGE

INDORE (M.P.)

DEPARTMENT OF FORENSIC SCIENCE

SYLLABUS

For

B.Sc. SECOND SEMESTER ONLY

BASED ON

NEW EDUCATION POLICY 2020

DEPARTMENT OF HIGHER EDUCATION

(M.P)

FORENSIC SCIENCE

SESSION 2021-22

Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department: Forensic Science

Syllabus Session 2021-22

Program: Certificate in Forensic Science **Class: B.Sc. II Semester**

S. No.	Paper	Paper Title	Paper Code	Theory Max. Marks 100				Practical Max. Marks 100				
				Credits	CCE	External assessment	Min Marks	Credits	Internal assessment	EXTERNAL assessment	Min. Marks	total credits
1	Paper II Core Course (Major)	Introduction to Forensic Science and Criminalistics	S1-FOSC2T	6	25	75	33	2	25	75	33	8
2	Paper I Core Course (Minor)	Criminal Investigation and law	S1-FOSC1T	6	25	75	33	2	25	75	33	8
3	Open Elective	Criminal Investigation and law	S1-FOSC1T	4	25	75	33	-	-	-	-	4

Second Semester Syllabus for B.Sc I Year Forensic Science Course (Major)

Part A- Introduction			
Program: Certificate	Class: B.Sc	Semester: II	Session: 2021-22
Subject: Forensic Science			

1.	Course Code	S1-FOSC2T	
2.	Course Title	Introduction to Forensic Science and Criminalistics (Paper 2)	
3.	Course Type: (Core Course/Elective/Generic elective/Vocational)	Core Course (MAJOR)	
4.	Pre-requisite (if any)	To Study this course, Student must be from Maths/Biology/Science background in 12th Class.	
5.	Course Learning Outcomes (CLO)	**Learning Objectives: After studying this paper the students will know the following:** a. Organizational setup of Forensic Science laboratories in India. b. The methods of securing, searching, and documenting crime scenes. c. Importance of physical evidence in criminal investigations d. The art of collecting, packaging and labeling and forwarding different types of physical and trace evidence at crime scenes. e. After the successfully completing the course, student will be able to join forensic science laboratory, police service, private detective or security agency or start his/her own investigative agency.	
	Credit Value	6	
	Total Marks	Max. Marks: 25+75	Min. passing marks:33

Part B- Content of the Course

Total no. of lectures (in hours per week): 2 hours per week
Total Lectures: 90

Unit	Topics	No. of lectures
I	**Forensic Science:** Forensic Science in India: History, Organizational setup of Forensic Science laboratories. Hierarchical set up of CFSL, State FSL, GEQDs, Fingerprint bureaus, LNJPNNICFS, Directorate of forensic science, Mobile Forensic laboratories. Police services at Forensic laboratories, qualifications, Duties and Code of conduct of Forensic Scientists at Forensic Science laboratory. **Keywords:** Forensic Science, CFSL, FSL Organization, Mobile forensic laboratories, Fingerprint Bureaus.	16
II	**Search and Seizures:** Section 42, 43, 44, 45, 50, 53, 57 and 58 of Criminal Procedure Code. **Physical Evidence:** Definition, Classification of Physical evidences- on the basis of class, nature and size, Different [redacted] Chain of custody. **Keywords:** Search and seizure, Physical evidences, Chain of custody.	18
III	**Searching, Collection, Packing, Labeling and Forwarding of Biological Evidences from Scene of Crime:** Human or animal blood, Dry and wet blood, Semen on undergarments, Body or any other surfaces, Saliva Sample in Cigarette buts, Cup or glass, Bottles, Bite marks, etc. Vomit on cloths or any other surfaces, Stomach wash, Teens, Nails, Viscera including preservation and amount of organ, Hair & Fiber, Botanical materials etc. **Keywords:** Biological evidences, Blood, Semen, Saliva, Hair and Fiber	18
IV	**Searching, Collection, Packing, Labeling and Forwarding of Chemical and Toxicological Evidences from Scene of Crime:** Cement, Mortar & Concrete, Explosive's material on various exhibits, and Arson evidence including charred materials, Wood, Paper etc. Petroleum products, Drugs and poisons, Viscera for toxicological analysis, Blood for Drug and Poison analysis, Urine for Drug and Poison analysis etc. **Keywords:** Chemical evidences, Cement, Explosives, Drugs and Poison.	20
V	**Searching, Collection, Packing, Labeling and Forwarding of Evidences related to Physics and Other impression from Scene of Crime:** Soil or Dust & Paint chips, Glass, Fractured glass, Colored glass, Tool marks, Skid marks and Tyre marks on various surfaces, [redacted] Fingerprints (Visible, latent and plastic), Footprints, Documents, Weapon, Firearms, Bullet, Cartridge cases etc. **Keywords:** Physical evidences, Soil, Paint, Glass, Impressions, Tool marks.	18

Part C- Learning Resources

Textbooks, References Books, Other resources

Suggested readings:

1. Peter R. D. F. (1983). Forensic Science- An introduction to Criminalistics. USA, McGraw-Hill.
2. Saferstein R. (1995). Criminalistics- An Introduction to Forensic Science. USA, Prentice Hall Inc.
3. Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trials. India, Universal Law Publishing Company.
4. Sharma J.D. (1988). Vidhivigyan Avem Vish Vigyan. India, Hindi Granth Academy.
5. Sharma J.D. (2011). Apradhon ka Vigyanik Anvesham. India, Hindi Granth Academy.
6. Siege J.A & Kathy M. (2006). Forensic Science: The Basics. USA, CRC Press.
7. Unnithan N.P (2013). Crime and Justice in India. India: SAGE Pub.

Suggestive Digital platforms web Links:

Suggested Equivalent Online Course:

1. http://www.courseru.org/learn/forensic-science
2. https://www.futurelearn.com/courses/introduction-to-forensic-science

Part D- Assessment and Evaluation

Suggested Continuous Evaluation methods:

Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25 Marks
University Exam (UE): 75 Marks

Internal assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	15 10

External Assessment: University Exam Section: 75 Time: 02:00 Hours	**Section(A):** Three Very Short Questions (50 words) **Section(B):** Four Short Questions (200 Words Each) **Section(C):** Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total = 75

Any Remarks/suggestions:

Assignments

1. History of Forensic Services in India.
2. Brief write-up on the development of GEQD in India.
3. Contribution of India in the field of fingerprint Classification.
4. Setup of State forensic science laboratory.
5. Setup OF Central forensic science laboratory.
6. Importance of location of physical evidence at a scene of crime.
7. Establishing Chain of Custody.
8. Importance of on-the-spot analysis of physical evidence at crime scene.
9. Importance of proper packaging and labeling of physical evidences.
10. Post mortem examination.

Projects:

1. Mobile FSL in India.
2. Hierarchical setup of CFSL or SFSL.
3. Development of DFS
4. To prepare a list based on region for CFSL, SFSL, and RFSL.
5. Physical Evidences to be collected at a crime scene for Murder.

Seminar topics:

1. Need for Changes in model code of conduct for FSL Scientist.
2. Difference between CFSL and SFSL.
3. Role of GEQD.
4. The reason behind non-inclusion of Fingerprint bureau with FSL.
5. Pros and Cons related privatization of FSL.
6. Standard rule form collection of physical evidences.
7. Modernization of FSL.
8. Why FSL should not be under Police department.

Visit:

Visit to nearest Forensic Science Laboratory/Real Crime Scene/Mobile Crime Scene Unit.

Second Semester Syllabus for B.Sc I Year Forensic Science Course (Practical)

Part A- Introduction

Program: Certificate	Class: B.Sc	Semester: II	Session: 2021-22

Subject: Forensic Science

1.	Course Code	S1-FOSC2P	
2.	Course Title	Physical Evidences (Paper2)	
3.	Course Type: (Core Course/Elective/Generic elective/Vocational)	Core Course (PRACTICAL - MAJOR)	
4.	Pre-requisite (if any)	To Study this course, student must be from Maths/Biology/Science background in 12th Class.	
5.	Course Learning Outcomes (CLO)	**Learning Objectives: After studying this paper the students will know the following:** a. The element of crime and its types. b. Police organization at national and state level. c. Crime scene management protocol and its importance in Criminal Justice System d. Different law followed in criminal investigation. e. After the successfully completing the course, student will be able to join Police Service, Private Detective or Security Agency or start his/her own Investigative Agency.	
	Credit Value	2	
	Total Marks	Max. Marks: 25+75	Min. passing marks:33

Part B- Content of the Course

Total no. of lectures (in hours per week): 2 hours per week

Total Lectures: 30

Unit	Topics	No. of lectures
1.	Collections, Packing, Labeling, and Forwarding of the physical evidences associated with Biological fluids and wet exhibits.	
2.	Collections, Packing, Labeling, and Forwarding of the physical evidences of Soil/dust and Glass materials.	
3.	Collections, Packing, Labeling, and Forwarding of the physical evidences of Hair and Fiber of human or animal origin.	
4.	Collections, Packing, Labeling, and Forwarding of the physical evidences of liquid materials and pharmaceutical products/drugs of abuse.	
5.	Collections, Packing, Labeling, and Forwarding of the physical evidences of Botanical material including plant parts or Diatoms.	
6.	Collections, Packing, Labeling, and Forwarding of the physical evidences of shell case/cartridge/bullet/pellets.	
7.	Collections, Packing, Labeling, and Forwarding of the physical evidences of charred documents, questioned documents etc.	
8.	To Know the basic steps of crime scene management followed by an investigator.	
9.	Preliminary Examination of Arson evidences.	
10.	Preliminary Examination of toxicological evidences.	
11.	Preliminary Examination of Blood Stains found on different surfaces like wall, glass, clothes and soil etc.	
12.	Preliminary Examination of evidences found in Case of vitriolage.	

Part C- Learning Resources

Textbooks, References Books, Other resources

Suggested readings:

1. De F. & P.R. (1983) Forensic Science- An Introduction to Criminalistics, New York, McGraw-Hill.
2. Horswell J. (2016). The Practice of Crime Scene Investigation, New York, CRC Press.
3. Nordby, James, S.H & J.J. (2003). Forensic Science: An Introduction to Scientific and Investigative Techniques. USA, CRC Press.
4. O'Hara & Osaerber. (1949). An Introduction to Criminalistics. New York, the Macmillan Company.
5. Siegel J.A & Mirakovits K. (2006). Forensic Science: The Basics, New York, CRC Press.
6. B.B Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).

Suggestive Digital platforms web Links:

Suggested Equivalent Online Course:

http://14.139.13.95/CEC/index.php/search_result

Part D- Assessment and Evaluation

Suggested Continuous Evaluation methods:

Internal assessment	Marks	External Assessment	Marks
Class Interaction Quiz	10	Viva Voice on practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/Model Seminar/ Technology Dissemination/ Report of Exursion/ Lab Visits/ Survey/ Industrial visit)	10	Table Work/ Experiments	50
TOTAL	25		75

Any remarks/ suggestions:

Assignments:

Drawing of Rough sketch of indoor/outdoor scene of crime.
Drawing of Final sketch of indoor/outdoor scene of crime.
Photography of the given scene of crime.
Searching of Physical evidence at Scene of crime.
Labeling & Forwarding of the Physical Evidences.
Examination of Arson evidences.
Examination of Toxicological evidences.

Second Semester Syllabus for B.Sc I Year Forensic Science Course (Minor)

Part A- Introduction

Program: Certificate	Class: B.Sc	Semester: II	Session: 2021-22

Subject: Forensic Science

1.	Course Code	SI-FOSC1T	
2.	Course Title	Criminal Investigation and Law (Paper I)	
3.	Course Type: (Core Course/Elective/Generic elective/Vocational)	Core Course (MINOR)	
4.	Pre-requisite (if any)	To study this course, student must be from Maths/Biology/Science background in 12th Class.	
5.	Course Learning Outcomes (CLO)	Learning Objectives: After studying this paper the students will know the following: a) The element of crime and its types. b) Police organization at national and state level. c) Crime scene management protocol and its importance in criminal justice system. d) Different law followed in criminal investigation. e) After the successfully completing the course, student will be able to join police service, private detective or security agency or start his/her own investigative agency.	
	Credit Value	6	
	Total Marks	Max. Marks: 25+75	Min. passing marks:33

Part B- Content of the Course

Total no. of lectures (in hours per week): 2 hours per week

Total Lectures: 90

Unit	Topics	No. of lectures
I	**Crime:** Elements, Nature, Causes and Consequences of crime. Definition, Aims and Scope of crime, Deviant behavior, Hate crimes, Organized crimes and public disorder, Domestic violence and Workplace violence, Victimology, Juvenile delinquency, social change and crime, psychological disorders and criminality, Situational crime prevention. **Keywords:** Crime, Violence, Deviant behavior, Juvenile delinquency, psychological disorders	16
II	**Police Organizations and FIR:** **State Police Forces:** State armed Police forces, home guards, Traffic police, CID, CB, unnecessary policing. **Central Armed Police Forces**- BSF, CRPF, CISF, ITBP, NSG, Assam Rifle. **Investigation:** FIR, Case diary, Interrogation of suspects, Interview of witnesses, Cognizable and Non-cognizable offences, Compoundable and Non-compoundable Offences, Police custody & Judicial custody, Bailable and non-bailable offences, procedure of filing charge sheet. **Keywords:** Police organizations, Central and State Police, CBI, NIA, RAW, CID, FIR, Case Diary, Police Custody, Bailable and Non-Bailable Offenses	18
III	**Scene of Crime:** Introduction to Crime scene, Classifications of Crime scenes securing and isolating the crime scene, Role of the First responding officer, Crime scene communication, Legal implications for crime scene searches, Plan of action,	16

	Note taking, Crime scene search and Photography, Types of cameras, Number of photographs, Admissibility of photographs, Videography of the crime scene. **Keywords:** Scene, Searching methods, Photography, Videography	
IV	**Indian Penal Code (1860):** **Pertaining to Offences against persons**- Sections 121A, 299, 300, 302, 304A, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362. Sections 375, 376 & 377 and their amendments. **IPC (1860)**: Pertaining to Offences against property sections- 378, 383, 390, 391, 405, 415, 420, 441, 463, 497, 498A, 499, 503, 511. **Keywords:** IPC Sections, Offence against persons, Offences against property.	20
V	**Criminal Procedure Code and Indian Evidence Act:** **Criminal Procedure Code (1973)**: Introduction and general idea of sections: 291-93, 154, 155, 156, 157, 158, 159, 160, 161, 162, 172, 173, 174, 175 and 176 **Indian Evidence Act (1872)**- Evidence and rules of relevancy in brief, Expert witness, Cross Examination and Re-examination of Witnesses. Sections- 32, 41, 45, 46, 47, 57, 58,60,73,114(A) 135, 136, 137, 138, 141. **Keywords:** Criminal Procedure Code, Indian Evidence Act, Expert Witness, Cross examination.	20

Part C- Learning Resources

Textbooks, References Books, Other resources

Suggested readings:

1. Ahuja R. (2001). Criminology. India: Rawat Pub.
2. Aitken C.G.G. & Stoney D.A. (1991). The use of statistics in Forensic Science. England: Ellis Hardwood Limited
3. Bowen R.T. (2016). Ethics and the practice of Forensic Science. USA: CRC Press.
4. Burke R.H. (2013). An Introduction to Criminological Theory 4th edition UK: Routledge
5. Heesewell J. (2016). The practice of crime Scene Investigation. USA: CRC Press.
6. Indian Penal Code, Criminal Procedure Code, Indian Evidence Act.
7. James S.H. & Nordby J.J.(2003). Forensic Science: an introduction to scientific and investigative techniques. USA: CRC Press.

Suggestive Digital Platforms Web Links:

Suggested Equivalent Online Course:

1. http://14.139.95.82/CEC/index.php/search_result/
2. BSF- https://bsf.gov.in
3. CRPF- https://crpf.gov.in
4. CBI- https://cbi.gov.in/en-us/contact-Us
5. IB- https://www.nibindia.in/welcome
6. NIA- https://www.nia.gov.in
7. MP Police- https://www.mppolice.gov.in

Part D- Assessment and Evaluation

Suggested Continuous Evaluation methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 25 Marks

University Exam (UE): 75 Marks

Internal assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	15 10
External Assessment: University Exam Section: 75	**Section(A):** Three Very Short Questions (50 words)	03 x 03 = 09

Time: 02:00 Hours	**Section(B):** Four Short Questions (200 Words Each) **Section(C):** Two Long Questions (500 Words Each)	04 x 09 = 36 02 x 15 = 30 Total = 75

Any Remarks/suggestions:

Assignments

1. Various aspects of Crime.
2. Different School of Criminology.
3. History of police in India.
4. To differentiate between Armed and Unarmed security agencies.
5. To differentiate between indoor and outdoor scene of crime.
6. Importance of still and movie photography at scene of crime.
7. History of Indian Penal Code.
8. Role of section 45 IEA in court proceeding.

Projects:

1. To prepare crime map based on region.
2. Hierarchical setup of state police.
3. Development of BPR&D.
4. List of Cognizable and Non-Cognizable Offences.
5. Crime Scene investigation for Murder.

Seminar topics:

1. Crime against Women or Children.
2. Hate Crime.
3. Victim societal relation.
4. Role of Police in crime solving.
5. Difference in the functioning of CBI and RAW.
6. Need for Police modernization.
7. Protection of scene of crime.
8. Search methods at scene of crime.
9. Importance of IPC in today's scenario.
10. Difference between CrPC and IEA.

Visit:

Visit to nearest Police Station/Real Crime Scene/Lower Court.

Second Semester Syllabus for B.Sc. I Year Forensic Science Course (Practical)

Part A- Introduction

Program: Certificate	Class: B.Sc.	Semester: II	Session:2021

Subject: Forensic Science

1.	Course Code	S1-FOSC1P
2.	Course Title	Crime Scene Management (Paper 1)
3.	Course Type: (Core Course/Elective/ Generic Elective/Vocational)	Core Course (PRACTICAL- MINOR)
4.	Pre- requisite (if any)	To study this course, student must be from Maths/Biology/Science background in 12th Class
5.	Course Learning Outcomes (CLO)	Learning objectives: After studying this paper the students will know the following: a. About crime scene and its preservation. b. Crime scene documentation procedures c. Different methods usedu for search of crime scene d. Different methods used for Sketching of crime scene. e. Gaining hands on training will help the students to handle real crime scene and crime investigation
	Credit Value	2
	Total Marks	Max. Marks: 25+ 75 / Min. passing Marks 33

Part B – Content of the Course

Total No. of Lectures (in hours per week):m 2 hours per week

Total Lectures: 30 hours

Unit	Topics	No. of Lectures
1.	Demonstration of crime scene management	
2.	Rough and final sketch of scene of crime	
3.	Photography of scene of crime through digital camera	
4.	Zonal method for searching of physical evidences at scene of crime	
5.	Spiral method for searching of physical evidences at scene of crime	
6.	Grid and strip method for searching of physical evidences at scene of crime	
7.	Wheel method for searching of physical evidences at scene of crime	
8.	Line method for searching of physical evidences at scene of crime	
9.	Sketching of outdoor scene of crime of homicide and suicide	
10.	Sketching of outdoor scene of crime of accidental case	
11.	Sketching of outdoor scene of crime of theft, dacoity and robbery	
12.	Sketching of outdoor scene of crime of suicide and murder	

Part C- Learning Resources

Text Books, Reference Books, Other resources

Suggested readings:

1. James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. New York, Taylor & Francis.
2. Saferstein R. (1995). Criminalistics – An Introduction to Forensic Science. USA, Prentice Hall Inc.
3. Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trails. India, Universal Law house.
4. Sharma J. D. (2011). Apradhon ka Vigyanik Anveshan. India, Madhya Pradesh Hindi Granth Academy.

Suggestive digital platforms web links:

Suggested Equivalent online courses:

Part D – Assessment and Evaluation

Suggested Continuous Evaluation methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva Voce on Practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/ Model Seminar/ Rural service/ Technology Dissemination / Report of Excursion/ Lab Visit/ Survey / Industrial visit)	10	Table work / Experiment	50
TOTAL	25		75

Any remarks/ suggestions:

Assignments:

Drawing of rough sketch of indoor/outdoor scene of crime
Drawing of final sketch of indoor/outdoor scene of crime
Photography of the given scene of crime
Searching and labelling of physical evidences at scene of crime

Second Semester Syllabus for B.Sc I Year Forensic Science Course

(Generic Open Elective)

Part A- Introduction			
Program: Certificate	Class: B.Sc	Semester: II	Session: 2021-22
Subject: Forensic Science			
1. Course Code	S1-FOSC11		
2. Course Title	Criminal Investigation and Law (Paper 1)		
3. Course Type: (Core Course/Elective/Generic elective/Vocational)	Generic Open Elective		
4. Pre-requisite (if any)	To Study this course, student must be from Maths/Biology/Science background in 12th Class.		
5. Course Learning Outcomes (CLO)	Learning Objectives: After studying this paper the students will know the following: a) The element of crime and its types. b) Police organization at national and state level. c) Crime scene management protocol and its importance in Criminal Justice System d) Different law followed in criminal investigation. e) After the successfully completing the course, student will be able to join Police Service, Private Detective or Security Agency or start his/her own Investigative Agency.		
Credit Value	4		
Total Marks	Max. Marks: 25+75	Min. passing marks:33	

Part B- Content of the Course

Total no. of lectures (in hours per week): 2 hours per week

Total Lectures: 60

Unit	Topics	No. of lectures
I	**Crime:** Elements, nature, causes and consequences of crime. Definition, aims and Scope of Crime, Deviant behavior, Hate crimes, Organized crimes and public disorder, Domestic violence and workplace violence, Victimology, Juvenile Delinquency, Social change and crime, psychological disorders and criminality, Situational Crime Prevention. **Keywords:** Crime, Violence, Deviant behavior, Juvenile delinquency, psychological disorders	10
II	**Police organizations and FIR:** **State Police Forces:** [redacted] **Central armed police forces**- BSF, CRPF, CISF, ITBP, NSG, Assam Rifle. **Investigation:** FIR, Case diary, Interrogation of suspects, Interview of witnesses, Cognizable and Non-cognizable offences, Compoundable and Non-compoundable offences, Police custody & Judicial custody, Bailable and Non-bailable offences, Procedure of filing charge sheet. **Keywords:** Police organizations, Central and State Police, CBI, NIA, RAW, CID, FIR, Case Diary, Police Custody, Bailable and Non-Bailable Offences	12
III	**Scene of Crime:** Introduction to Crime Scene, Classifications of Crime scenes securing and isolating the crime scene, Role of the First responding officer, Crime scene	10

	communication, Legal implications for Crime scene searches, Plan of action, Note taking, Crime scene search and photography, Types of cameras, Number of photographs, Admissibility of photographs, Videography of the crime scene. **Keywords:** Scene, Searching methods, Photography, Videography	
IV	**Indian Penal Code (1860):** **Pertaining to Offences against persons**- Sections 121A, 299, 300, 302, 304A, 304B, 307, 309, 319, 320, 324, 326, 351, 354, 359, 362. Sections 375, 376 & 377 and their amendments. **IPC (1860)**: Pertaining to Offences against property sections- 378, 383, 390, 391, 405, 415, 420, 441, 463, 497, 498A, 499, 503, 511. **Keywords:** IPC sections, Offence against persons, Offences against property.	14
V	**Criminal Procedure Code and Indian Evidence Act:** **Criminal Procedure Code (1973):** Introduction and general idea of sections: 291-93, 154, 155, 156, 157, 158, 159, 160, 161, 162, 172, 173, 174, 175 and 176 Indian Evidence Act (1872)- Evidence and rules of relevancy in brief, expert witness, Cross Examination and Re-examination of Witnesses, Sections- 32, 41, 45, 46, 47, 57, 58, 60, 73,114(A) 135, 136, 137, 138, 141. **Keywords:** Criminal Procedure Code, Indian Evidence Act, Expert Witness, Cross examination.	14

Part C- Learning Resources

Textbooks, References Books, Other resources

Suggested readings:

1. Ahuja R. (2001). Criminology. India: Rawat Pub.
2. Aitken C.G.G. & Stoney D.A. (1991). The use of statistics in Forensic Science. England: Ellis Hardwood Limited
3. Bowen R.T. (2016). Ethics and the practice of Forensic Science. USA: CRC Press.
4. Burke R.H. (2013). An Introduction to Criminological Theory 4th edition UK: Routledge.
5. Horsewell J. (2016). The practice of crime Scene Investigation. USA: CRC Press.
6. Indian Penal Code, Criminal procedure code, Indian Evidence Act.
7. James S.H. & Nordby J.J (2003). Forensic Science: An Introduction to Scientific and Investigive techniques. USA: CRC Press.

Suggestive Digital platforms web Links:

Suggested Equivalent Online Course:

1. http://14.139.95/CEC/index.php/search_result
2. BSF- https://bsf.gov.in
3. CRPF- https://crpf.gov.in
4. CBI- https://cbi.gov.in/en-us/contact-Us
5. IB- https://www.nibindia.in/welcome
6. NIA- https://www.nia.gov.in
7. MP Police- https://www.mppolice.gov.in

Part D- Assessment and Evaluation

Suggested Continuous Evaluation methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 25 Marks

University Exam (UE): 75 Marks

Internal assessment:	Class Test	15
Continuous Comprehensive Evaluation (CCE): 25	Assignment/Presentation	10

External Assessment: University Exam Section: 75 Time: 02:00 Hours	**Section(A):** Three Very Short Questions (50 words)	03 x 03 = 09
	Section(B): Four Short Questions (200 Words Each)	04 x 09 = 36
	Section(C): Two Long Questions (500 Words Each)	02 x 15 = 30 Total = 75

Any Remarks/suggestions:

Assignments

1. Various aspects of Crime.
2. Different School of Criminology.
3. History of police in India.
4. To differentiate between Armed and Unarmed security agencies.
5. To differentiate between indoor and outdoor scene of crime.
6. Importance of still and movie photography at scene of crime.
7. History of Indian Penal Code.
8. Role of section 45 IEA in court proceeding.

Projects:

1. To prepare crime map based on region.
2. Hierarchical setup of state police.
3. Development of BPR&D.
4. List of Cognizable and Non-Cognizable Offences.
5. Crime Scene investigation for Murder.

Seminar topics:

1. Crime against Women or Children.
2. Hate Crime.
3. Victim societal relation.
4. Role of Police in crime solving.
5. Difference in the functioning of CBI and RAW.
6. Need for Police modernization.
7. Protection of Scene of crime.
8. Search methods at Scene of crime.
9. Importance of IPC in today's scenario.
10. Difference between CrPC and IEA.

Visit:

Visit to nearest Police Station/Real Crime Scene/Lower Court.

DEPARTMENT OF FORENSIC SCIENCE

GOVT. HOLKAR SCIENCE COLLEGE

INDORE (M.P.)

SYLLABUS

FOR

B.Sc Second year

BASED ON DEPARTMENT OF HIGHER EDUCATION (M.P.)

FORENSIC SCIENCE

(3 YEARS UG PROGRAM)

(2021-22 onwards)

Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department: Forensic Science

Syllabus Session 2021-22

Programme: B.Sc. **Class: B.Sc. II YEAR**

Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -1	Indian Penal Code, Criminal Procedure Code, Indian Evidence Act and Judicial system	222-I	40	28	10	3	33	50	17
Paper -2	Examination of Physical Evidences & Forensic Ballistics	222-II	40		10	3			

27.11.2021

Govt. Holkar (Model, Autonomous) Science College, Indore

Department: Forensic Science

YEAR 2020-21

Class: B.Sc. II Year

Title of the Paper (Course): Indian Penal Code, Criminal Procedure Code, Indian Evidence Act and Judicial system

Course Code: 222-I

Course Objective:

1: To know Indian judicial system.

2: To know functioning of Court in India

Course Outcome: After completion of this paper students will be able to-

CO1: Describe Indian Penal Code.

CO2: Illustrate Criminal Procedure Code.

CO3: Recognize Indian Evidence Act.

CO4: Summarize Indian Judicial System.

CO5: Relate Forensic Science and Indian Judicial System.

27.11.2021

Unit-I Indian Penal Code, 1860

1. Offences against person (Ss. 299 to 309, 319-326, 339, 340, 354, 359, 362, 375-377).
2. Offences against property (Ss. 378 to 404,415-420,425,441)
3. Sexual offences (Ss. 375 to377).
4. General exceptions (Ss. 76 to106)

Unit-II Criminal Procedure Code, 1973

1. Constitution of Criminal Court (Ss. 6 – 25) and Power of Courts (Ss. 26 –35).
2. Arrest of Persons (Ss. 41 -60), Warrant of Arrest (Ss.70- 81).
3. Preventive Action of the Police (Ss. 149 –153).
4. Evidence in Inquiries and Trials (Ss. 291 –293).

Unit-III Indian Evidence Act, 1872

1. Relevancy of facts (Ss. 5 – 10), Admission (Ss. 17, 22, 23, 25, 26). 2. Experts (Ss. 45, 46, 47, 47A) and Proof (Ss. 56 –58).
2. Oral Evidence (Ss. 59 – 60) and Documentary Evidence (Ss. 61 – 65, 65B, 67, 67A, 73)
3. IEA Sections – 113A, B, 114A, 137 -38, 141 -43, 146, 148, 151,159)

Unit-IV Administration of Justice and Punishment

1. Difference between civil and criminal justice.
2. Primary and secondary function of Court of Law.
3. Rules for assessment of punishment.
4. Imprisonment.

Supriya

27.11.2021

Unit-V Courts in India

1. Introduction to Courts in India.
2. Functioning of Courts at State level (With special reference to Madhya Pradesh).
3. Functioning of Supreme Court of India.
4. Special Courts: CBI Court, Juvenile Court, Family Court etc.

27.11.2021

S.No.	Name of Book	Name of Author	Name of Publisher
1.	An Introduction to Forensic Science in Criminal investigation Techniques	Dr.Rukmani Krishnamurti	Selective & Scientific Books, Delhi-110092
2.	Physical Evidence in Criminal Investigation and trials	Dr. B P Maithil	Selective & Scientific Books, Delhi-110092
3.	Crime Scene Management, A Forensic Approach	Dr. M.S. Rao, Dr. B P Maithil	Selective & Scientific Books, Delhi-110092
4.	Handbook of Forensic Psychology	Prof. (Dr.) Vimala Veeraghavan	Selective & Scientific Books, Delhi-110092
5.	Computer Crime & Computer Forensic	Dr. R K Tewari, P.K. Sastry, K.V Ravi Kumar	SELECT Publishers, Delhi-110092
6.	Textbook of Medical Jurisprudence Forensic Medicine	Parikh	CBS Publishers & Distributors Pvt Ltd, New Delhi-110002
7.	Practical aspects of Forensic Chemistry 12	Anil Kr. Teotia, Rishi Pal	Selective & Scientific Books, Delhi-110092
8.	Criminology & Penology with Victimology	Prof. N V Paranjape	Central Law Publications, Allahabad
9.	Suspect Document	Wilson R Harrison	
10.	Forensic Science in Crime Investigation	B S Nabar	Asia Law House, Hydrabad
11.	The Essentials of Forensic Medicine and Toxicology	Dr. K.S. Narayan Reddy	K. Sugana Devi, Hyderabad-500036
12.	Firearms investigation and Trials	B.R. Sharma	

27.11.2021

13.	Computer Crime Computer Forensic	Dr. R K Tiwari & P K Sastri, K.V Ravikumar	Select Publishers, Delhi-110092
14.	VidhivigyanavemVishVigyan	Dr. J D Sharma	The Lawyer's Home, Indore-452007
15.	ApradhkaVegyanikAnveshan	Dr. J D Sharma	Madhya Pradesh Hindi Granth Academy, Bhopal-462003
16.	Instrumental Methods of Chemical Analysis	Chatwal&Anand	Mrs. Meena Pandey, Himalaya Publishing House, Girgaon, Mumbai-400004
17.	Forensic Science & Its Related Issues	V.N. Sehgal, Prof. Surinder Nath	Selective & Scientific Books, Delhi-110092
18.	Biometrics & Fingerprint Analysis	Mrs. S. IndraSudha	Selective & Scientific Books, Delhi-110092
19.	Forensic Science & Crime Investigation	Dr. B.P. Maithil, Dr. Rajesh Mishra, Dr. D.K. Satyapathi	Selective & Scientific Books, Delhi-110092

27.11.2021

Govt. Holkar (Model, Autonomous) Science College, Indore

Department: Forensic Science

YEAR 2020-21

Class: B.Sc. II Year

Title of the Paper (Course): Examination of Physical Evidences & Forensic Ballistics

Course Code: 222-II

Course Objective:

1: To know Fingerprint, Documents, Handwriting and its analysis

2: To know Biological evidence, Physical evidence and its examination.

Course Outcome: After completion of this paper students will be able to-

CO1: Describe Fingerprint and its examination.

CO2: Basic illustration of Documents and Handwriting.

CO3: Basic identification of Saliva, Urine, Blood and DNA & its analysis.

CO4: Basic recognition of Firearm and Ammunition.

CO5: Explain of Hair, Fiber, Glass, and Fire related cases.

27.11.2021

Unit-I Fingerprints

1. History, Important Features and Pattern of Fingerprints.
2. Ridge Characteristics, Classification of Fingerprints: Primary and Secondary.
3. Location and Preservation of Fingerprints.
4. Development of Latent Fingerprints, Matching and Examination of Fingerprints.

Unit-II Documents& Handwriting

1. Types and Nature of Documents.
2. Ink, Paper, Writing Instruments and Their Characteristics.
3. Characteristics and factors affecting Handwriting.
4. Examination of Documents and Handwriting.

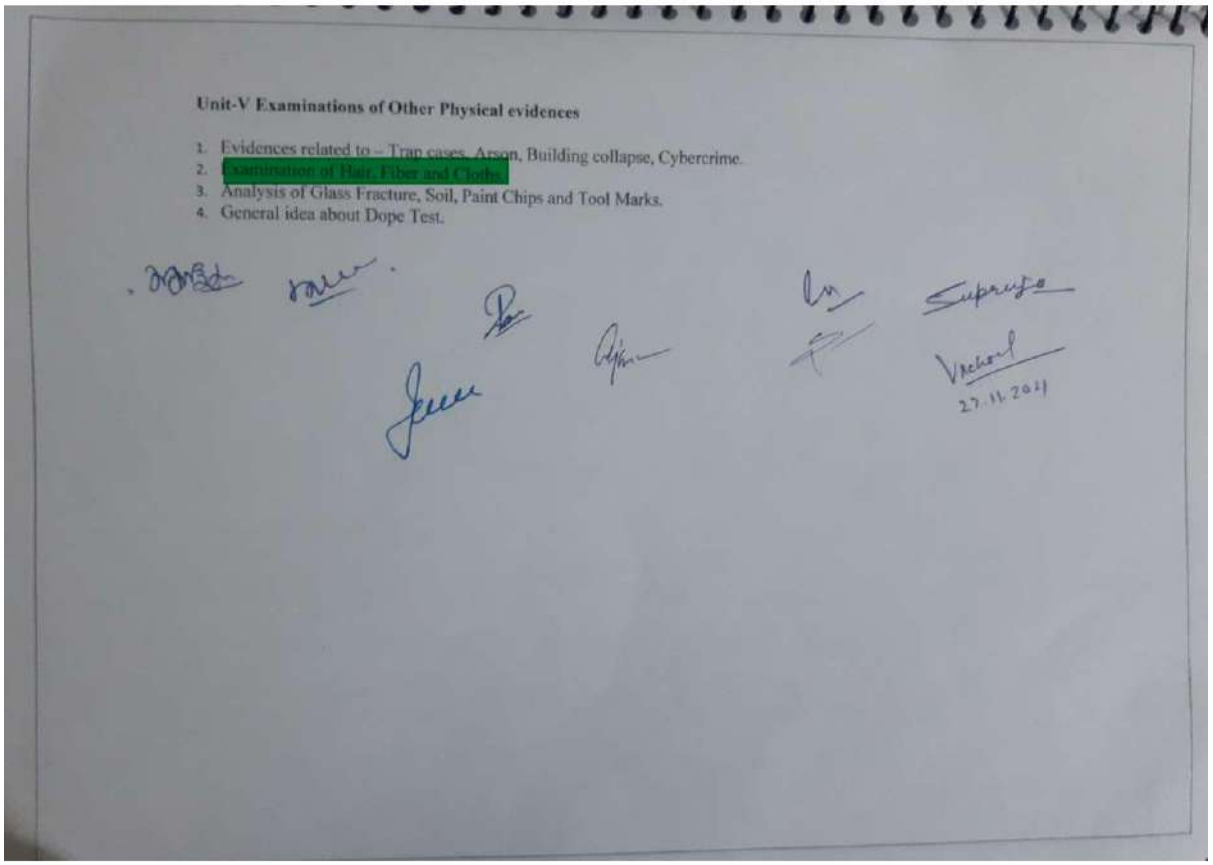
Unit-III Examination of Biological Samples

1. Blood and Blood stain, Examination of Blood Grouping.
2. Examination of Saliva, Semen and Urine.
3. Isolation, Purification and Characterization of DNA
4. Genetic Marker and DNA Fingerprinting.

Unit-IV Firing Mechanisms and Firearm Injuries

1. Gun Short Residues (GSR), Mechanism of formation of GSR, Modern methods of analysis of GSR from the shooting hand and target with special reference to clothing.
2. Firearm Injuries: Ballistic aspect of Firearm Injuries.
3. Examination of Bullet, Fire Empty Cartridge and Gunpowder.
4. Types of Firearms (Pistol, Revolver, Rifles, Machine Guns, Shotgun)
5. Ammunition: Types, Cartridge Components (Cartridge case primer propellant, Bullets, Pellets and wads)

27/12/21



Unit-V Examinations of Other Physical evidences

1. Evidences related to – Trap cases, Arson, Building collapse, Cybercrime.
2. Examination of Hair, Fiber and Cloths.
3. Analysis of Glass Fracture, Soil, Paint Chips and Tool Marks.
4. General idea about Dope Test.

27.11.2021

S.No.	Name Of Book	Name of Author	Name of Publisher
1.	An Introduction to Forensic Science in Criminal investigation Techniques	Dr.Rukmani Krishnamurti	Selective & Scientific Books, Delhi-110092
2.	Physical Evidence In Criminal Investigation and trials	Dr. B P Maithil	Selective & Scientific Books, Delhi-110092
3.	Crime Scene Management, A Forensic Approach	Dr. M.S. Rao, Dr. B P Maithil	Selective & Scientific Books, Delhi-110092
4.	Handbook of Forensic Psychology	Prof. (Dr.) Vimala Veeraghavan	Selective & Scientific Books, Delhi-110092
5.	Computer Crime & Computer Forensic	Dr. R K Tewari, P.K. Sastry, K.V Ravi Kumar	SELECT Publishers, Delhi-110092
6.	Textbook of Medical Jurisprudence Forensic Medicine	Parikh	CBS Publishers & Distributors Pvt Ltd, New Delhi-110002
7.	Practical aspects of Forensic Chemistry 12	Anil Kr. Teotia, Rishi Pal	Selective & Scientific Books, Delhi-110092
8.	Criminology & Penology with Victimology	Prof. N V Paranjape	Central Law Publications, Allahabad
9.	Suspect Document	Wilson R Harrison	
10.	Forensic Science in Crime Investigation	B S Nabar	Asia Law House, Hyderabad
11.	The Essentials of Forensic Medicine and Toxicology	Dr. K.S. Narayan Reddy	K. Sugana Devi, Hyderabad-500036
12.	Firearms investigation and Trials	B.R. Sharma	
13.	Computer Crime Computer Forensic	Dr. R K Tiwari & P K Sastri, K.V Ravikumar	Select Publishers, Delhi-110092

27.11.2021

14.	VidhivigyanavemVishVigyan	Dr. J D Sharma	The Lawyer's Home, Indore-452007
15.	ApradhkaVegyanikAnveshan	Dr. J D Sharma	Madhya Pradesh Hindi Granth Academy, Bhopal-462003
16.	Instrumental Methods of Chemical Analysis	Chatwal & Anand	Mrs. Meena Pandey, Himalaya Publishing House, Girgaon, Mumbai-400004
17.	Forensic Science & Its Related Issues	V.N. Sehgal, Prof. Surinder Nath	Selective & Scientific Books, Delhi-110092
18.	Biometrics & Fingerprint Analysis	Mrs. S. IndraSudha	Selective & Scientific Books, Delhi-110092
19.	Forensic Science & Crime Investigation	Dr. B.P. Maithil, Dr. Rajesh Mishra, Dr. D.K. Satyapathi	Selective & Scientific Books, Delhi-110092

27.11.2021

Class- B.Sc. II Year

Title of the Paper (Course) - Practical

Course Code- PR-02

1. To obtain Plain and rolled inked fingerprints.
2. Location of visible & latent fingerprints.
3. Development of latent fingerprints.
4. Lifting of fingerprints.
5. To identify the finger Print Patterns.
6. Identification of ridge characteristics.
7. Primary classification of given 10-digit fingerprint card.
8. Examination of Blood:
    i. Preliminary Examination of blood
    ii. Difference between Human and Animal Blood
    iii. Crystal test of Blood
    iv. ABO grouping of Human Blood
    v. RH factor of human blood
9. Preliminary Examination of Saliva.
10. To study Comparison Microscope.
11. Difference between Human and Animal Hair.

27.11.2021

12. Microscopic and chemical examination of different plants, animal's fibers.
13. Preliminary Examination of Semen. Handling of Charred Documents.
14. To identify the alteration.
15. Examination of forged signature.
16. Decipher of mechanically erased writing.
17. Differentiation between typed and printed documents.
18. Establishing the origin of documents i.e., manual typed or generated by print.
19. Examination of Tool –Marks.
20. Identification of Shell-Case, Bullet and Shot using Vanier Calipers, and Screw Gauge.
21. Examination of Fired Empty Cartridge and Bullet using Comparison Microscope.
22. Measurement the depth of curved glass using speedometer.
23. To determine the refractive index of glass/ paint chip with the help of Refractometer.
24. Casting of foot/footwear print and tyre marks from soft surface.
25. Any other exercise if required.

27.11.2021

DEPARTMENT OF FORENSIC SCIENCE

GOVT. HOLKAR SCIENCE COLLEGE

INDORE (M.P.)

SYLLABUS

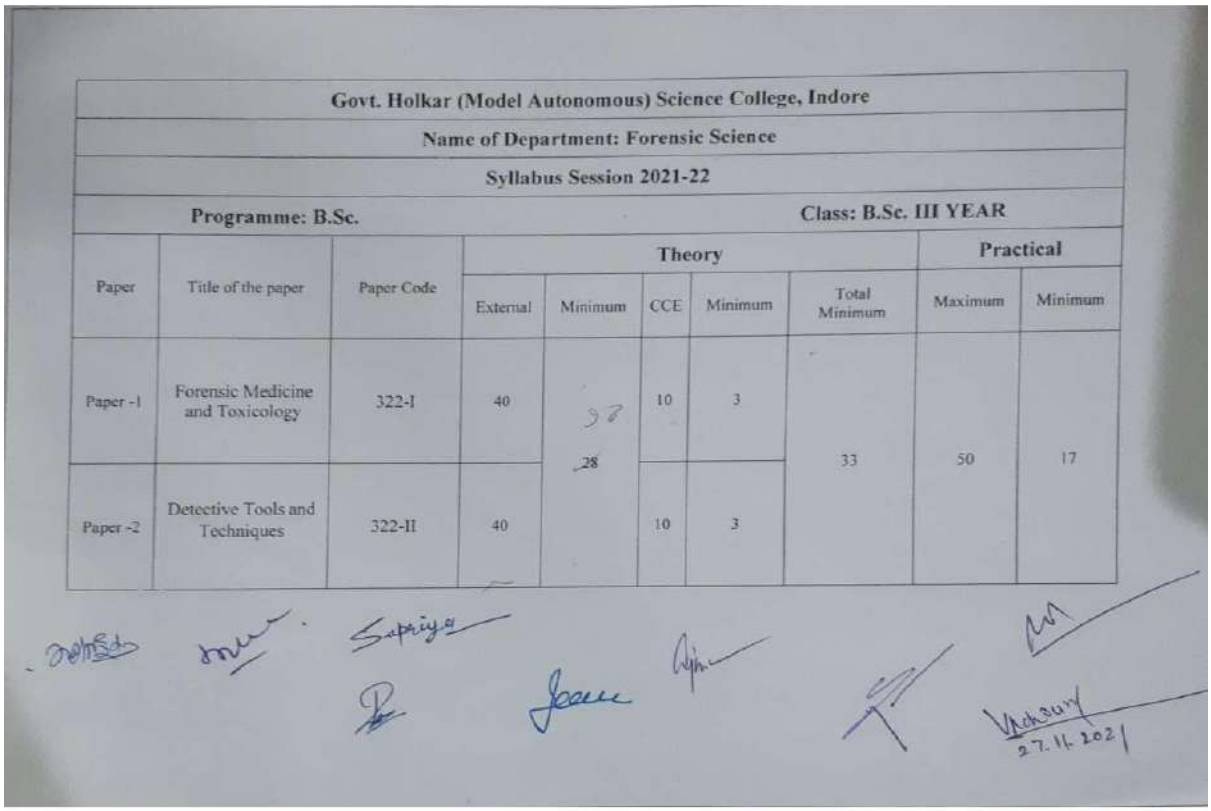
FOR

B.Sc Third year
BASED ON DEPARTMENT OF HIGHER EDUCATION (M.P.)

FORENSIC SCIENCE

(3 YEARS UG PROGRAM)

(2021-22 onwards)



Govt. Holkar (Model Autonomous) Science College, Indore

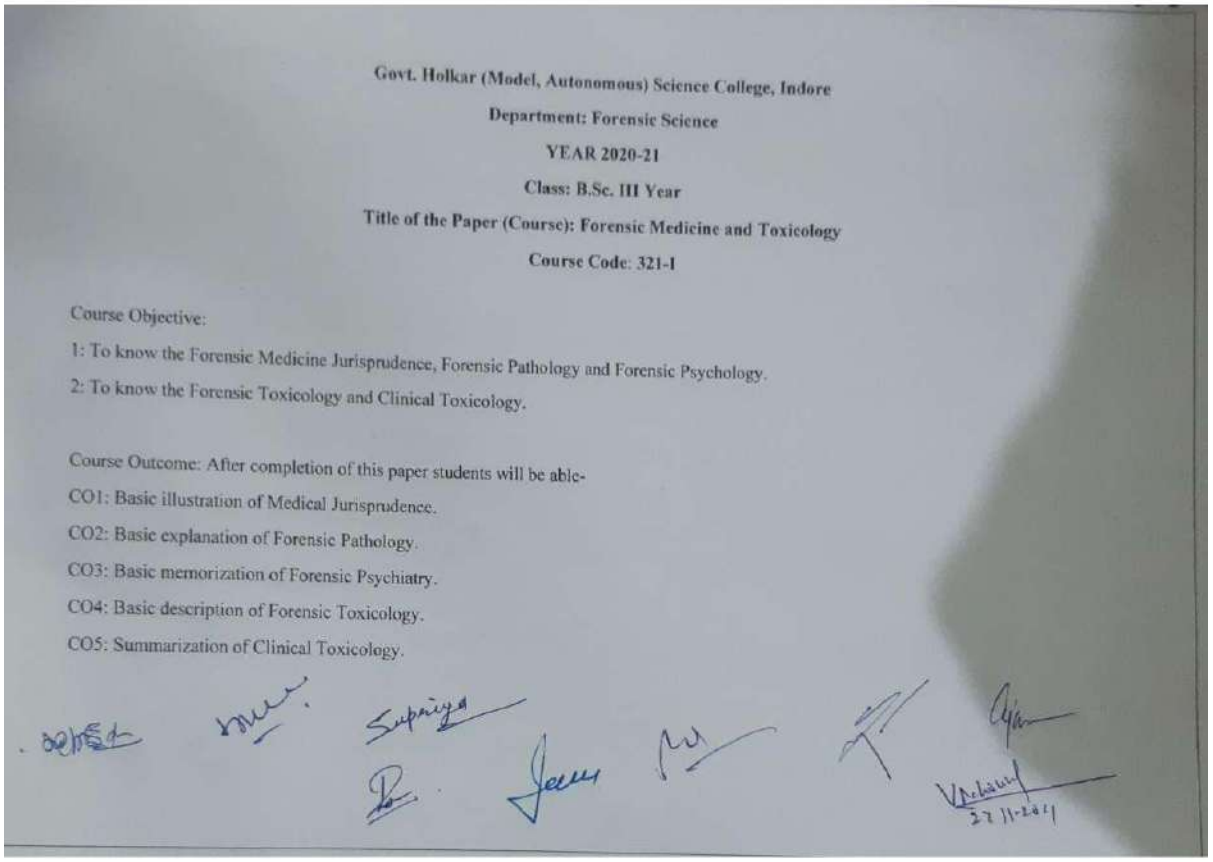
Name of Department: Forensic Science

Syllabus Session 2021-22

Programme: B.Sc. **Class: B.Sc. III YEAR**

Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -1	Forensic Medicine and Toxicology	322-I	40	28	10	3	33	50	17
Paper -2	Detective Tools and Techniques	322-II	40		10	3			

27.11.2021



Govt. Holkar (Model, Autonomous) Science College, Indore

Department: Forensic Science

YEAR 2020-21

Class: B.Sc. III Year

Title of the Paper (Course): Forensic Medicine and Toxicology

Course Code: 321-I

Course Objective:

1: To know the Forensic Medicine Jurisprudence, Forensic Pathology and Forensic Psychology.

2: To know the Forensic Toxicology and Clinical Toxicology.

Course Outcome: After completion of this paper students will be able-

CO1: Basic illustration of Medical Jurisprudence.

CO2: Basic explanation of Forensic Pathology.

CO3: Basic memorization of Forensic Psychiatry.

CO4: Basic description of Forensic Toxicology.

CO5: Summarization of Clinical Toxicology.

Unit-I Forensic Medicine Jurisprudence

1. Definition, history and scope of Forensic Medicine.
2. Nature and Powers of criminal court in India, General idea about NDPS Act- 1985 (Section- 15-32,37)
3. Evidence in court, Medico Legal reports of dying declaration.
4. Medical ethics- Infamous conduct, misconduct, appeal and punishment.

Unit-II Forensic Pathology

1. Modes and Types of Death, Signs of Death, Post-mortem Changes (Time Since Death) and Post-Mortem Examination (Autopsy).
2. Introduction, definition and types of Corpus Delicate.
3. Introduction to Path Physiology- Signs and Symptoms, Introduction of Drug of Abuse, Classification, Drug abuse in Sports, NADA, WADA.
4. Introduction, definition and medico-legal aspects of Trauma and Injury and their Classification.

Unit-III Sexual Jurisprudence, Infanticide and Forensic Psychiatry

1. Explanation of Virginity, Pregnancy, Criminal abortion and Rape.
2. Viability, Haste's Rule, Cause of death: examination.
3. Battered baby syndrome, Sudden infant death syndrome.
4. Definition and brief overview of common mental illnesses (Forensic Psychology).

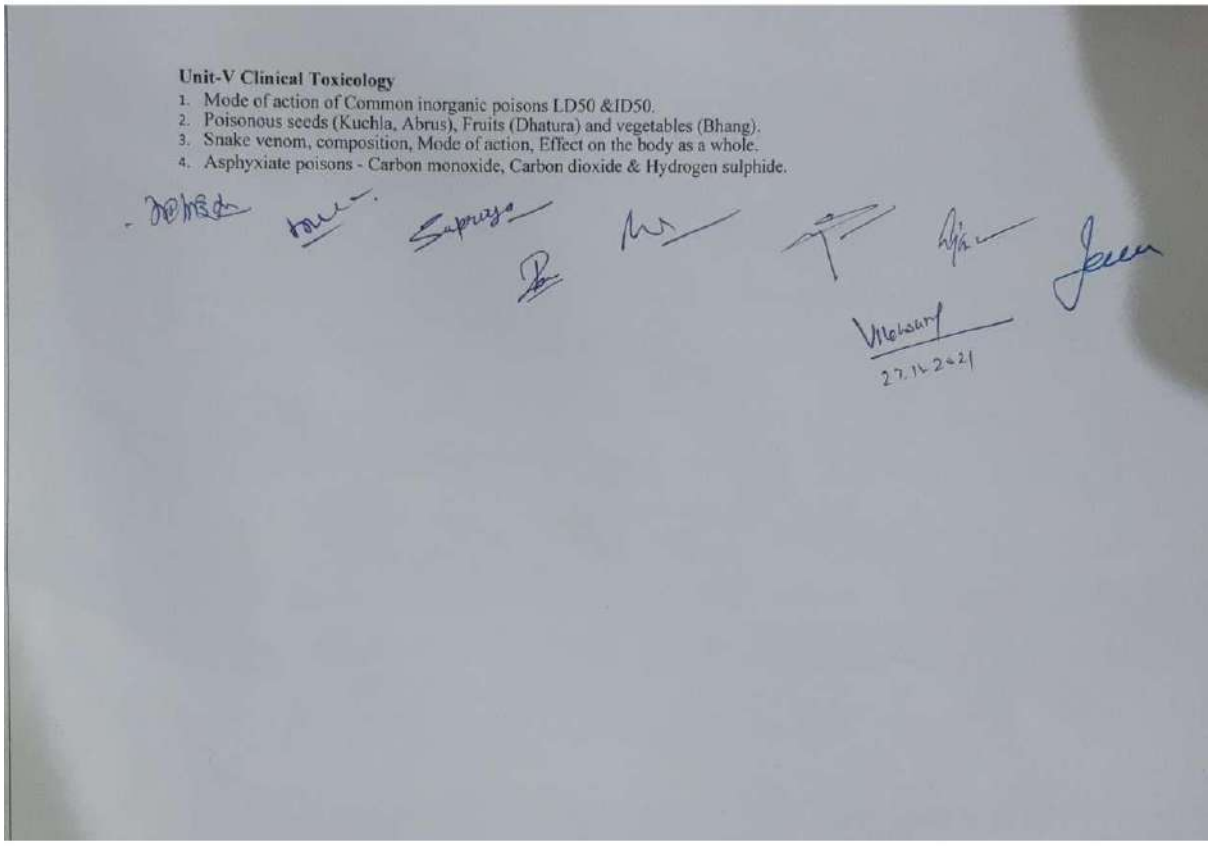
Unit-IV Forensic Toxicology

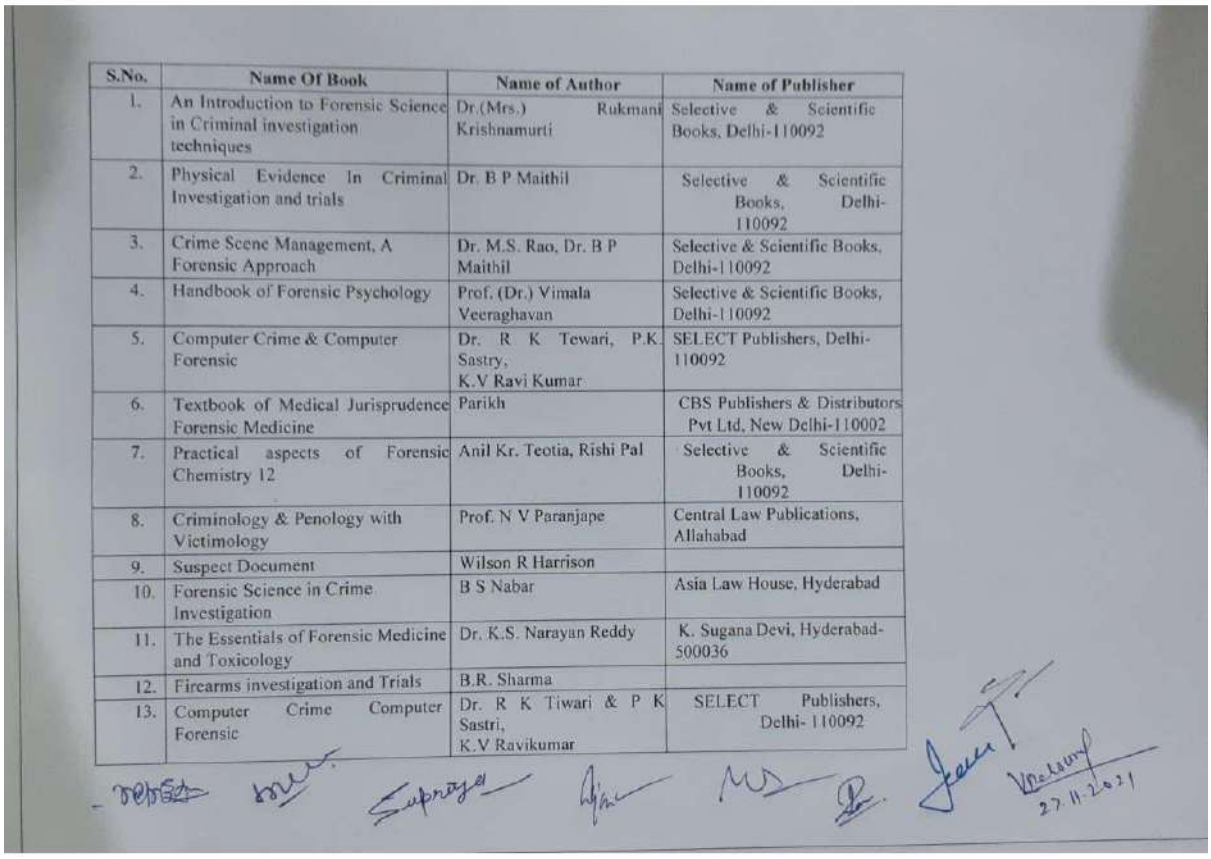
1. Introduction, History and Definition of Forensic Toxicology.
2. Medico-legal aspects of poisons and Types of Poisoning, Classification of Poisons.
3. General Principles of management of poisoning, Alcoholic Drinks (Ethyl Alcohol and Methyl Alcohol)
4. Corrosive poisons – (Sulphuric acid, Phenol and Oxalic acid) and Metallic Poisons (As, Hg, Pb, Cu, Zn).

27.11.2021

Unit-V Clinical Toxicology

1. Mode of action of Common inorganic poisons LD50 &ID50.
2. Poisonous seeds (Kuchla, Abrus), Fruits (Dhatura) and vegetables (Bhang).
3. Snake venom, composition, Mode of action, Effect on the body as a whole.
4. Asphyxiate poisons - Carbon monoxide, Carbon dioxide & Hydrogen sulphide.





S.No.	Name Of Book	Name of Author	Name of Publisher
1.	An Introduction to Forensic Science in Criminal investigation techniques	Dr.(Mrs.) Rukmani Krishnamurti	Selective & Scientific Books, Delhi-110092
2.	Physical Evidence In Criminal Investigation and trials	Dr. B P Maithil	Selective & Scientific Books, Delhi-110092
3.	Crime Scene Management, A Forensic Approach	Dr. M.S. Rao, Dr. B P Maithil	Selective & Scientific Books, Delhi-110092
4.	Handbook of Forensic Psychology	Prof. (Dr.) Vimala Veeraghavan	Selective & Scientific Books, Delhi-110092
5.	Computer Crime & Computer Forensic	Dr. R K Tewari, P.K. Sastry, K.V Ravi Kumar	SELECT Publishers, Delhi-110092
6.	Textbook of Medical Jurisprudence Forensic Medicine	Parikh	CBS Publishers & Distributors Pvt Ltd, New Delhi-110002
7.	Practical aspects of Forensic Chemistry 12	Anil Kr. Teotia, Rishi Pal	Selective & Scientific Books, Delhi-110092
8.	Criminology & Penology with Victimology	Prof. N V Paranjape	Central Law Publications, Allahabad
9.	Suspect Document	Wilson R Harrison	
10.	Forensic Science in Crime Investigation	B S Nabar	Asia Law House, Hyderabad
11.	The Essentials of Forensic Medicine and Toxicology	Dr. K.S. Narayan Reddy	K. Sugana Devi, Hyderabad-500036
12.	Firearms investigation and Trials	B.R. Sharma	
13.	Computer Crime Computer Forensic	Dr. R K Tiwari & P K Sastri, K.V Ravikumar	SELECT Publishers, Delhi-110092

27.11.2021

14.	VidhivigyanavemVishVigyan	Dr. J D Sharma	The Lawyer's Home, Indore-452007
15.	ApradhkaVegyanikAnveshan	Dr. J D Sharma	Madhya Pradesh Hindi Granth Academy, Bhopal-462003
16.	Instrumental Methods of Chemical Analysis	Chatwal & Anand	Mrs. Meena Pandey, Himalaya publishing House Girgaon, Mumbai-400004
17.	Forensic Science & Its Related Issues	V.N. Sehgal, Prof. Surinder Nath	Selective & Scientific Books, Delhi-110092
18.	Biometrics & Fingerprint Analysis	Mrs. S. Indra Sudha	Selective & Scientific Books, Delhi-110092
19.	Forensic Science & Crime Investigation	Dr. B.P. Maithil, Dr. Rajesh Mishra, Dr. D.K. Satyapathi	Selective & Scientific Books, Delhi-110092

Supriya

Vachly

27.11.2021

Govt. Holkar (Model, Autonomous) Science College, Indore

Department: Forensic Science

YEAR 2020-21

Class: B.Sc. III Year

Title of the Paper (Course): Detective Tools and Techniques

Course Code: 322-II

Course Objective:

1: To know the Different Detective tools used in Forensic Science.

2: To know the Chromatography, Microscopy and Electrophoresis.

Course Outcome: After completion of this paper students will be able-

CO1: Basic description of Detective tools.

CO2: Basic illustration of Microscopy and Chromatography.

CO3: Basic explanation of Spectroscopy and Electrophoresis.

CO4: Summarization of Centrifugation and Radio isotopic method.

CO5: Basic identification of Molecular Biology.

22.11.2021

Unit-I Detective Tools in Forensic Science

1. Introduction to Various Detective Tools used in Forensic Science.
2. Brief Idea about Narco Test, Brain mapping and Polygraph.
3. Spy camera, Microchip and Taping.
4. General Idea about Modern Techniques in Forensic Science: VSC, ESDA, 3D Facial Reconstructions, Forensic C14 dating, Automated Fingerprint Identification System (AFIS).

Unit-II Microscopy &Chromatographic Techniques

1. Brief Idea about Principle and Application of Bright field, Dark field and Electron Microscopy.
2. Comparison Microscope and Other Modern Microscope.
3. Principle and Application of Paper Chromatography, Thin Layer Chromatography, Gel Filtration, Affinity, Ion-Exchange Chromatography.
4. Gas Chromatography and HPLC.

Unit-III Electrophoresis and Spectroscopy

1. Electrophoresis: Principle, Types and Applications.
2. Polyacrylamide and Agarose Gel Electrophoresis
3. Spectroscopy: Basic Principle, Law of Absorption and Types.
4. Principle and Application of Visible & Ultraviolet Spectroscopy.

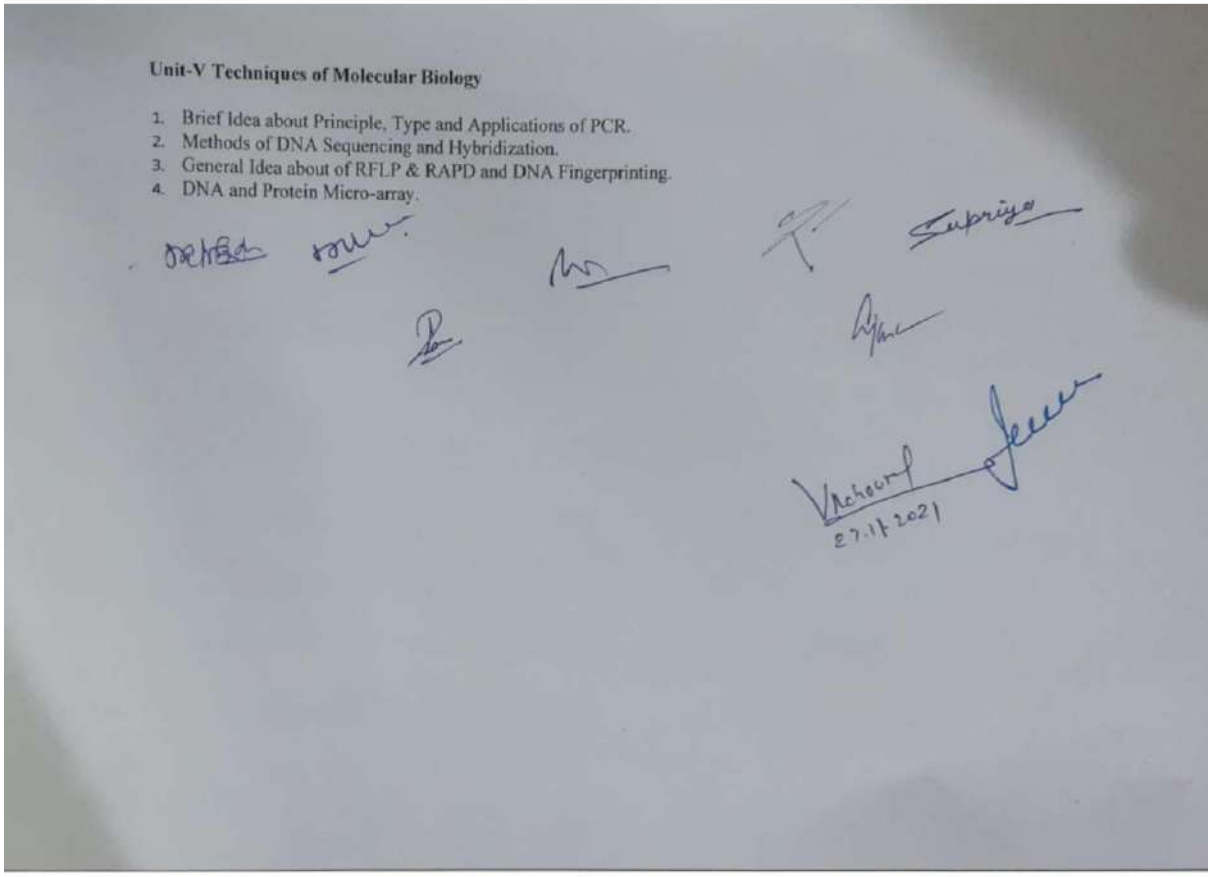
Unit-IV Centrifugation and Radio-Isotopic Techniques

1. Centrifugation: Basic Principle and Application of Preparative and Analytical Centrifuge.
2. Brief Idea about Radio-Isotopic Techniques, Radioactive Decay.
3. Use of Radioisotopes in Forensic Science.
4. Autoradiography- Principle and Applications.

27.11.2021

Unit-V Techniques of Molecular Biology

1. Brief Idea about Principle, Type and Applications of PCR.
2. Methods of DNA Sequencing and Hybridization.
3. General Idea about of RFLP & RAPD and DNA Fingerprinting.
4. DNA and Protein Micro-array.



S.No.	Name Of Book	Name of Author	Name of Publisher
1.	An Introduction to Forensic Science in Criminal investigation Techniques	Dr.(Mrs.) RukmaniKrishnamurti	Selective & Scientific Books, Delhi-110092
2.	Physical Evidence In Criminal Investigation and trials	Dr. B P Maithil	Selective & Scientific Books, Delhi-110092
3.	Crime Scene Management, A Forensic Approach	Dr. M.S. Rao, Dr. B P Maithil	Selective & Scientific Books, Delhi-110092
4.	Handbook of Forensic Psychology	Prof. (Dr.) Vimala Veeraghavan	Selective & Scientific Books, Delhi-110092
5.	Computer Crime & Computer Forensic	Dr. R K Tewari, P.K. Sastry, K.V Ravi Kumar	SELECT Publishers, Delhi-110092
6.	Textbook of Medical Jurisprudence Forensic Medicine	Parikh	CBS Publishers & Distributors Pvt Ltd, New Delhi-110002
7.	Practical aspects of Forensic Chemistry 12	Anil Kr. Teotia. Rishi Pal	Selective & Scientific Books, Delhi-110092
8.	Criminology & Penology with Victimology	Prof. N V Paranjape	Central Law Publications, Allahabad
9.	Suspect Document	Wilson R Harrison	
10.	Forensic Science in Crime Investigation	B S Nabar	Asia Law House, Hyderabad
11.	The Essentials of Forensic Medicine and Toxicology	Dr. K.S. Narayan Reddy	K. Sugana Devi, Hyderabad-500036
12.	Firearms investigation and Trials	B.R. Sharma	
13.	Computer Crime Computer Forensic	Dr. R K Tiwari & P K Sastri, K.V Ravikumar	Select Publishers, Delhi-110092

27.12.2021

14.	VidhivigyanavemVishVigyan	Dr. J D Sharma	The Lawyer's Home, Indore-452007
15.	ApradhkaVegyanikAnveshan	Dr. J D Sharma	Madhya Pradesh Hindi Granth Academy, Bhopal-462003
16.	Instrumental Methods of Chemical Analysis	Chatwal&Anand	Mrs. Meena Pandey, Himalaya Publishing House, Girgaon, Mumbai-400004
17.	Forensic Science & Its Related Issues	V.N. Sehgal, Prof. Surinder Nath	Selective & Scientific Books, Delhi-110092
18.	Biometrics & Fingerprint Analysis	Mrs. S. IndraSudha	Selective & Scientific Books, Delhi-110092
19.	Forensic Science & Crime Investigation	Dr. B.P. Maithil, Dr. Rajesh Mishra, Dr. D.K. Satyapathi	Selective & Scientific Books, Delhi-110092

27.11.2021

Class- B.Sc. III Year

Title of the Paper (Course)- Practical

Course Code- PR 03

1. Identification of anion by color test.
2. Determination of cat ions by spot test.
3. Isolation of Non-Volatile poison by solvent extraction.
4. Extraction of Ethanol by simple distillation.
5. Measurement of absorption Maxima of some organic solvent by UV visible spectrophotometer.
6. Calculation of strength of some organic solvent by UV visible spectrophotometer.
7. Separation of some metal ions by paper chromatography.
8. Separation of some basic drugs by thin layer chromatography.
9. Separation of few volatile solvents by gas chromatography.
10. Separation of some Benzodiazepines by HPLC.
11. Separation of serum protein/isozymes by electrophoresis.
12. Polymerase Chain Reaction (**PCR**).
13. **PCR** based method of **DNA** tying profiling: **RFLP, RAPD SNPs,** microsatellites; Data analysis.
14. Exercise related to criminal laws and legal documentation/presentation.
15. Identification of Toxic compounds.
16. Practical demonstration of wound and injuries.
17. Any other exercise if required.

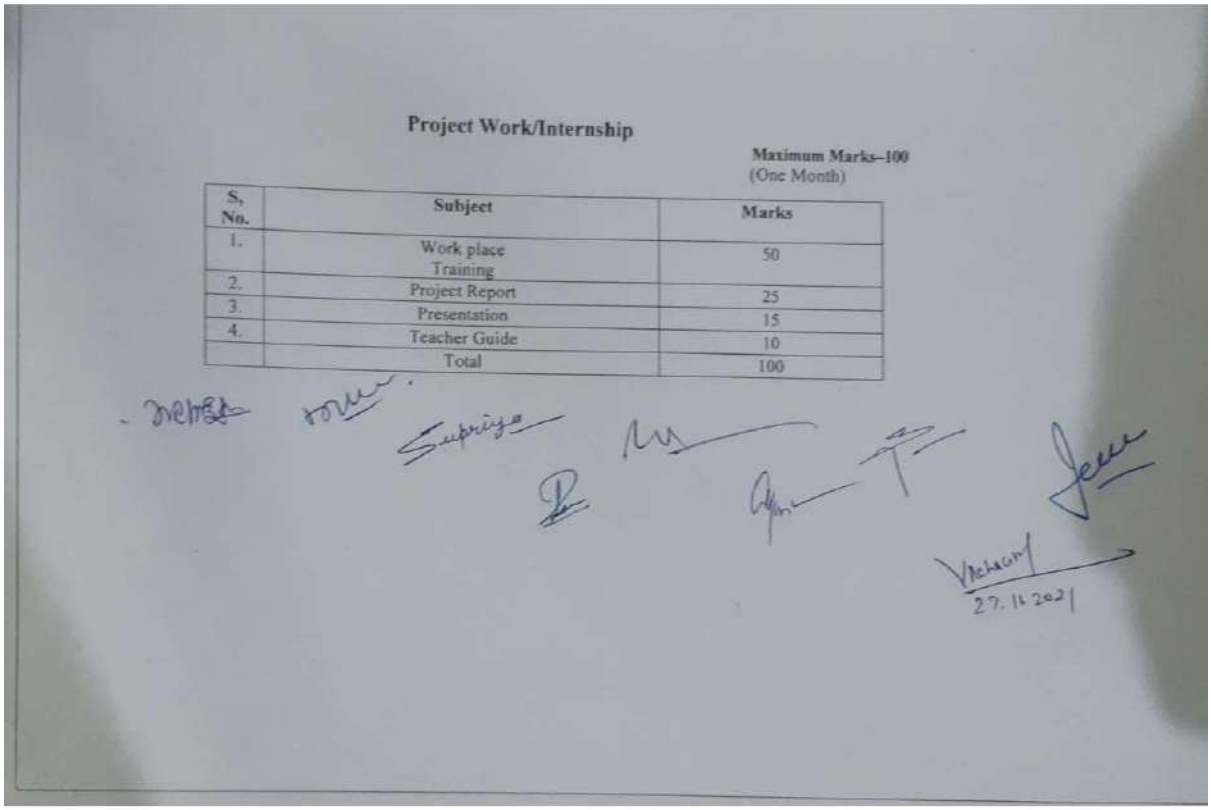
Supriya

27.11.2021

Project Work/Internship

Maximum Marks–100
(One Month)

S. No.	Subject	Marks
1.	Work place Training	50
2.	Project Report	25
3.	Presentation	15
4.	Teacher Guide	10
	Total	100



Govt. Holkar (Model, Autonomous) Science College, Indore (M.P.)										
Department of Forensic Science										
M.Sc. I semester										
Syllabus Session 2021-2022										
S. No	**Paper**	**Course Title**	**Course Code**	**Credits**	**CCE (max)**	**CCE (min)**	**External Assessment Max**	**External Assessment Min**	**Total Max**	**Total Min**
01	Core 1	Forensic Science and Criminal Justice System	FS-11	4	25	9	75	26	100	35
02	Core 2	Forensic Medicine	FS-12	4	25	9	75	26	100	35
03	Core 3	Questioned Documents, Finger Print, and other prints	FS-13	4	25	9	75	26	100	35
04	Core 4	Instrumental Methods – Physical	FS-14	4	25	9	75	26	100	35
05	Practical-I	Based on Theory Paper 1 & 2	PRFS-11	3			75		75	26
06	Practical–II	Based on Theory Paper 3 & 4	PRFS-12	3			75		75	26
07	Seminar-I			1			25		25	9
08	Seminar-II			1			25		25	9
				24					**600**	

Govt. Holkar (Model, Autonomous) Science College, Indore (M.P.)										
Department of Forensic Science										
M.Sc. II semester										
Syllabus Session 2021-2022										
S. No	**Paper**	**Course Title**	**Course Code**	**Credits**	**CCE (max)**	**CCE (min)**	**External Assessment Max**	**External Assessment Min**	**Total Max**	**Total Min**
01	Core 5	Instrumental Methods – Chemical	FS-21	4	25	9	75	26	100	35
02	Core 6	Forensic Biology	FS-22	4	25	9	75	26	100	35
03	Core 7	Forensic Chemistry and Explosives	FS-23	4	25	9	75	26	100	35
04	Core 8	Forensic Toxicology and Pharmacology	FS-24	4	25	9	75	26	100	35
05	Practical 4	Based on Theory Paper 5 & 6	PRFS-21	3			75		75	26
06	Practical 5	Based on Theory Paper 7 & 8	PRFS-22	3			75		75	26
07	Seminar III	Seminar III		1			25		25	09
08	Seminar IV	Seminar IV /Field Trip/Industrial Visit etc.		1			25		25	09
				24					**600**	

Govt. Holkar (Model, Autonomous) Science College, Indore (M.P.)										
Department of Forensic Science										
M.Sc. III semester										
Syllabus Session 2021-2022										
S.no	**Paper**	**Course Title**	**Course Code**	**Credits**	**CCE (max)**	**CCE (min)**	**External Assessment Max**	**External Assessment Min**	**Total Max**	**Total Min**
01	Core 9	Forensic Ballistics	FS-31	4	25	9	75	26	100	35
02	Core 10	Instrumental methods-Biology	FS-32	4	25	9	75	26	100	35
03	Elective-I	Forensic Serology	FS-33-A	4	25	9	75	26	100	35
	Elective-II	Fingerprints, Impressions and their examination	FS-33-B							
04	Elective-III	DNA profiling	FS-34-A	4	25	9	75	26	100	35
	Elective-IV	Pharmaceutical Jurisprudence	FS-34-B							
05	Open Elective	Open Paper (Will be selected out from inter-disciplinary approved list of papers)	OE	4	25	9	75	26	100	35
06	Practical-7	Based on Theory Paper 9& 10	PRFS-31	3			75		75	26
07	Practical-8	Based on Theory Elective Paper	PRFS-32	3			75		75	26
				26					**650**	

Govt. Holkar (Model, Autonomous) Science College, Indore (M.P.)										
Department of Forensic Science										
M.Sc. IV semester										
Syllabus Session 2021-2022										
S.no	**Paper**	**Course Title**	**Course Code**	**Credits**	**CCE (max)**	**CCE (min)**	**External Assessment Max**	**External Assessment Min**	**Total Max**	**Total Min**
01	Core 11	Forensic Physics	FS-41	4	25	9	75	26	100	35
02	Core 12	Applied Forensic Science and Scientific Investigation of crime	FS-42	4	25	9	75	26	100	35
03	Elective-I	Emerging trends in forensic science	FS-43-A	4	25		75	26	100	35
	Elective-II	Forensic Psychology	FS-43-B							
04	Elective-III	Biometrics	FS-44-A	4	25		75	26	100	35
	Elective-IV	Computer and Cyber Forensic OR Project	FS-44-B							
05	Practical-09	Based on Theory Paper 11 & 12	PRFS-41	3			75		75	26
06	Practical-10	Based on Theory Elective Paper	PRFS-42	3			75		75	26
08	Internship			4					100	
				26					**650**	

Part- A: Introduction for Code

	Govt. Holkar (Model, Autonomous) Science College, Indore
Department of Forensic Science	
SYLLABUS SESSION– 2021-2022	
M.Sc. – 1 SEMESTER	
Title of the Paper (Course): Forensic Science and Criminal Justice System Course Code: FS-11	
Course Objective	
1: To know basic principle & understanding of forensic science and criminal justice system 2: To know understanding of crime scene management.	
Course Outcomes - After completion of this paper students will come to -	
C01	Explain Fundamental principle and scope of forensic science
C02	Identify the importance and effects of preserving the crime scene
C03	Summarize the various theories of crime.
C04	Recognize the different sections of IEA, IPC and CRPC
C05	Describe relationship between courts, forensic science and police.
Part B: Content of Course	
Unit 1	**Introduction to Forensic Science**: Forensic Science: Definition, Nature and Scope, Basic principles and its significance, Development of Forensic Science in India and abroad, Functions, Responsibilities and ethics of Forensic Scientist, Organizational structure of Forensic Science Laboratories at Central & State levels, Ethics in Forensic Science Institutions in India.
Unit 2	**Crime**: Definition, Types, Theories of Causation of Crime- Pre-classical and Neo-classical, Constitutional, geographic, economic, psychological and sociological, Multiple Causation approach, General Factors of Crime and forms of punishment in brief, causes prevention and characteristics of criminals. **Criminal Justice System**: Police Organization at District, State and Central Level. Organization of courts in India. Jurisdiction of Court in criminal cases, prosecution, FIR, Case Diary, Roznamacha Report Writing and Evidence Evaluation: Report formats of crime scene and laboratory findings. **Court Testimony**: Admissibility of expert testimony, pro court preparation & Court appearance, examination in-chief & re-examination, cross-examination.
Unit 3	**Crime Scene Management and Evidences:** **Scene of Crime:** Classification, protection of scene of crime, preservation of scene of crime – photography, videography and sketching method, Response to Special Crime scene (Man-made and natural). Legal and Human Consideration during investigations. **Evidences:** Meaning, Types, Searching Methods, Chain of Custody
Unit 4	**Collection, Preservation, Packing and Forwarding of Evidences:** Collection, preservation, packing and forwarding from scene of crime, Victim and deceased body in cases of Homicide Investigation, Death due to burning, Rape and Sexual offences, hanging (Suicidal, Homicidal and Accidental), Drowning, Human Remains, Human Poisoning (Fetal and Survival), Death by Firearms, Firearm exhibits, Forged, Torn and Charred Documents, Bank Notes,

	Capturing of Volatile evidences in computer fraud and Cyber Crime, audio and video CCTV Footage, Transportation of Digital Evidences, Blood, Semen and other biological Stains, tissues, Viscera, Hair& Fibre, Glass, Soil and Dust, Petroleum product, Latent Fingerprint, Drug and Poisons, Metals
Unit 5	**Indian Penal Code**: Introduction, general exceptions, offences against person, offences against property, Attempt to suicide, Sexual offences. **Criminal Procedure Code**: Introduction and General idea of sections: 291-93, 154,155,156,157,158,159,160,161,162,172,173,174,175 and 176. **Indian Evidence Act**: Introduction and General idea of sections: 32,45, 46,47,57,58,60,73,135,136,137, and 159. **Juvenile Delinquency**: Brief Introduction: Juvenile Justice Act, 2000, POCSO Act, 2019, Child and Adolescent Labor Act, 1986, Case Studies.

Part C: Learning Resources
1. Saferstein: Criminalistics – An Introduction to Forensic Science, Prentice Hall Inc. USA (1995).
2. C.G.G. Aitken and D.A. Stoney: The use of statistics in Forensic Science, Ellis Harwood Limited, England (1991)
3. James, H.S. and Nordby, J.J.; Forensic Science; an Introduction to scientific and Investigative Techniques, CRC press, USA (2003)
4. O`Hara & Osterberg: An introduction to Criminalistics.
5. Forest: Forensic Science, An Introduction.
6. Lee, Honry: Advance in Forensic Science.
7. Sharma J.D. Vidhivigyan Avem Vish Vigya.
8. Sharma J.D. Apradho ka Vigyanic Anveshan.
9. Sharma B.R. Forensic Science in Criminal Investigation and trials.
10.Mordby, J. Deed Reckoning – The Art of forensic Science detection, CRC press LLC, Boca Raton FL, CRC press (2000)
11.Ram Ahuja: criminology, Rewal Publ. Jabalpur (2000).
12.Indian Penal Code
13.Criminal Procedure Code
14.Indian Evidence Act

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION – 2021-2022	
M.Sc. – 1SEMESTER	
Title of the Paper (Course): Forensic Medicine **CourseCode: FS-12**	
Course Objective	
1: To understand the basic concept of forensic medicine and legal procedures. 2: To have knowledge of personal identity traits, post-mortem examination, injuries and different modes of death.	
Course Outcomes - After completion of this paper students will come to-	
C01	Describe the Forensic medicine and legal procedures of court.
C02	Link the parameters to fix personal identity.
C03	Relate the post-mortem changes & their medico legal importance.
C04	Interpret the death and its Medico-legal Aspect
C05	Illustrate Post-mortem examination and sexual offences.
Part B: Content of the Course	
Unit 1	**Forensic Medicine**: Definition of Forensic Medicine and Medical Jurisprudence, Brief knowledge about legal procedure in court, inquest, Subpoena & oath of medical expert, Criminal court and their powers Recording of medical expert evidence in courts. Professional Negligence, Types of medical evidence, Kinds of witness and rules for giving evidence.
Unit 2	**Personal Identity**: Definition and importance, parameters contributing to personal identity- Race, Sex, Age, Complexion, Features & Photographs, Anthropometry, Stature, Scar, Hair, Teeth, Wounds, Foetal Age, Bite Marks, Fingerprints, Footprints, Tattoo marks, Birth marks, Occupational Marks, Handwriting, Clothes and Ornaments, Voice & Speech, DNA, Disputed paternity.
Unit 3	**Wounds & Injuries:** Introduction, its types, Mechanical Injury- Abrasion, Contusion, Laceration, Incised wound, Stab, Self-inflicted and fabricated, FirearmInjury, Bomb explosion wounds. **Regional Injuries:** Head Injury, Skull, Traffic Accident, Air craft, Boxing, Railway, Mass-Disasters. Medico-Legal aspects, post mortem &ante mortem wounds: General characteristics of injuries from cold, heat, burns, scalds, lightning, electricity andradiation, Forensic Importance of Wounds.
Unit 4	**Death and its Medico- legal aspects**: Modes of death (Coma, Syncope, Asphyxia), Sudden death,

	Post – Mortem Changes: Cessation of vital functions, Changes in the Eyes, Skin and muscles. Temperature, post- mortem lividity, Rigor mortis, Decomposition, Adipocere, Mummification, Post-mortem Interval, Estimation time since death. Mechanical Asphyxia: Hanging and its types, Ligature marks and its examination, Strangulation, Bansadola, Garroting, Mugging, Suffocation, Gagging, Choking and Café coronary. **Traumatic Asphyxia:** Burking, Postural Asphyxia, Sexual Asphyxia, Drowning (Ante Mortem and Post Mortem)
Unit 5	**Post-Mortem Examination:** Importance, external & Internal examination in brief, Viscera & its preservation, Examination of decomposed and mutilated bodies, Exhumation, Cause of death **Sexual O** **ffences:** Sexual offences, Virginity and Pregnancy

Part C : Learning Resources:
1. Modi J. S. : Medical Jurisprudence and Toxicology.
2. Taylor : Medical Jurisprudence
3. Parikh C.K. : Chikitsa Nyaya Shastra Aur Vish Vigyan.
4. Kieth Simpsen & Bernard Knight : Forensic Medicine
5. Poison : CJ, DJ, Gee, B. Knight : Forensic Medicine
6. Reddy : Forensic Medicine

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – 1 SEMESTER	
Title of the Paper (Course): Questioned Documents, Finger Prints and ImpressionsCourse Code: FS-13	
Course Objective	
1: To know about questioned document, handwriting and signature analysis.	
2: To know about the fingerprint and its development & examination of others prints.	
Course Outcomes - After completion of this paper students will come to-	
C01	Explain questioned documents, understanding of ink and paper & its examination.
C02	Identify typewriting, forged documents and its examination.
C03	Infer fingerprint, its type and examination.
C04	Develop Latent fingerprints by physical and Chemical methods and to understand Automation Methods
C05	Identify foot & footwear print, others print & its examination and related laws.
Part B: Content of the course:	
Unit 1	**Document and Writing Instruments**: History, Questioned document and their types. Instruments used to prepare documents, Ink and its types, Physical and Chemical examination, Paper & its type, Manufacturing and Examination of paper, Collection, Handing, Preservation and forwarding of documents seized from scene of crime. **Examination of Documents**: Preliminary examination of documents, instruments required for examination. **Handwriting** – Class and Individual characteristics, basis of handwritingcomparison, making of exemplar, variation in handwriting. **Signature:** Genuine & Forged signatures and their examination.
Unit 2	**Forged & Typed Documents**: Alteration – Erasure, Addition, Obliteration and Sheet insertion. Secret writing & its decipherment. Charred documents, Torn Documents & their decipherment, Indented writing. **Typed & Printed Document:** Class and Individual characters & their comparison. Typed and Printed matter and their examination. **Photocopied and Scanned Documents**: Class and Individual characteristics and their comparison.

Unit 3	**Finger Prints**: History of finger print, Dactylography, Dactyloscopy, Friction Skin, formation of ridges, Ridges and Furrows, ridge characteristics, finger print patterns, Type Line, Focal point, Pattern area, Core, Delta, Ridge counting in Loops, ridge tracing in whorl. Types of Fingerprints: Latent, Visible and Plastic Prints. **Classification of finger prints** – Henry System and its Modification, Battley Classification. Edgeoscopy, Poroscopy
Unit 4	**Fingerprint Development**: Location of Fingerprints, Development of latent printsby Physical and Chemical methods, Other emerging methods of development, Lifting of fingerprints, Development of fingerprint from cadavers.

	Automation: Introduction, History, AFIS, NAFIS, FACT, CCTNS, AMBIS, AADHAR
Unit 5	**Other Prints:** Foot and footwear prints, gait pattern, casting of print on different surface and their comparison. Forensic importance of lip print, bite mark and palm print. **Laws reference to IPC and IEA:** IPC Sections: S.29, S.29A, S.34, S.120B, S409, S.415, S.416, S.418, S.420, S.467, S. 468, S.470, S.471, S.489(A-E) **IEA Sections:** S.3, S.45, S.45A, S.47, S.73, S.114

Part C: Learning Resources
1. Rev. ED: Ordway Hilton; Scientific Examination I of Questioned Documents, Elsevier, New York; (1982)
2. Albert S. Osborn; Questioned documents, Second Ed; Universal Law publishing, Delhi; (1998)
3. Albert S.Osborn ; The Problem of Proot – Secon Ed. ; Universal Law Publishing Delhi ; (1998)
4. Charles C. Thomas, Typewritting Identification I.S.Q.D. Billy Bates; Springfield, Illinois, USA, (1971)
5. Charles C. Thomas, I.S.Q.D. Identification system for Questioned documents; Billy Prior Bates Springfield, Illinois, USA, (1971)
6. Wilson R. Harrison; Suspect documents – Their Scientific Examination; Universal Law Publishing, Delhi. (1997)
7. Hard less, H.R.: Disputed documents, handwriting and thumbs- print identification: profusely illustrated, Law book Co., Allahabad, (1988)
8. David R. Ashbaugh: Quantitative and Qualitative Friction ridge analysis, CRS press, (1999)
9. Mehta M.K.: Identification of Thumb Impression & cross Examination of finger prints, N.M. Tripathi (P) Ltd. Bombay (1989)
10. Henry C. Lee & R.E. Ganesslen, Advance in Finger print Technology, ~ RC press, Boca Raton, London, (1991)

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – 1 SEMESTER	
Title of the Paper (Course): Instrumental Method – Physical	**Course Code: FS-14**
Course Objective	
1: To be familiar with the process of calibration, qualitative and quantitative analysis.	
2: To understand working of different instruments for forensic aspects.	
Course Outcomes- After completion of these paper students will come to-	
C01	Illustrate different spectroscopic techniques.
C02	Understand the basic concept of Atomic and Molecular Spectroscopy
C03	Illustrate the principle and instrumentation of UV- VIS and IR techniques.
C04	Explain Atomic absorption/ Emission and X- ray Spectroscopy
C05	Describe Radio Chemical Techniques
Part B: Content of the Course:	
Unit 1	**Basic Concept of Spectroscopy:** General idea on Spectroscopy, it's classification, Electromagnetic spectrum (Radiation Chart), Characteristics of radiation and their units, Dual nature of Electromagnetic Radiation, Sources of radiation, their utility and limitations, Interaction of radiation with matter: Reflection, Refraction, Dispersion, Diffraction, Scattering, Transmission, Interference and Polarization. Photoelectric effect.
Unit 2	**Basic Concept of Atomic and Molecular Spectroscopy** Absorption and Emission spectrum & their representation. Atomic energy level diagram, Molecular energy level diagram. **Types of Molecular energy:** Translational, Electronic transitional, vibrational and rotational energy their classical and quantum equation. **Types of Molecular Spectra:** Electronic, vibrational, rotational, ESR, NMR, Raman and Mossbauer spectra, Basic instrumental setup of spectrophotometer.
Unit 3	**General Principles**: Laws of absorption- Grothus-Draper Law, Lambert Law, Beers Law, Deviation from Beer's law **UV:** Range of radiation, sources used, electronic energy level diagram, types of transition, representation of UV spectra, measurement of UV spectra, Chromophore and auxochromes, types of absorption bands. Schematic diagram of general UV instrument, Qualitative and quantitative Forensic applications of UV- Visible Spectroscopy **Infrared Spectroscopy:** Range of IR spectra, source of radiation, representation of IR spectrum, degree of freedom for polyatomic molecule, normal modes of vibrations, schematic diagram of general IR instrument, measurement of IR spectra, Forensic applications of IR spectroscopy. **FTIR**: Principle, Instrumentation with Schematic diagram, Qualitative and Quantitative Forensic Applications

Unit 4	**Atomic absorption/ Emission and X- ray Spectroscopy** **Atomic Absorption Spectroscopy:** Principle, Instrumentation and technique, Interference in AAS, correction methods, advantages of AAS over emission spectroscopy, disadvantages of AAS, Forensic application of AAS. **Atomic Emission Spectroscopy:** Principle, Instrumentation and technique, Arc/spark emission, Forensic application of AES, advantages and disadvantages of AES. **X-ray techniques**- Introduction, Basic Instrumentation and Forensic Importance of X-ray Absorption, X-ray Fluorescence Spectroscopy **EDX- ray Spectroscopy:** Principle, Instrumentation with schematic diagram, working and Qualitative and Quantitative Forensic Applications.
Unit 5	**Radio Chemical Techniques:** Basic Principle and Theory, Nature of α, β and γ radiation, α- rays change, β- rays change, Radioactive decay process, rate of radioactive disintegration and half-life (Decay Law), radiation detectors, Neutron source, Neutron Activation Analysis, Radio carbon and it's techniques, **Nuclear Magnetic Resonance Spectroscopy:** Basic Principle and instrumentation. **ICP-MS:** Principle, Instrumentation, with Schematic Diagram, Working, Forensic Applications

Part C : Learning Resources
1.James W. Robinson; Atomic spectroscopy, 2nd Edn. Revised & Expanded, marcel Dekkar, inc. NY. (1996)
2.N. Subrahmanyam & Brij Lal: A text book of optics, S. Chand & Co. (2004)
3. Hobart H. Willard, Lynne L. Merrett Jr. John A Dean Frank A. Settle Jr; Instrumental Method of Analysis, 7th Edn, CBS pub. & Distributors (1986)
4. K.C. Thompson & R.J. Renolds: Atomic Absorption Fluorescence & Flame Emission Spectroscopy, A practical approach, 2nd Edn. Charles Griffin & Co. (1978)
5. Robert M. Silverstein & Francis X Websters; Spectrometric Identification of Organic Compounds, 6th Edn., John Wiley & Sons, inc. (1997)
6. P.S. Kalsi V.B. Patania; Spectroscopy, Campus books International, (2004)
7. P.S. Kalsi V.B. Patania; Spectroscopy, Campus books International, (2004)
8. D.R. Khanna & H.R. Gulati; Fundamentals of Optics, Geometrical Physical & Quantum, 20th Edn., R. Chand & co. (2002)
9. R.S. Khandpur; Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New Delhi (2004)
10. John A. Dean; Analytical Chemistry Handbook McGraw Hill Inc. (1995)

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Practical – I

Class- M.Sc. Semester-I

Title of the Paper (Course)- Practical Based on Paper 1 & Paper 2

Course Code- PRFS-11

(Duration: 3 hrs. in each batch)

Practical Question 1	15
Practical Question 2	15
Practical Question 3	10
Practical Question 4	10
Practical Question 5	10
Record	07
Viva Voce	08

1. Basics of crime scene sketching.
2. Sketching of scene of crime.
3. Sketching of outdoor scene of crime (murder, suicide, accident etc.)
4. Sketching of indoor scene of crime (theft, dacoity, murder, suicide etc.)
5. Photography of scene of crime using manual & digital camera.
6. Methods for searching of physical evidence at scene of crime.
7. Collection, packing, labelling and forwarding of physical evidence from scene of crime to forensic science laboratory.
8. Post mortem report format
9. Practical demonstration of post-mortem and ante-mortem injuries
10. Any other suggested.

Practical - II

Class- M.Sc. Semester-I

Title of the Paper (Course)- Practical Based on Paper 3 & Paper 4

Course Code- PRFS-12

(Duration: 3 hrs. in each batch)

Practical Question 1	15
Practical Question 2	15
Practical Question 3	10
Practical Question 4	10
Practical Question 5	10
Record	07
Viva Voce	08

1. Examination of various ink samples using planar chromatography techniques.
2. Decipherment of secret, erased, obliterated indented hand writing using physical/chemical techniques.
3. Matching of hand writing and signatures (genuine/forged)
4. Examination of type written and printer generated prints.
5. Print your own 10-digit finger print card using black ink.
6. Primary and secondary classification of given finger print chart.
7. Identification of ridge characteristics
8. To understand the working and measurement of λ-max of various organic and inorganic compounds by UV- Vis. Spectrophotometer.
9. To know the concentration of given liquid by colorimeter.
10. Any other suggested.

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – II SEMESTER	
Title of the Paper (Course): Instrumental Method – Chemical	**Course Code: FS-21**
Course Objective	
1: To know basic principle & understanding of forensic science and criminal justice system.2: To have a basic understanding of crime scene management.	
Course Outcomes- After completion of this paper students will come to-	
C01	Summarize the Sample preparation and treatment techniques.
C02	Describe the Principle and application of optical microscopy and electron microscopy.
C03	Illustrate the Principle, instrumentation and application of various chromatographic techniques.
C04	Relate various types of electrophoretic techniques.
C05	Explain the Principle and instrumentation of mass spectrometry & hyphenatedtechniques.
Part B: Content of the course:	
Unit 1	**Sample Preparation and Treatment Techniques**: Distillation Methods- Principle ofsample distillation, Fractional Distillation, Distillation under reduced pressure and Steam Distillation. **Sample treatment Techniques** - Centrifugation, Filtration, Evaporation, Crystallization, Lyophilization, Cleanup Process, Liquid-Liquid Extraction (LLE), Liquid Phase Extraction (LPE), Liquid –Liquid Micro Extraction (LLME) Solid Phase Micro Extraction (SPME), Soxhlet extraction, Acid Digestion, Microwaveassisted extraction, Salting Out, Gas Phase Extraction.
Unit 2	**Microscopy**: Basic Principles, simple and compound microscope, Comparison microscope, Phase contrast microscope, Stereoscopic microscope, polarizing microscope, fluorescent microscopy, Infra-red microscopy, Atomic force microscope,Confocal Microscope **Electron Microscope**: Scanning Electron Microscope (SEM) & Transmission Electron Microscope (TEM), Different fixation and staining techniques of electron microscope,Light and Dark Field Microscope.
Unit 3	**Chromatographic Techniques**: Principle, Working, Classification and Applications of Chromatography. **Planar Chromatography**- Paper Chromatography (PC), Thin Layer Chromatography(TLC), High Performance Thin Layer Chromatography (HPTLC) **Column Chromatography:** HPLC, GC, Ion exchange chromatography, Exclusion (Permeation) chromatography, Affinity Chromatography, Supercritical Fluid Chromatography (SFC) Interpretation of different types of Chromatograms, Selection of column and mobile phase used in Chromatography, Basics of Chromatogram.

Unit 4	**Electrophoretic Techniques**: Principle of Electrophoresis, Isoelectric Focusing, Factor affecting electrophoresis. Types of Electrophoresis- Agarose gel, Polyacrylamide Gel Electrophoresis (PAGE), Sodium Dodecyl Sulphate (SDS), High Voltage, Low Voltage Preparative, Two-dimensional electrophoresis, Disc Gel Electrophoresis, Pulse field gel Electrophoresis, Capillary Electrophoresis- Principleand Instrumentation Forensic Application of electrophoresis.

Unit 5	**Mass Spectrometry (MS)**: Principles and Instrumentation, Ion production Technique- EI, CI, FD, FAB, Different Type of Peaks, Metastable Peak, Nitrogen Rule, Ring Rule, Mc- Lafferty rearrangement Hyphenated Techniques: GC-MS, LC-MS/MS and their Applications in Forensic Science.

Part C: Learning Resources:
1.Jarris K.E., A.L. Gray & R.S. Hock, EDS; Handbook of Inductively Coupled plasma Mass **Spectrometry; Glasgow Blockie, (1992)**
2.Maclaffrty, F.W. & F. Turecek; Interpretation of Mass spectra; 4th Ed. Mill Valleym C.A. Univ. **Science Books, (1993)**
3.Chapmen, J.R.; Practical Organic Mass spectrometry, A guide for Chemical and Biochemical **Analysis, Wiley, New York, (1993)**
4.Lindsay, S.; High Performance Liquid Chromatography, New York, Wiley (1992)
5.Sharma B.K.; Instrumental Methods of Chemical analysis
6.Chatwal and Anand: Instrumental Method of Chemical Analysis.
7.Kriggle: Instrumental Method
8.Willard, Merrit and Dean: Instrumental methods of analysis
9.Saferstien: Forensic Science Handbook Vol. I, II, III
10.Lee Honry: An Introduction to Forensic Science.
11.Egon Stahl: Thin Layer Chromatography.
12.Shrivastava & Shrivastava: Introduction to Chromatography
13.Kaur Analytical and Molecular Spectroscopy, Pragati Prakashan.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. –II SEMESTER	
Title of the Paper (Course): Forensic Biology	**Course Code: FS-22**
Course Objectives	
1: To learn the importance of biological viscera and other samples. 2: To know about the various botanical evidences and wildlife crimes & their examination.	
Course Outcomes -After completion of this paper students will come to-	
C01	Illustrate human body system.
C02	Summarize body fluids, preservation and their analysis.
C03	Identify teeth and its examination procedure.
C04	Explain hair, fibers and their examination & importance of botanical evidences.
C05	Describe the importance of insects and wildlife in forensic science.
Part B: Content of the course:	
Unit 1	**Cell Biology and System Physiology:** Structural Organization and function of Intracellular organelles: Cell wall, Nucleus, Mitochondria, Golgi Apparatus, Lysosomes, Endoplasmic Reticulum, Peroxysomes, Plastids, Vacuoles, Chloroplast **Cell Division and cell Cycle:** Mitosis and Meiosis, membrane structure and Functions. **Basic Concept of anatomy and Physiology:** Digestive, Respiratory, Skeleton, Nervous, Excretory and Reproductive system, Preservation of visceral samples in different types of cases.
Unit 2	**Body Fluids, Stains, Hair and Fibres** **Blood:** Composition, histology, identification and examination of blood and blood stains, Lochial and Menstrual stains **Semen:** Composition, Structure of spermatozoa, Identification and Examination of semen and seminal stain. Identification and examination of other body fluids/ stains- vaginal, saliva, urine, pus, faeces, vomit, milk and sweat
Unit 3	**Forensic Odontology and Osteology** Definition pattern, structure and nature of teeth, types, Age determination by teeth, role in mass disaster, diseases of teeth and their significance in personal identification. Identification of burnt bones, recovery and identification of skeletal remains in accidental cases and mass disasters. Facial reconstruction.
Unit 4	**Forensic Botany** Various types of wood, timber varieties, seeds and leaves – their identification and matching, Study and identification of pollen grains, identification of starch grains, powder and stains of species, Microscopic and biochemical examination of pulp material etc. Isolation, classification and identification of microorganism. Diatoms – Types morphology, methods of isolation from different tissue and forensic importance of planktons-especially diatom and their forensic significance in drowning cases.

Unit 5	**Forensic Entomology** General Entomology, significance of terrestrial and aquatic insects in forensic investigations and their role in determining time since death. Impact of ecological factors on insect's developments. **Wild Life Forensic** Introduction and Importance of wild life, Protected and endangered species of Animals and Plants, Wild life species – Identification and examination of physical evidence by conventional and modern methods, Identification of Pug marks of various animals. Census of wild life population. Wild life Protection Act.1972, Environmental Protection Act, 1986

Part C: Learning Resources:
1.E.J. Gardner, M.I. Simmons and D.P. Snustad; Principles of Genetics; John Wiley, New York; (1991)
2.H.G. Greenish & E. Collin; An anatomical Atlas of vegetable Powders; J&A Churchill, London; (1904)
3.Richard Saferstein; Forensic Hand Book; Ed.; Prentic Hall, Englewood Cliff, New Jersey; (1982)
4.P.L. Williams and R. Warwick; Gray's anatomy; Churchill Livingston, London; (1980)
5.Biology Methods manual; Metropolitan Police Forensic Science Laboratory, London; (1978)
6.Herbert R. Mauersberger; Mathews Textile Fibers – their physical, Microscopic and chemical properties; John Wiley, New York; (1954)
7.R.P. Pandey, Plant Anatomy; S. Chand, new Delhi; (1998)
8.Edwin, H. Mc Caney-Human Genetics, The Molecular Revolution, Jones & Bartlett Pub.London; (1993)
9.Albert's, B, Bray, D, Lewis, J, Roberts K & Watson, J.D; Molecular Biology of cell, 2nd ed. Garland Pub. New York (1989)
10.Morrison, Robert D; Environmental Forensics principles and Applications, CRC Press, Boca Raton, New York, (2000)
11.Oates, D W, Brown, C W & Weigel, D L; Bood and tissue identification of selected bird and mammals; JPR study Projects Lincoln NE Nebraska Gome and Perks Commission (1974)
12. Catts, E.P. & Haskell NH: Entomology and death: A procedural guide: Joyce's Print Shop (1990)
13. Lewis, B Gene IV, Oxford University press, England (1980)

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written ExamMaximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Chemistry	
SYLLABUS SESSION: 2021-2022	
M.Sc. – II SEMESTER	
Title of the Paper (Course): Forensic Chemistry and Explosives	**Course Code: FS-23**
Course Objective	
1: To know about the chemical procedure which are used in investigation. 2: To know about the explosive substances and its analysis.	
Course Outcomes - After completion of this paper students will come to-	
CO1	Explain Forensic Chemistry, beverages and their analysis.
CO2	Define and illustrate Drug of abuse and their analysis.
CO3	Illustrate and interpret petroleum product, Cement and other chemical.
C04	Identify and relate the fire and arson.
C05	Describe Explosives and its analysis.
Part B: Content of the course:	
Unit 1	**Forensic Chemistry:** Introduction, Types of cases which require chemical analysis, Limitations of forensic samples, conventional methods of chemical analysis, presumptive tests (color/spot tests), Microcrystal tests, Elemental analysis (organic and inorganic). **Analysis of beverages:** Analysis of Beverages: Alcoholic and non-alcoholic beverages and their composition, Analysis of alcoholic beverages as per BIS and PFA Act. Distinction between licit and illicit liquors, Forwarding exhibits in Alcohol cases, Consequences of Drunken Driving
Unit 2	**Drugs of abuse:** Introduction, drug addiction and its problems, classification of drugs of abuse, Depressants, stimulants, Hallucinogens, Identification: Field tests and laboratory tests. **Drug abuse in sports:** Introduction, common prohibited substances, Analytical approach. Brief Introduction to Drugs and Cosmetic Act,1940, Excise act, NDPS Act, 1985
Unit 3	**Examination of Petroleum Products:** Distillation & Fractionation, various fraction and their commercial uses. Standard method of analysis of Petroleum product for adulteration. **Trap cases:** Purpose, Examination of chemicals used in trap case **Cement:** Composition, types and Forensic analysis, Mortar & concrete and Forensic Analysis **Metallurgical analysis:** Analysis of Gold, Analysis of Contents of Gold Powder in cheating cases.
Unit 4	**Fires:** Nature and Chemistry of fire, classification, Igniters of fires, phases of fires, Main types of fires, Motives, Determination and cause and Origin of Fire, Investigation in fatal case of Arson, Analysis of Accelerant. IPC sections 435,436 and 438
Unit 5	**Explosives** : Classification, composition and characteristics of explosives, pyrotechnics, IEDs, explosion process and affects, types of hazards, effect of blast wave on structures, human etc., specific approach to scene of explosion, post blast residue collection, reconstruction of sequence of events, evaluation and assessment of scene of

	explosion, systematic examination of explosives and explosion residues in thelaboratory using chemical and instrumental techniques and interpretation of results. Detection and quantitative determination of Explosophores (anion), Black powder, Nitrocellulose and Dynamite, Explosive wounds, Explosive Act, 1884.

Part C: Learning Resources
1.Maudham Bassett et. al: Vogel's textbook of Quantitative Chemical analysis, 6th Ed., Longman Essex (2004)
2.I.L. Finar: Organic Chemistry Vol. II Pearson Education (Singapore)
3.R.T. Morrison, R.N. Boyd: Organic Chemistry, 6th Ed., Prentice Hall New Delhi (2003)
4.Brean S. Furniss et. al.: A.I. Vogel textbook of Practical Organic Chemistry, Addison Wesley Longman, Edinburgh.
5.A. Burger: Medicinal Chemistry, Vol. II Wiley Interscience, NY (1970)
6.D.A. Skoog D.M. West, F.J. Holler: Analytical Chemistry – An Introduction, 7th Ed., Saunders college Pub. Philadelphia, USA (2000)
8.F.G. Holfmann: Handbook of Drug and Alcohol Abuse.
9.Boudreau JE, et. al; Arson & Arson Investigation Survey & Assessment National Institute of Law Enforcement, U.S. Dept. of Justice, US Govt. printing press (1977)
10.Dettean J.D. Kirk's fire Investigation, 5th Ed., Practice Hall, Eaglewood Cliffs, N.J. (2002) w.e.f. 2005 – 2006
11.Working Procedure manual – Chemistry, Explosive and Narcotics BPR & D Pub. (2000)

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – II SEMESTER	
Title of the Paper (Course): Forensic Toxicology and Pharmacology Course Code: FS-24	
Course Objective:	
1: To know about the poisoning and classification of poisons. 2: To learn the methods of post-mortem.	
Course Outcomes- After completion of this paper students will come to-	
C01	Understand different types of poisons.
C02	Illustrate Extraction and Isolation Procedure of Poisons
C03	Explain drug of abuse and its analysis process.
C04	Describe pharmacological pathway of drugs.
C05	Summarize Pharmacological Studies and Analyze Vegetable poisons
Part B : Content of the course:	
Unit 1	**Forensic Toxicology**: Introduction, Concept and Significance Poisons: Definition, classification of poison, Types of poisoning, sign and symptoms of poisoning, mode of action, Route of Administration and excretion, factors modifying the action of poisons, Toxicological exhibits in fatal and survival cases, their preservation, Treatment in cases of poisoning, Analysis report.
Unit 2	**Extraction, Isolation and clean- up procedures**: Extraction of Volatile Poisons; Distillation. **Extraction of Toxic metals in matrices:** Dry Ashing, Wet Digestion, Fresenium and Babo Method, Selective Chemical Treatment **Extraction of Toxic anions in Matrices**: Protein precipitation, Dialysis and Microdiffusion, Total Alcohol Extract. **Extraction of drugs and plant poisons in matrices**: Stas-otto, Ammonium Sulphate method, Tungstate methods, acid digest method. **Extraction of Pesticides** from matrices , urine, vomit, blood, fruits, vegetables and butter fat, Head space procedure and various clean-up procedures
Unit 3	**General Study and Analysis**: Collection, Preservation and Packaging of drugs at scene and their identification and quantitative estimation. Non-Volatile Organic Poisons: Pesticides, Rodenticides, Bactericides, Fungicides, Larvicides, with their active compounds and salient features. Toxic Cations and Anions: Source, Toxicity, Characteristics, Detection and Determination of Mercury, Arsenic, Lead, bismuth, Copper, Aluminium. Iron, Barium, Zinc.
Unit 4	**Volatile poisons and Irrespirable gases:**

	Volatile Poisons: Chemical name, Source, Physical properties and other characteristics of forensic interest. Irrespirable gases: Carbon monoxide, Carbon Dioxide, Hydrogen sulphide, Sulphur dioxide, Chlorine, Nitrous oxide, Methane. Methylisocyanide. War gases. Ammonia, Tear gas, Phosgene, Mustard gas. Quantitative estimation of carbon mono oxide in blood. Quantitative estimation of ethyl alcohol in blood and urine.
Unit 5	**Forensic Pharmacological studies**: Pharmacokinetics; Concept of Parmacokinetics, Absorption, Distribution, Metabolism and excretion, Adverse drug interactions, post-mortem redistribution. Alkaloids: Definition, Classification and general characteristics and analysis Vegetable Poisons: Opium, Dhatura, Marking nut, Nux Vomica, Oleander, Aconite, Argemone Mexicana, croton, calotropis, cannabis, Erythroxylon coca, Ergot, Nerium, Plumbago, Semecarpous anacardium, Thevetia peruviana. Animal Poisons: Snake, Scorpions, Cantharides, Insects amd other animal toxins

Part C: Learning Resources:
1. Stolemen: Progress in Chemical Toxicology: Acad. Press, New York, (1963).
2. Cravey, R.H., Baselt, R.C.: Introduction to Forensic Toxicology, Biochemical publications, Davis C A, (1981).
3.Curry, A.S.: Poison Detection in Human Organs, C. Thomas Springfield, Illinois USA, (1963).
4.Gleason, M.N. et.al: Clinical Toxicology of Commercial products, Williams and Williams, Baltimore, USA, (1969).
5.Sunshine, I.: Guidelines for Analytical Toxicology Programme, Vol. I, CRC Press, USA, (1950.
6.Sunshine: Methods of Analytical Toxicology, CRC Press USA, (1975).
7.Working Procedure Manual – Toxicology, BPR&D Publication, (2000).
8.Saferstein: Forensic Science Handbook, Vols. I, II; (Ed); Prentice Hall, Eglewood Cliffs, NJ; (1988)
9.Modi, Jaishing P.: Textbook of Medical Jurisprudence & Toxicology, M.M. Tripathi Pub., (2001).
10.Parikh C.K. Textbook of Medical Jurisprudence, Forensic Medicines and Toxicology. CBS Pub. New Delhi (1999)

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Practical - I

Class- M.Sc. Semester-II

Title of the Paper (Course)- Practical Based on Paper 5 & Paper 6

Course Code- PRFS-21

(Duration: 3 hrs. in each batch)

Practical Question 1	15
Practical Question 2	15
Practical Question 3	10
Practical Question 4	10
Practical Question 5	10
Record	07
Viva Voce	08

1. Various types of microscopes – their components and working.
2. To identify the given compounds using thin layer and paper chromatography.
3. To know practical working and handling of High-performance liquid chromatography.
4. To know Practical working and handling of gas chromatography.
5. Electrophoresis techniques – Preparations of gels, media, buffers and demonstration of Gel-Electrophoresis.
6. Morphological examination of human and animal hair.
7. Microscopic and chemical examination of different plants and animal fibers.
8. To identify the bones from their characteristics.
9. Detection of salivary stain.
10. Any other suggested.

Practical - II

Class- M.Sc. Semester-II

Title of the Paper (Course)- Practical Based on Paper 7 & Paper 8

Course Code- PRFS-22

(Duration: 3 hrs. in each batch)

Practical Question 1	15
Practical Question 2	15
Practical Question 3	10
Practical Question 4	10
Practical Question 5	10
Record	07
Viva Voce	08

1. Separation and Identification of Volatile liquid by simple distillation.
2. Identification of salts and metals by simple colour test and group analysis.
3. Identification of different vegetable poison by colour test, chromatography etc.
4. Identification of Insecticides and pesticides by TLC/ colour test.
5. Extraction and Identification of drugs/ toxicants from biological matrix and their detection.
6. Systematic analytical approach to pre-blast and post-blast explosives
7. Any other suggested.

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – III SEMESTER	
Title of the Paper (Course): Forensic Ballistics	**Course Code: FS-31**
Course Objective	
1: To know about the science behind the bullet, its structure & Formation of different parts. 2: To know about the classification of Forensic Ballistics.	
Course Outcomes- After completion of this paper students will come to-	
C01	Illustrate firing and trajectory formation.
C02	Define concept of Internal and External Ballistics
C03	Explain Terminal and Wound Ballistics.
C04	Explain Ammunition with its analysis
C05	Illustrate GSR analysis.
Part B : Content of the Course:	
Unit 1	**Basics of Firearms:** History and background of Firearms, their classification and characteristics, Various components of small arms, Smooth bore and rifled firearm, Proof marks, Different systems and their functions, Rifling (direction of lands and grooves), Purpose of rifling, Types of rifling, Chocking, Trigger and firing mechanism, Improvised/country-made/imitative firearms and their constructional features. Types and components of ammunition, Classification and constructional features of different types of cartridges, Types of primers and priming composition, Propellants and their compositions, Various types of bullets and compositional aspects, Shape and size of projectiles, Smooth bore firearm projectile, Safety aspects for handling firearms-various locks, Head space, Head stamp markings.
Unit 2	**Internal and External Ballistics:** Definition, Firing Process(Ignition of propellants and manner of burning), Theory of recoil, Various factors affecting the internal ballistics (lock time, Ignition time, Barrel time, Erosion, corrosion and gas cutting), Projectile velocity determination, Equation of motion of projectile, Muzzle energy, Principal problems of exterior ballistics (vacuum trajectory, Effect of air resistance on trajectory, Base drag, yaw, Gyroscopic stability), Greenhill formula, trajectory computation, Ballistics coefficient and limiting velocity, Measurements of trajectory parameters, Proof-firing, Degressive and Progressive powder, Magnus effects, Doppler-Radar method.
Unit 3	**Terminal Ballistics** – Effect of projectile on hitting the target- function of bullet shape, striking velocity, Penetration potential, tumbling of bullets, influence of range, Ricochet and its effects, stopping power. **Wound Ballistics**- Mechanics of bullet wound production, Threshold velocity for penetration of skin/flesh/bones, preparation of gel block, nature of wounds of entry and exit, cavitation's – temporary and permanent cavities, evolution of injuries caused due to various firearms (shot-gun, rifle, handguns and country made firearms), abrasion collar, methods of measurements of wound ballistics parameters, post-mortem and ante– mortem firearms injuries.

Unit 4	Principles and practice of identification of firearms on the basis of their parts, Ammunition and their components, Techniques for obtaining test material from various types of weapons and their linkage/ comparison with fired ammunition, Determination of range of fire-burning, Scorching, Blackening, Tattooing and metal fouling, Shot's dispersion and GSR distribution. **Class and Individual Characteristics**- Different types of marks produced during firing process on cartridge (firing pin marks, breech face marks, chamber marks, extractor and ejector marks, striation marks), Cart-Wheel Pattern.
Unit 5	**Time of firing** – different method employed, and their limitations, stereo & comparison microscopy, automatic bullet and cartridge comparison system, Balling of shot, Miscellaneous firearms, **Analysis of Gunshot Residues** – Mechanism of formation of GSR, source and collection, spot test, chemical test, identification of shooter and instrumental methods of GSR Analysis, Post-mortem reports, Arms Act and Arms rule 2016.

Part C: Learning Resources:
1. J. Howard Mathews; Charles C. Thomas, Firearms Identification, Vols. 1,2& 3; Springfield, Illinois; (1973)
2. Hatcher, Jury and Weller; Firearms Investigation, Identification and Evidence; Stackpole Books, Harrisburg, P A; (1977)
3. Vincent Di Maio, Gunshot Wounds; CRC Press, Washington, DC; (1999)
4. Brain J. heard; Hand book of firearms and Ballistics; John Willey, England; (1997)
5. T. A. Warlow; Firearms, The Law and Forensic Ballistics; Taylor and Francis, London;(1996)
6. Kari G. Sellier et. al.; wound Ballistics and the Scientific Background; Elsevier, London;(1994)
7. M. Johari, Identification of Firearms, Ammunition and Firearms Injuries; BPR&D, NewDelhi; (1980)
8. LV. Hogg; The Cartridges Guide – A small arms Ammunition Identification Manual; The Stackpole Co., Harrisburg, P A (1982)
9. Gary J. Ordog, Management of Gunshot Wounds; Elsevier, New York (1983)
10. Working Procedures Manual: Ballistics, BPR & D Pub. (2000)

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – III SEMESTER	
Title of the Paper (Course): Instrumental Methods- Biology	**Course Code: FS-32**
Course Objective	
1: To know about different instruments related to Biological Analysis. 2: To know Applied Genetic Engineering and higher detection biological methods.	
Course Outcomes- After completion of this paper students will come to-	
CO1	Understand cell and tissue culture methods
CO2	Describe centrifugal techniques
CO3	Explain Enzymatic and Radio-labelling Techniques.
CO4	Illustrate Histochemical and Immunochemical techniques.
CO5	Describe Applied Genetic Engineering
Part B: Content of the Course:	
Unit 1	**Biochemical Analysis:** pH, buffer, Cytological Techniques, Cell and Tissue Culture Methods (Plant and animal) Cell fractionation, Perfusion and homogenization of the tissue, Flow Cytometry, Biological Staining Techniques for Microbes and Plants, Culture Media techniques, Colorimetry, Karyotyping (Cytogenetic Techniques)
Unit 2	**Centrifugal Techniques** Centrifugation - Basic Principles, Relative Centrifugal Force, Sedimentation coefficient **Types of centrifuges:** Micro Centrifuge (High speed and Ultra centrifuge), preparative centrifuge (differential and density gradient) and Analytical Centrifuge, Applications-Isolation of Cell Components
Unit 3	**Enzymatic Methods of Analysis:** Principle of Catalysis, Purification and Protein Estimation (Lowry Protein Assay), Protein-Protein Interaction Assay, Protein Staining, Protein Imaging **Enzyme Assay Techniques**: UV-Visible Spectrophotometer, Luminescence method, Immuno-chemical method, Automated enzymes analysis, Immobilized enzymes. **Radio-labelling Techniques:** Detection and Measurement of different types of Radio Isotopes normally used in biology
Unit 4	**Histochemical and Immunochemical Techniques** General principles, precipitation reaction, Gel Immunodiffusion, Immune-electrophoresis, Complement Fixation, Antibodies Generation Detection of molecule used in RIA, ELISA, Western Blot, Immuno-precipitation, Fluo-cytometry, Immuno- fluorescence Technique
Unit 5	**Applied Genetic Engineering** Concept of recombinant DNA Technology and purpose, basic methodology, use of Plasmids, Restriction Endonucleases, Linkers, Adapters, Ligation. **Hybridization Techniques**: Northern, Southern, Colony Hybridization **Primer Design**: Construction of cDNA libraries in Plasmids

Part C: Learning Resource:
1. Keith Wilson & John Walker; Practical Biochemistry- Principles & Techniques, 5th Edition, Cambridge University Press 2000.
2. David. L. Nelson & Michael M, Cox Lenninges; Principles of Biochemistry, 4th edition, Freeman Pub. 2005.
3. Fundamental immunology William E. Paul
4. Thomas J. Kindt, et. al. Kuby Immunology, 6th edition 2001
5. Principles of enzymology by Trevor & Palmer
6. Vogel's Text Book of Quantitative Chemical Analysis by G. H. Jeffery, J. Bassett, J.
7. Mendham and R. C. Denney, 5th Edition, Longman Scientific & Technical.
8. Molecular biology by T.A. Brown

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – III SEMESTER	
Title of the Paper (Course): Forensic Serology	**Course Code: FS-33-A**
Course Objective	
1: To know about the bio molecule and its examination. 2: To know the genetic, biological fluid and its examination.	
Course Outcomes -After completion of this paper students will come to-	
CO1	Illustrate Biomolecules their importance and examination.
CO2	Define Basics of genetics and genes.
CO3	Explain Immune system.
CO4	Discuss Origin of species.
CO5	Illustrate blood groups and different types of markers.
Part B : Content of the Course:	
Unit 1	**Biomolecules:** Structure and function of proteins-Amino Acids, peptides, Proteins and their Reactions. **Overview of Protein Structure**- Primary, Secondary, Tertiary and Quaternary Structure; Protein denaturation and Foldings. **Structure and Function of Carbohydrates**: Mono, Di, Oligo and Polysaccharides **Structure and Function of Lipids**: Fatty acids, Role of Lipids as structural and signal molecule **Enzymes**: Nomenclature, Classification, Kinetic Mechanism and Applications **Biological Membranes**: Composition and transport across membrane.
Unit 2	**Genetics and Gene Expression:** **Basic Concept of Genetics**: Mendelian principles of dominance, Segregation and Independent Assortment, genotypes and phenotypes, alleles and multiple alleles. **Mutation**: Types, Causes and Detection, Mutant types- Lethal, conditional, biochemical, loss of function and gain of function Structural and Numerical Alteration of Chromosomes: Deletion, Duplication, Inversion and Translocation. **Biochemical Markers of Individuality**: General understanding, classification of markers, Biochemical basis of genetic variation. Introduction of Expression of Gene and Gene Mapping
Unit 3	**Immunology**: Immune System, Immune response, Antigens, haptens and adjuvant **Immunoglobulin:** Structure and function, raising of anti-sera, Antigen-Antibody reaction. **Lectins**: Introduction and their Forensic significance.
Unit 4	**Determination of Origin of Species** Determination of human and animal origin form bones, hair, flesh, nails, skin, teeth, body tissue, fluids/stains viz. blood,

	menstrual blood, semen, saliva, sweat, vomit through immuno-diffusion and immuno-electrophoresis, cross reactivity among closely related species.
Unit 5	**Serogenetic markers** **Blood group**: History, Biochemistry and genetics of ABO, Rh, Mn and other systems, method of ABO blood grouping (absorption-inhibition, Mixed agglutination and absorption elution) from blood stains and other body fluids/stainsviz. menstrual blood, semen, saliva, sweat, vomit, hair, bone, nail. Blood group specific ABH substance, determination of secretors/non secretor status,Lewis antigen, Bombay blood group **Polymorphic enzymes typing**- PGM, ESD, EAP, AK, etc., and their forensic significance, HLA typing, role of serogenetic markers in individualization, paternitydisputes.

Part C: Learning Resources:
1. Analytical Biochemistry: Holme.
2. Handbook of forensic Science by Richard Saferstein
3. The elements of Immunology: Fahim Halim Khan
4. Fundamental immunology William E. Paul
5. An Introduction to Forensic Genetics, (2007): Goodwin William, John Wiley & Sons Ltd,
6. Basic human genetics (1991): Kapur V, Jaypee Brothers
7. Essentials of Human Genetics (2009): Kothari, Manu L, Universities Press (India) Pvt. Ltd.
8. Genetic Markers in Human Blood, (1969): Giblett, Eloise R. Blackwell Scientific Publications
9. Race, R.R, and Sanger, R. (1975): Blood Groups in Man. Blackwell Scientific, Oxford.
10. Human blood groups-Chemical and biochemical basis of antigen specificity (Second edition): Helmut Schenkel –Brunner, Springer Wein New York
11. Forensic DNA Typing: Biology, Technology, and Genetics behind STR Markers by John M. Butler

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – III SEMESTER	
Title of the Paper (Course): Finger Prints, Impressions and Their Examination **Course Code: FS-33-B**	
Course Objective	
1: To know the classification and analysis of fingerprint. 2: To know about the chemical and physical method of analysis of fingerprint and other impressions.	
Course Outcomes- After completion of this paper students will come to-	
CO1	Explain history and development of Finger Prints
CO2	Illustrate the classification of Finger prints
CO3	Describe Fingerprint Developing Methods
CO4	Illustration Fingerprints of Living and Cadaver
CO5	Describe the examination of Foot, Footwear and other impressions
Part B: Content of the Course:	
Unit 1	History and development of Fingerprints composition of sweat, formation of ridges, ridge characteristics pattern types, pattern area. Focal Point, Type lines, Ridge count, Destruction of patterns.
Unit 2	**Classification of fingerprints**: Henry System of Classification, Secondary Classification Small Letter group, Sub-secondary classification, Final classification, Major and Key classification, Single digit classification, Search of fingerprints, Fingerprint Bureau.
Unit 3	Chance Fingerprints, Latent and Visible fingerprints, Plastic Fingerprints, Development of latent fingerprints, conventional methods of development of latent fingerprints-fluorescent method, magnetic powder method, fuming method, chemical method etc., digital imaging and enhancement, application of laser and other radiation to develop latent fingerprints, metal deposition method and development of latent prints on skin.
Unit 4	Taking of fingerprints from living and dead persons, preserving and lifting of fingerprints, photography of fingerprints, digital transmission, comparison of fingerprints, basis of comparison, class characteristics, Automatic fingerprint identification system.
Unit 5	**Foot and Footwear prints.** Importance, Gait pattern, casting of footprints in different medium, electrostatic lifting of latent footprints, Taking of control samples and examination. Tyre marks/prints and skid marks, taking of control samples and examination. **Lip prints**- Nature, location, collection and evaluation. **Bite Marks**- Forensic Significance, Photography, Lifting and preservation of bite marks and evaluation. **Ear Prints**- Forensic Significance, location, collection and evaluation.

Part C: Learning Resources:
1. David R. Ashbaugh: Quantitative and Qualitative Friction ridge analysis, CRS press, (1999)
2. E. Ronald Menzel: Fingerprint Detection with Lasers, Second edition: MarcelDekker, Inc. USA, (1999)
3. James F. Cowger: Friction Ridge skin CRC Press London, (1993)
4. Mehta M.K.: Identification of Thumb Impression & cross Examination of finger prints, N.M. Tripathi (P) Ltd. Bombay (1989)
5. Moenssens: Finger Prints Techniques, Chitton Book Co. Philadelphia, New York. (1975)
6. Chatterjee S.K., Speculation in Finger print Identification, Jantralekha Printing works, Kolkata, (1981).
7. Cowger, James F: Friction ridge skin: Comparison and Identification of fingerprints: CRC Press, Boca Raton, New York, (1993)
8. Cook Nancy: Classifying fingerprints- Innovative learning publication Mentro Park (1995)
9. Cossidy, MJ.: footware Identification, Royal Canadian Mounted Police, Ontario, Canada (1980)
10. J.A. Seigel, P.J saukoo and G C Knupfer: Encyclopedia of Forensic Sciences Vol. I, II and III, Acad. Press (2000)
11. Smith, B.C, Holland MM, Sweel, DL and Dizinno. A: DNA and Forensic Odontology, Colorado Springs, USA, (1995)
12. Hillison, S: Dental Anthropology, Cambridge Univ. Press, UK (1996)
13. Kasprzak, J: Possibilities of Cheiloscopy in Forensic science (1980)
14. Medlin H O: Ear print Identification, Solve Crime Military Police Journal (1967)
15. Iannarelli, A V: Ear print Identification, Forensic Identification series, Paramount (1989)
16. Henry C. Lee & R.E. Ganesslen, Advance in Finger print Technology, ~ RC press, Boca Raton, London, (1991)

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written ExamMaximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – III SEMESTER	
Title of the Paper (Course): DNA Profiling	**Course Code: FS-34-A**
Course Objective	
1: To know DNA structure. 2: To know about the DNA profiling and other techniques.	
Course Outcomes- After completion of this paper students will come to-	
CO1	Illustrate the concept of gene, nucleic acid and chromosomes.
CO2	To detect techniques in DNA profiling.
CO3	Illustrate handling, collection, preservation and storage of DNA samples.
CO4	Describe Quality Assurance, validation and forensic issues of DNA sample
C05	Interpret legal prospective of DNA profiling.

Part B: Introduction for code:

Unit 1	**Human Genome and DNA Profiling:** Concept of genes- alleles, Multiple alleles, genetic Code, Organization of Eukaryotic Cells and their genome Organization of genes and Chromosomes: Operon, Unique and Repetitive DNA, Intraped genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons. Conformation of Nucleic Acid- Helix, A, B and Z DNA, tRNA, Micro-RNA History of DNA Profiling and its Limitations, Introduction to Population genetics.
Unit 2	**Detection Techniques in DNA Profiling** **Concept of Sequence Variation:** VNTRs, STRs, MiniSTRs, SNPs. **Detection Techniques:** RFLP, PCR Analysis and their comparisons, Y-STR, mtDNA Analysis, PCR based typing methods such as HLA – DQA1, Amply- type ®PM Polymarker, D1S80, Gender ID, Denaturation, Renaturation and Methylation, DNA sequencing and Hybridization.
Unit 3	**Handling of DNA Samples**: Sources of DNA, Touch DNA, Collection, Preservation, Packaging and storage of Exhibits for DNA Analysis, Factors affecting DNA Stability.
Unit 4	**Quality Assurance and Validation**: Isolation and Purification, Quantification and Quality Assessment of DNA from hard and soft tissues and body fluids- blood and blood stains, semen and seminal stains, buccal smears, hair, bones and teeth **Forensic Issues**: Degraded DNA, PCR inhibition, Contamination, Mixed samples and Low Copy Number
Unit 5	**Legal perspective: legal** standard for admissibility of DNA profiling – procedural & ethical concerns, status of development of DNA profiling in India & abroad, DNA Database: uses and issues **Forensic Significance and Case Studies:** - Application in Kinship and parentage testing, Child Swapping, Missing person and Disaster Victims Identification, Civil Immigration, Veterinary and Wild Life and Agriculture Cases.

Part C: Learning Resources
1.Daniel L. Hartl & Elizabeth W. Jones; Genetics- Principle & Analysis, 4th Ed., Jones & Bartlet ıb. 1998.
2.Jaiprakash G. Shewale, Ray H. Liu Forensic DNA Analysis: Current Practices and Emerging Technologies, CRC Press, 2013
3.John M Butler: Forensic DNA Typing. Elsevier Academic Press.
4. Keith Immen and Norah Rudus, 1997. An introduction to Forensic DNA Analysis. CRC Press, New York.
5.Lee M.C. and Gaenesten, R.E: DNA and other Polymorphism in Forensic Science. Year book Medical Published.
6.Daniel L. Hartl & Elizabeth W. Jones; Genetics- Principle & Analysis, 4th Ed., Jones & Bartlet Pub. 1998.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By writtenExam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – III SEMESTER	
Title of the Paper (Course): Pharmaceutical Jurisprudence Course Code: FS-34-B	
Course Objective	
1: To know about the pharmaceutical jurisprudence. 2: To know about the different acts and law related to pharmaceutical.	
Course Outcomes- After completion of this paper students will come to-	
CO1	Define pharmaceutical and drugs legislation in India.
CO2	Recognize acts, rules related to drugs and cosmetics.
CO3	Illustrate Drugs and Cosmetic Act
CO4	Describe Drug and Magic Remedies, Food Adulteration and Factories Act
C05	Illustrate intellectual properties rights and Indian Patent Act
Part B: Content of the course:	
Unit 1	1. Evolution of Pharmaceutical and Drug Legislation in India. 2. The Pharmacy Act 1948. 3. Code of Pharmaceutical Ethics. 4. Consumer protection Act 1986. 5. Narcotic and Psychotropic substances Act 1985.
Unit 2	**Drugs and Cosmetics Act 1940 and Drugs & Cosmetic Rules 1945 (also amendments).** 1. Administration of the Act – The controlling and licensing regulation at state level and central level (the organization, function and duties of state and central drug control authorities). 2. Drugs & Cosmetic Act Rules – the provisions related to • The manufacture of drugs (other than homeopathic) including schedule C, C (1), F, F (1) and X drugs and cosmetics. • The sale and distribution of drugs (other than homeopathic) including schedule C, C (1), F, F (1) and X drugs and cosmetics.
Unit 3	**Drugs & Cosmetics Act** 1. (i.) The import and export of drugs & cosmetics. (ii) Labelling and packing requirements for all categories of drugs & cosmetics. 2. (i.) List of schedules to the Drugs & Cosmetics Rules. (ii.) Detailed study of schedule M (new), U and Y. 3. Medicinal & Toilet preparations (Excise Duties) Act 1955.
Unit 4	1. Drugs and magic Remedies (Objectionable Advertisements) Act 1954. 2. Prevention of Food Adulteration Act 1954 (salient features) 3. The Factories Act 1948 and the Amendment (salient features.).

Unit 5	**IPR's and Patent Laws** 1. Intellectual Property Rights – a brief introduction to various IPR's. 2. Indian Patent Act 1970 and the Amendments to the Act (up to date with reference to WTO Agreement) • Introduction & Objectives • Inventions and Not inventions according to the Act. • Procedure of obtaining patent for drugs and pharmaceuticals. 3. Drug Price Control Order (Latest). 4. Pharmaceutical Policy 2002.

Part C: Learning Resources:
1. Forensic Pharmacy by B.M. Mithal, Vallabh Prakashan.
2. Forensic Pharmacy by Dr. B.S. Kuchekar, A.M. Khadatare and Sachin C. Itkar, Nirali Prakashan, Pune.
3. Drugs and Cosmetics Act 1940 by Vijay Malik, Eastern Book Company, Lucknow.
4. Bare Acts, published by Govt. of India.
5. Patent Act 1970 with patent Rules, published by Taxman Allied services (P) Ltd., 59132, New Rohtak Road, New Delhi – 110005.
6. ISO, International Organisation for Standardisation, Switzerland, 1994.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Practical - I

Class- M.Sc. Semester-III

Title of the Paper (Course)- Practical based on paper 9 & paper 10

Course Code- PRFS-31

(Duration: 3 hrs. in each batch)

Practical Question 1	15
Practical Question 2	15
Practical Question 3	10
Practical Question 4	10
Practical Question 5	10
Record	07
Viva Voce	08

1. Comparison of tool marks and fired cartridge/ bullet using comparison microscope.
2. Identification of explosive and gunshot residue by chemical test.
3. Identification of Shell-Case, Bullet and Shot using Vanier Calipers, and Screw Gauge.
4. Demonstration of different centrifugation techniques
5. To prepare gel plates for electrophoresis.
6. Demonstration and working of PCR
7. Demonstration of" Gel Documentation System"
8. Any other suggested.

Practical - II

Class- M.Sc. Semester-III

Title of the Paper (Course)- Practical based on Open Elective Paper

Course Code- PRFS-32

(Duration: 3 hrs. in each batch)

Practical Question 1	15
Practical Question 2	15
Practical Question 3	10
Practical Question 4	10
Practical Question 5	10
Record	07
Viva Voce	08

Elective Paper 33-A

1. Preliminary examination of Blood
2. Confirmatory examination (Crystal test) of blood
3. To Determine Species of Origin from Blood by Gel diffusion method
4. Detection of salivary stains.
5. Preparation of slide for scale pattern study of hairs.
6. Estimation of stature from long bones.
7. To Determine ABO and Rh factor of human blood.
8. Examination of dried blood stains – identification and grouping.
9. Extraction of DNA from blood
10. Any other suggested.

Elective Paper 33-B

1. Print your own 10-digit finger print card using black ink.
2. Primary and secondary classification of given finger print chart.
3. Identification of ridge characteristics
4. Any other suggested.

Elective Paper 34- A

1. Extraction of DNA from blood.
2. Demonstrations of PCR method.
3. Demonstrations of RFLP method.
4. Any other suggested.

Elective Paper 34- B

1. As per Teachers' Suggestions.

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department Of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – IV SEMESTER	
Title of the Paper (Course): Forensic Physics	**Course Code: FS-41**
Course Objective	
1: To know about the physical evidences and its analysis such as glass, soil, tool marks etc. 2: To know the photography, Speaker identification and its analysis.	
Course Outcomes- After completion of this paper students will come to-	
C01	Define glass, dust, soil, paint, cement, tool marks & their importance
C02	Summarize tool marks, types and analysis
C03	Illustrate voice and speaker identification
C04	Explain crime scene photography
C05	Relate Statistics and math with Forensic Science
Part B: Content of the course:	
Unit 1	**Glass:** Nature, Composition, Types, Fractures, Forensic marks and forensic examinations. **Dust and soil:** Nature, Composition and forensic examinations. **Paint:** Nature, Composition, Types and forensic examinations. **Building material:** Types of cement and their composition, Determination of adulterants by physical, chemical and instrumental methods, Examination of brick, Analysis of cement mortar and Cement concrete.
Unit 2	**Tool marks:** Types of tool marks: Compression marks, Striated marks, Combination of compression and striated marks, Repeated marks, Class characteristics and individual characteristics, Tracing and lifting of marks, Forensic examinations, Restoration of erased / obliterated marks, Examination of wire / cables/ electric Meter, Counterfeit coins/currency.
Unit 3	**Speaker identification and tape authentication:** Introduction, Importance, Nature (Phenoms, variations of sound), problems (Telephone utterance, wiretapping, controlled voice, transmission channel, miscellaneous), collection (Mechanical mode, magnetic mode, optical mode), Evaluation (Listening, computer analysis, Sound spectrograph, Automatic speaker analysis, Sound spectrograph, Automatic speaker recognition), interpretation, Analysis of audio-video signal for authenticity.
Unit 4	**Crime scene photography:** Introduction to photography techniques, UV, Infrared and Fluorescence. Photogrammetry and its types. Special photography situations; Accident, Surveillance, Areal and Underwater. Digital imaging techniques. Legal issues related to photographs and digital images.
Unit 5	**Essentials of Mathematics and Statistics in Forensic Science:** Number System, Units of Measurement and their Conversion, Types of Data, Measurement of Central Values-Mean, Mode and Median, Bay's Theorem, Chi-square Test, t-Test, F-Test of equality of Variance, Pearson's Square Test.

Part C: Learning Resources
1. 1. C.E. O 'Hara and J.W. Osterburg; An Introduction to Criminalistic: Indiana UniversityPress, Blomington, (1972).
2. 2. R. Saferstein; Forensic Science Handbook, Vols. I, II; (Ed); Prentice Hall, EglewoodCliffs, NJ; (1988).
3. 3. F.W. Sears, M.W. Zemansky and H.D. Young; University Physics, Sixth Ed., Narosa;(1995).
4. 4. Jenkins and White; Fundamentals of Optics; Mc Graw Hill; Fourth Ed.
5. 5. Dennis Shaw; Physics in the Prevention and Detection of Crime, Contem Phys. Vo U7;(1976).
6. 6. Philip Rose; Forensic Speaker Identification; Taylor and Francis Forensic Science Series,London (2001).
7. 7. Bengold & Nelson Moryson – Speech and Audio signal Processing; John Wiley & Sons,USA, (1999).
8. 8. Nickolls, L.C.; Scientific Investigation of Crime, Bulterwest, London (1956).
9. 9. Raymond C Murray & John C.F. Tedrew; Forensic Geology; Prentice Hall, New Jersey(1991).
10. 10. Working Procedure Manual: Physics BPR&D Publication (2000).
11. 11. B. Caddy; Forensic Examination of glass and paints analysis and interpretation ISBN0784 05749 (2001).

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written ExamMaximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
Class – M.Sc. – IV SEMESTER	
Title of the Paper (Course): Applied Forensic Science and Scientific Investigation of Crime **Course Code: FS-42**	
Course Objective	
1: To know about scientific knowledge used for crime investigation 2: To know about different types crimes scene.	
Course Outcomes After completion of this paper students will come to-	
CO1	Illustrate crime scene, types and physical evidences.
CO2	Recognize different types of patterns.
CO3	Interpret scientific investigation of motor vehicle, fire and arsons cases.
CO4	Illustrate civil and criminal cases studies.
CO5	Define forensic science Career.
Part B: Content of the course:	
Unit 1	**Crime Scene:** Types, protection of scene of crime, preservation of scene of crime – photography, videography and sketching method, Scientific survey and documentation of crime scene, Scientific methods of crime reconstruction. **Physical Evidences**: Collection, Preservation, Packaging and Forwarding of various forensic samples.
Unit 2	**Physical patterns:** Introduction, Physical patterns in identification, individualization and reconstruction. **Impression Patterns:** Blood stain pattern analysis, Patterns on glass, Patterns in fire and arson cases, Tyre marks, Skid marks. **Firearms and tool marks related patterns:** Imprints, Indentations, Striations. **Serial Number:** Comparison, Restoration and analysis. Modus Operandi, Portrait parley, Bite marks.
Unit 3	**Scientific investigation of crimes:** **Motor vehicle investigation** – Identification and search of physical evidences, Involvement of vehicle in crime, Investigation in theft and hit and run cases. **Fire and Arson case investigation;** Scene investigation, Collection and preservation of samples, Fire debris analysis, Detection of ignitable liquid residue. **Investigation in offences against the properties;** Burglary and robbery.
Unit 4	**Various Case studies:** **Civil cases –** White collar crimes, Theft crime, Property crime, Organized crime, High tech crime and Defamation,

	Criminal cases – Rape, Homicide, Explosive, Kidnapping, Domestic abuse, Child abuse, Drug and Alcohol related crimes, Human Trafficking, Honor Killing, and Bioterrorism.
Unit 5	**Career in Forensic Science:** Need of Forensic science and Scientists, Different universities providing Forensic degrees/diploma/certificates, Admissions, Eligibility, Funding, Scholarships, Forensic experts and their qualities, Types of Forensic Experts, Demand and supply, Investigative Journalism. Private sectors and Government sectors for education and Jobs, Research Carrier in Forensic Science, Recruiters, Career in Government laboratories/Institutes. **Private Practices:** Private detective agencies and their Structural organization, Accreditation, Licenses, Certification and Registration.

Part C: Learning Resource
1. 1. Saferstein Richard: Criminalistics – An Introduction to Forensic Science, Prentice hall Inc. USA (1995).
2. 2. C.G.G. Aitken and D.A. Stoney: The use of statistics in Forensic Science, Ellis Harwood Limited, England (1991)
3. 3. James, H.S. and Nordby, J.J.; Forensic Science; an Introduction to scientific and Investigative Techniques, CRC press, USA (2003)
4. 4. O'Hara & Osterberg : An introduction to Criminalistics.
5. 5. Forest: Forensic Science, An Introduction.
6. 6. Lee, Honry : Advance in Forensic Science.
7. 7. Sharma J.D. Vidhivigyan Avem Vish Vigya.
8. 8. Sharma J.D. Apradho ka Vigyanic Anveshan.
9. 9. Sharma B.R. Forensic Science in Criminal Investigation and trials.
10. Saferstein Richard: Criminalistics – An Introduction to Forensic Science, Prentice hall Inc. USA (1995).

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A; Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – IV SEMESTER	
Title of the Paper (Course): Emerging trends in forensic science CourseCode: FS-43-A	
Course Objective	
1: To know about the advance method of investigation used by scientist and investigator. 2: To know scientific view of investigation.	
Course Outcomes: After completion of this paper students will come to-	
CO1	Citation of Investigative Techniques
CO2	Illustrate Advanced DNA Techniques
CO3	Explain Microbial Forensics and Bioterrorism
C04	Describe the effects of social media
C05	Interpret Advanced Criminal Investigative Techniques
Part B: Content of the course:	
Unit 1	**Investigative Techniques:** Polygraphy- Basic of Polygraphy, Polygraphy examination (The Pre-test interview and Questioning technique), Physiological and Physiological stress evaluator and their admissibility in courts, Merits and Limitations of Polygraphy. Brain Mapping- Basic of Brain Mapping, Equipment's and Procedure of Brain Mapping. Narco Analysis- Basic of Narco Analysis, Requirements and Procedure, admissibility in Courts, Merits and Limitations of Narco Analysis.
Unit 2	**Advanced DNA techniques:** New and Future Technologies- DNA Chips, SNPs, Microarrays. Gene Amplification- RT-PCR and Qualitative RT-PCR, DNA Sequence and Automation.
Unit 3	**Microbial Forensics and Bioterrorism:** Introduction to Microbial Forensics, Methods for Detection of Microbes. Introduction to Bioterrorism- Concept of Biosecurity, NBC (Nuclear, Biological and Chemical), CBRNE (Chemical, Biological, Radiological, Nuclear and High Yield Explosive), Dirty Bombs, Bioterrorism Response Strategies.
Unit 4	**Social Media Forensics:** Introduction to social media, Security issues in social media, Types of Crimes- Cyber bullying, Online Grooming, Cyber Stalking, social media and its impact on Business, Politics, Law and Revolutions, Emerging trends in social media.
Unit 5	**Advanced Criminal Investigative Techniques:** Alternative Light Sources, 3D Crime Scene Reconstruction Technique, High speed ballistics photography, Facial identification and computerized facial reconstruction, Ear Print, Cheiloscopy, Global Positioning System (GPS) and IGS, C14 dating.

Part C: Learning Resources
1. 1. Forensic Science in Criminal Investigation & Trials - B. R. Sharma.
2. 2. The Hand Book of Forensic Psychology – Weiner Hass.
3. 3. Hand Book of Forensic Psychology – O' Donohue Levensky.
4. 4. Brain Experience – C. R. Mukundan.
5. 5. Criminal Profilling – B. Turvey.
6. 6. Investigative Forensic Hypnosis – J. Niehans.
7. 7. Art & Science of the Polygraph Techniques – J. A. Matte.
8. 8. Detecting Lies & Deceit – A.Vrij.
9. 9. Forensic Speaker Identification (2007) by Philip Rose.
10. 10. Kleiner, Munay (2002): Handbook of Polygraph testing. Academic Press.
11. 11. Bengold & Nelson Moryson – Speech and Audio signal Processing; John Wiley & Sons, USA, (1999).

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A: Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
M.Sc. – IV SEMESTER	
Title of the Paper (Course): Forensic Psychology	**Course Code: FS-43-B**
Course Objective	
1: To know the basic term of forensic psychology. 2: To know different psychometric assessment test and their application.	
Course Outcomes- After completion of this paper students will come to-	
CO1	Summarize history, ethics, scope of forensic psychology.
CO2	Illustrate Psychopathology and abnormal behavior
CO3	Describe Investigative Techniques
CO4	Explain juvenile delinquency.
CO5	Interpret elements mental illness and their analysis.
Part B: Content of the course:	
Unit 1	**Basics of Forensic Psychology:** Introduction, Definition of Forensic Psychology. History and Development of Forensic Psychology, scenario in India. Scope of Forensic Psychology, Ethics of Forensic Psychology, functions and role of forensic psychologist. Forensic Psychologists as an Expert.
Unit 2	**Psychopathology & Abnormal Behavior:** Theories of Offending, Gender & Crime, Ethnicity & Crime. Effect of Media. Terrorism & the related psychological aspects. **Psychometric Assessment tools used in Forensic Psychology:** Intelligence Tests, Achievement and Aptitude Tests, Personality Tests, MMPI Test, Rorschach Test, Thematic Apperception Test, Neuropsychological tests, Nature of Crime (Organized, Disorganized, Planned, Spontaneous), Crime Scene Analysis, Psychological Autopsy, Stages and Types of Offender Profiling. Behavioral Analysis, Serial Killers, Signature, Modus Operandi, Portrait Parley.
Unit 3	**Investigative Techniques:** **Polygraphy**: Basics of Polygraphy, Polygraphic Examination (the Pre-test Interview and Questioning Technique), Physiological and Physiological Stress Evaluator and their Admissibility in Courts, Merits and Limitations of Polygraphy **Brain Mapping:** Basics of Brain Mapping, Equipment and Procedure of Brain Mapping. **Narco-Analysis**: Basics of Narco-Analysis, Requirements and procedure, admissibility in courts, Merits and Limitations of Narco- Analysis
Unit 4	**Juvenile Delinquency:** Theories of Offending: Social Cognition, Moral Reasoning. Child Abuse: Physical, Sexual, Emotional Juvenile Sex Offenders Prevention of Delinquency

Unit 5	**Elements of Forensic Psychiatry:** Forensic Psychiatry: Introduction to different mental illnesses; neurosis (depression, mood disorder, Insanity, Psychosis, Delusion, delirium, schizophrenia), Impulsive control stress disorder, Anti-social personality disorder, psychopathy, Post traumatic stress disorder and post-partum stress disorder. Substance Abuse. Association between mental disorder and crime. Mc Naughten rule, diminished responsibility, testamentary capacity, competency Evaluation

Part C: Learning Resources
1. Introduction to Forensic Psychology' by Bruce Arrigo
2. Forensic & Criminal Psychology' by Dennis Howitt.
3. Abnormal Psychology' by Halgin & Whitbourne.
4. Abnormal Psychology', by Robert C. Carson, James N. Butcher, Susan Mineka, Jill M. Hooley thirteenth Edition, Thirteenth Edition.
5. Encyclopedia of Forensic Science' by Jay A. Siegel, PekkaJ. Saukko, Geoffey C. Knupfer, Volume-1 to Volume-5.
6. Mental Disorders and Treatment' by Katherine Marsland.
7. Handbook of Forensic Psychology' by Prof. Dr. Vimala Veeraraghavan.
8. Criminal Profiling and Introduction to Behavioural Evidence Analysis' by Brent Turve, Second Edition.
9. Diagnostic & Statistical Manual-IV TR, American Psychological Association.
10. Psychological Testing' by Anne Anastasi, Susana Urbina, Seventh Edition.

Part A; Introduction for code:

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Part A; Introduction for code:

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
Class – M.Sc. – IV SEMESTER	
Title of the Paper (Course): Biometrics	**Course Code: FS-44-A**
Course Objective	
1: To know about the permanent parameter of identification of human. 2: To know the advance science of investigation.	
Course Outcomes- After completion of this paper students will come to-	
CO1	Define biometric techniques
CO2	Illustrate fingerprint and computerization of pattern& analysis.
CO3	Explain speaker and voice identification and analysis.
CO4	Identify Face recognition method.
C05	Describe Pattern Recognition & Biometrics
Part B: Content of the course:	
Unit 1	**Biometrics**: Definition, Scope, Types of biometric tool, Physiological or Behavioural, Verification Vs Identification, Applications, Biometrics Technologies, Working of Biometrics, Benefits, Application Design. Professional ethics and conduct of forensic expert, Dealing with news media.
Unit 2	**Fingerprint Recognition**: Fingerprint Scanning, Practical Applications for Fingerprint Scanning, Accuracy and Integrity, Fingerprint Matching, Fingerprint Classification, Fingerprint Image Enhancement, Fingerprint Feature Extraction, Fingerprint Form Factors, Types of Scanners: Optical - Silicon – Ultrasound, Fingerprint Matching.
Unit 3	**Speaker Recognition:** Algorithms for training, recognition and adaptation to speaker and transmission channel, mainly based on Hidden Markov Models (HMM), methods for reducing the sensitivity to external noise and distortion, acoustic modeling of static and time-varying spectral properties of speech, statistic modeling of language in spontaneous speech and written text, specific analysis and decision techniques for speaker recognition.
Unit 4	**Face Recognition:** Introduction, working, Image Quality, Facial Scan Process Flow, Verification v/s Identification, Primary Facial Recognition Technologies, Facial Recognition Application
Unit 5	**Other Advances** Pattern Recognition & Biometrics - Handprint Biometrics - DNA Biometrics Iris & retinal imaging, gait pattern, Digital Signatures, Pattern comparison, Computer simulation, Image processing, Image capturing, Image restoration & enhancement. Image editing, Compression Technique.

Part C: Learning Resources
1. Samir Nanavathi, Michel Thieme, and Raj Nanavathi, "Biometrics -Identity verification in a network", Wiley Eastern, 2002.
2. John Chirillo and Scott Blaul," Implementing Biometric Security", Wiley Eastern Publications, 2005.
3. John Berger," Biometrics for Network Security", Prentice Hall, 2004.
4. Forensic Speaker Identification (2007) by Philip Rose
5. Bengold & Nelson Moryson – Speech and Audio signal Processing; John Wiley & Sons, USA, (1999)

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written ExamMaximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous ComprehensiveEvaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment:External Exam: 75 Time: 3 hours	75	75
		100

Govt. Holkar (Model, Autonomous) Science College, Indore	
Department of Forensic Science	
SYLLABUS SESSION: 2021-2022	
Class – M.Sc. – IV SEMESTER	
Title of the Paper (Course): Computer & Cyber Forensic **Course Code: FS-44-B**	
Course Objective	
1: To know about the basic information of Computer. 2: To know the Investigation process of Computer & Cyber Forensic.	
Course Outcomes- After completion of this paper students will come to-	
CO1	Explain and Summarize of Computer & Internet.
CO2	Recognize Computer Crime.
CO3	Illustrate Internet & Digital Crime.
CO4	Describe Computer & Cyber Crime.
C05	Explain social media, Cryptography & Stenography.
Part B: Content of the course:	
Unit 1	**Basic Introduction of Computer System:** Various components of computer, Motherboard, Processor, Memory, Storage devices, Operating System, Booting process, Hardware- Input and Output devices, Software and Network. **Introduction to Internet**: Definition of Network and Internet, Network types and Topologies, Types of IP Address, Internet in India.
Unit 2	**Computer Crime:** Introduction, Classification, Computer Virus- Types, Worms, Trojan Horse, Trap Door, Super Zapping, Logic Bomb, Salami Logic, Characteristics of computer crime and criminals, Common targets of computer criminals.
Unit 3	**Internet Crime:** Introduction, different types of Internet crime- Cyber Laundering, Terrorism, Cyber Warfare, Prevention of Internet Crime. Network Crime- Introduction, Types- Eavesdropping, Spoofing, Modification, Cross-site Scripting, DNA Spoofing, Routing Table Poisoning, ARP Poisoning, Web Jacking, Attacks on Wireless Network.
Unit 4	**Investigation of Computer and Cyber Crime:** Process of Investigation and Detection of Crime, Procedure of Search and Seizure of Volatile and Non- Volatile Physical Evidence, Examination of Digital Evidence. Information Technology Act, 2000.
Unit 5	**Social Media:** Introduction, Security issues in social media, Types- Cyber Bulling, Online Grooming, Cyber Stalking, social media and its impact on Business, Politics,Law and Revolutions, Importance. **Cryptography:** Introduction, Types of Keys. **Steganography:** Introduction.

Part C: Learning Resources
1. C.E. O 'Hara and J.W. Osterburg; An Introduction to Criminalistic: Indiana University Press, Blomington, (1972).
2. R. Saferstein; Forensic Science Handbook, Vols. I, II; (Ed); Prentice Hall, Eglewood Cliffs, NJ; (1988).
3. Nickolls, L.C.; Scientific Investigation of Crime, Bulterwest, London (1956).
4. Working Procedure Manual: Physics BPR&D Publication (2000).
5. James D. McCabe; Network Analysis, Architecture and Design, 3rd edition.
6. N. M. Karie and H. S. Venter, "Taxonomy of challenges for digital forensics," Journal of Forensic Sciences, vol. 60, no. 4, July 2015, pp. 885-893.
7. M. Losavio, K. C. Seigfried-Spellar, and J. J. Sloan III, "Why digital forensics is not a profession and how it can become one," Criminal Justice Studies, vol. 29, no. 2, 2016, pp.143-162.
8. S. L. Garfinkel, "Digital forensics research: The next 10 years," Digital Investigation, vol. 7, 2 0 1 0, pp. S 6 4- S 7 3.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE): 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time: 3 hours	75	75
		100

Practical - I

Class- M.Sc. Semester-IV

Title of the Paper (Course)- Practical based on paper 11 & paper 12

Course Code- PRFS-41

(Duration: 3 hrs. in each batch)

Practical Question 1	15
Practical Question 2	15
Practical Question 3	10
Practical Question 4	10
Practical Question 5	10
Record	07
Viva-Voce	08

1. Identification and matching of dust/ soil sample by physical methods (including density gradient method).
2. Identification, Comparison and matching of cloth sample, Glass piece and glass fractures.
3. Restoration of erased punched mark on metal piece by chemical treatment.
4. To calculate the refractive index of glass.
5. Measurement the depth of curved glass by using Spherometer.
6. Examination of Paint and paint chips sample.
7. To examine tampered Electric Energy Meter, Electrical Cables and Wires.
8. Examination of Cement, Concrete and Mortar.
9. Examination of Security Features of Currency Notes.
10. To analyse Voice Sample.
11. To caste and examine Tire impression.
12. Collection, Preservation, Packing and forwarding of various Forensic Sample.
13. Analysis of Blood Pattern.
14. Investigate, Compare and analysis of marks on different surfaces.
13. Any other suggested.

Practical - II

Class- M.Sc. Semester-IV

Title of the Paper (Course)- Practical based on Open Elective Paper

Course Code- PRFS-42

(Duration: 3 hrs. in each batch)

Practical Question 1	15
Practical Question 2	15
Practical Question 3	10
Practical Question 4	10
Practical Question 5	10
Record	07
Viva-Voce	08

Elective 43-A

Emerging trends in forensic science

1. Demonstration/Working of Polygraph.
2. Narco-analysis- Demo/working/principle/framing questionnaire.
3. Brain mapping- Demo/working/principle/Interpretation of results.
4. To analyze voice sample.
5. To demonstrate Face recognition Technique.
6. To analyze Gait pattern.
7. To demonstrate PCR and RT-PCR.
8. To demonstrate DNA sequence.
9. To develop the Microbial Colonies on Agar Media and Identify the Species.
10. To investigate the Crime scene with the help of Alternative Light Source and reconstruct the SOC using 3D Crime scene Reconstruction Technique.
11. To caste and compare Ear Print and Lip Print.
12. To trace the location using GPS technology.
13. Any other suggested.

Elective 43-B

Forensic Psychology

1. To perform different forensic psychological assessment tests.
2. To assess and evaluate adult offender profile.
3. To assess and evaluate juvenile profile.
4. To detect lies and deceit using forensic behavioral analysis tools.
5. Any other suggested.

Elective 44-A

Biometrics

1. To demonstrate Automatic identification Fingerprints systems.
2. To demonstrate Facial Recognition technologies.
3. To analyze Gait pattern.
4. To demonstrate Speaker Recognition technique.
5. Any other suggested.

Elective 44-B

Computer & Cyber Forensic

1. Image processing using tools like Photoshop, photo paints etc.
2. To demonstrate Computer and Computer System.
3. To recover Deleted Data from Internal and External storage.
4. Creation and verification of various electronic signatures.
5. To secure MS files by Encryption.
6. To trace Ip Address from Website and E-mail.
7. Any other suggested.

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Geology

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

Govt.Holkar (Model Autonomous) Science College, Indore
DEPARTMENT OF GEOLOGY
B.Sc.I semester Syllabus Under NEP2020
Session 2021-22

Class: B. Sc. I Semester

Marks: 75+ (CCE) 25 = 100

Subject: Geology

Credit: 4

Paper: Core I

Title of Paper: - Physical Geology (Major)

Code of the Paper: S1-GEO1T

Part A : Introduction for Code- C111-I	
Pre-requisite (if any)	To study this course, a student must have had the subject Math's Group or Biology Group in the class 12th.
Course Objectives	This course enables the students to appreciate the dynamic nature of the Earth processes. They will also be appraised about the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift, plate tectonics. This course will also impart knowledge of various geomorphic processes operation on the earth and their effects on the land surface.
Course Learning Outcomes	1. Student will gain preliminary knowledge of Geology, its Branches and importance. They will understand Solar System and Earth as dynamic body and also able to understand about origin, age and interior of the Earth.
	2. Student will gain basics knowledge about the Concept of Plate tectonics, Mid-oceanic ridges and trenches, Island arcs, Isostasy. Continental drift and about Sea-floor Spreading.
	3. Student will able to understand the Earthquakes and Volcanoes. They Also know about basic principles of Geomorphology and rock weathering.
	4. Students will gain knowledge about Geological work of Rivers, Underground water, and wind and their landforms. They Also understand about Karst topography and Desert.
	5. Students will gain knowledge about Geological work and landforms of Glacier and Ocean. They will also understand about Unconformity and other geological structure.

Part B :Content of the Course		
As per HE Syllabus		
Total numbers of lectures (in hours per week): 2 hours per week		
Total Lectures: 60 hours		
Unit	**Topic**	**No. of Lectures**
Unit-I	**Introduction to Geology:** 1. Introduction to Geology, its branches and importance. 2. Introduction to Solar System; Star, Planet, satellite, asteroid and meteorite. 3. Origin of the Earth-Planetesimal hypothesis. 4. Interiors of the earth-crust, mantle and core. 5. Radioactivity methods of age of the Earth. Geological Time Scale.	12

इकाई-I	**भूविज्ञान का परिचय:** 1. भूविज्ञान का परिचय, इसकी शाखाएं एवं महत्व। 2. सौर मंडल का परिचय, तारा, ग्रह, उपग्रह, क्षुद्रग्रह और उल्कापिंड। 3. पृथ्वी की उत्पत्ति–ग्रहाणु परिकल्पना। 4. पृथ्वी की आतंरिक रचना–पर्पटी, प्रावार और क्रीड। 5. पृथ्वी की आयु की रेडियोधर्मी विधियां। भूवैज्ञानिक समय मापक।	
Unit-II	**Dynamic Earth:** 1. Concept and theories of Isostasy. 2. Continental drift and Sea floor spreading and evidences. 3. Concept of plate tectonics, tectonic plates and types, and plate boundaries. 4. Mid-oceanic ridges, trenches and island arcs.	12
इकाई-II	**गतिशील पृथ्वी:** 1. समस्थिति की संकल्पना और सिद्धांत। 2. महाद्वीपीय विस्थापन और समुद्र–तल प्रसार एवं साक्ष्य। 3. प्लेट विवर्तनिकी की अवधारणा, विवर्तनिक प्लेट और प्राकर, एवं प्लेट सीमाएं। 4. मध्य महासागरीय कटक, खाइयॉं और द्वीप–चाप।	
Unit-III	**Geomorphic Processes:** 1. Earthquakes- causes, effects and distribution. Seismic Zones of India. 2. Volcanoes: types and landforms. Volcanic zones of India. 3. Fundamental concepts of geomorphology. 4. Types of rock weathering. 5. Soil formation, soil profile and types of soil.	12
इकाई-III	**भू–आकृति प्रक्रियाएं:** 1. भूकंप–कारण, प्रभाव और वितरण। भारत के भूकंपी क्षेत्र। 2. ज्वालामुखी: प्रकार और भू–आकृतियॉं। विश्व के ज्वालामुखी क्षेत्र। 3. भू–आकृति विज्ञान की मूलभूत अवधारणाएँ। 4. शैल अपक्षय के प्रकार। 5. मृदा निर्माण, मृदा परिच्छेदिका और मृदा के प्राकर।	
Unit-IV	**Geological Works:** 1. Geological works of river, and its landforms. 2. Drainage system. Introduction to wetlands. 3. Geological works of groundwater, and karsts topography. 4. Geological works of wind and its landforms. Introduction to desert.	12
इकाई-IV	**भूवैज्ञानिक कार्य:** 1. नदी के भूवैज्ञानिक कार्य और इसकी स्थलाकृतियॉं। 2. अपवाह तंत्र। आर्द्रभूमि का परिचय। 3. भूजल के भूवैज्ञानिक कार्य और कार्स्ट स्थलाकृतियॉं। 4. वायु के भूवैज्ञानिक कार्य और इसकी स्थलाकृमियॉं। मरूस्थल का परिचय।	
Unit-V	**1. Geological works:** 1.1. Geological works of glacier, and its landforms. 1.2. Geological works of ocean, and coastal landforms. **2. Introduction to Structures:** 2.1. Unconformity: Definition and types. Overlap and Off lap.	12

	2.2. Brief introduction to fold, fault and joint.	
इकाई-V	**1. भूवैज्ञानिक कार्य:** 1.1. हिमनद के भूवैज्ञानिक कार्य और इसकी स्थलाकृतियाँ। 1.2. महासागर के भूवैज्ञानिक कार्य और तटीय स्थलाकृतियाँ। **2. संरचनाओं का परिचय:** 2.1. विषमविन्यास की परिभाषा एवं प्रकार। अतिव्यापन और अपन्यापन। 2.2. वलन, भ्रंश और संधि का संक्षिप्त परिचय।	
	Key Words/ Tags: Geology, Planet, Earth, Hypothesis, Plate-tectonics, Continent, Earthquake, Volcano, Drainage, Unconformity, Fold, Fault, Joint, Glacier, Wind, River.	
	सार बिंदु (की वर्ड)/टैग: भूविज्ञान, ग्रह, पृथ्वी, परिकल्पना, प्लेट–विवर्तनिकी, महाद्वीप, भूकंप, ज्वालामुखी, अपवाह तंत्र, विषमविन्यास, वलन, भ्रंश, संधि, ग्लेशियर, वायु, नदी।	

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

Text Book ,Referene Books, Other resources

1. घोष, मुकुल; भौतिक भूविज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
2. तिवारी जे पी एवं सिंह, बी.के; भौतिक भूविज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
3. सिंह, सविंदर; भूआकृतिविज्ञान, प्रवालिका प्रकाशन प्रयाग
4. दुबे वी.एस. एवं मिश्र, प्रभाशंकर; भूविज्ञान एक परिचय, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
5. तिवारी, दीपक राज; भूगतिकी एवं भूआकृतिविज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
6. राठौर, बी.एस. एवं तिगनाथ संजय; संरचनात्मक भूविज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल, 3rd 2018
7. Holmes, A. Doris L Holmes Edit., Principles of Physical Geology, Van Nostrand Reinhold, 1978.
8. Mahapatra, G.B. Text Book of Physical Geology, CBS, India, 2018
9. Mathur, S.M., Physical Geology of India, NBT India, 1991
10. Miller, William J., Physical Geology: An Introduction. D Van Nostrand Co.,5th Ed ., 1949
11. Mukerjee, P.K., Text Book of Geology. World Press Private Ltd, 2013
12. Thornbury, W.D., Principles of Geomorphology. New Age International, 2nd Edition, 1969
13. Billing, M.P., Structural Geology. Pearson Education, India, 3Rd Ed., Reprint, 2016 Ebook:
1. Jain Sreepat, Fundamentals of physical Geology. Springer India, 2013
2. Digital platform web links:
1. https://opentextbc.ca/physicalgeology2ed/front-matter/download-a-pdf/
2. https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up
3. https://www.tulane.edu/~sanelson/eens1110/index.html [for introduction to folds, faults…]

Suggested equivalent online course:

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	25
College Exam:	75

Internal Assessment:	Class Test	15
Continuous Comprehensive	Assignment/ Presentation	10
Evaluation	**Total**	**25**

(CCE): 25		
External Assessment: College Exam Section: Time: **2.00 Hours**	Section (A): Three Very Short Questions (50 words each)	03 x 03 = 09
	Section (B): Four Short Questions (200 words each)	04 x 09 = 36
	Section (C): Two Long Questions (500 words each)	02 x 15 = 30
	Total	**75**

DEPARTMENT OF GEOLOGY

Class: B. Sc. I Semester **Marks: 75+ 25 = 100**

Subject: Geology **Credit: 2**

Paper: Practical- I (Major)

Code of the Paper:

Title of Paper: Physical Geology **S1-GEO1P**

Part A : Introduction for Code- C111-1P	
Pre-requisite (if any)	This Practical course is related to theory course Paper-I
Course Objectives	This course enables the students to appreciate the dynamic nature of the Earth processes. This course will also impart knowledge of various geomorphic processes operation on the earth and their effects on the land surface.
Course Learning Outcomes	1. Students will acquire a solid base of knowledge of Geomorphic features with help of models, maps and photographs.
	2. They will get numbering of topographic maps on various scales.
	3. Student interprets various geomorphic landforms and drainage patterns on topographic maps.
	4. Student will gain basics knowledge about mountain ranges, lakes and rivers on the outline map of India.
	5. Student will plot seismic observatories on the outline map of India and they also plot epicenter and magnitudes of Major earthquakes of India.

Part B :Content of the Course		
As per HE Syllabus		
Total numbers of lectures (in hours per week): 2 hours per week		
Total Lectures: 60 hours		
Unit	**Topic**	**No. of Lectures**
Unit-I	Study of Geomorphic features from models, maps and photographs.	6
इकाई-I	भू–आकृतिक रचनाओं का मॉडलों, मानचित्र और छायाचित्र में अध्ययन।	
Unit-II	Numbering of topographic maps (survey of India Toposheet) on various Scales	6
इकाई-II	विभिन्न मापक पर स्थलाकृतिक मानचित्रों (सर्वे ऑफ इंडिया, टॉपोशिट) की क्रम–संख्या एवं विवरण का अध्ययन।	
Unit-III	Interpretation of various geomorphic landforms and drainage pattern on topographic maps.	6

इकाई-III	स्थलाकृतिक मानचित्र पर विभिन्न भू–आकृतिक स्थलाकृतियों और अपवाह तंत्र की व्याख्या।	
Unit-IV	Plotting of major mountain ranges, lakes and rivers on the outline map of India.	6
इकाई-IV	भारत के रेखा मानचित्र पर प्रमुख पर्वत – श्रृंखलाओं, झीलों और नदियों को दर्शाना।	
Unit-V	Plotting of seismic observatories on the outline map of India. Plotting of epicenters and magnitudes of major earthquakes of India.	6
इकाई-V	भारत के रेखा मानचित्र पर भूकंपीय वेधशालाओं को दर्शाना। भारत के प्रमुख भूकंपों के अधिकेंद्रों और परिमाणों को दर्शाना।	
	Key Words/ Tags: Geomorphic model, Topographic map, Landform, Drainage pattern, Earthquake, Seismic observatories, Epicentre, Magnitude	
	सार बिंदु (की वर्ड) / टैग: भू–आकृतिक मॉडल, स्थलाकृतिक मानचित्र, स्थलाकृतिक, अपवाह तंत्र विन्यास, भूकंप, भूकंपीय वेधशालाएं, उपरिकेंद्र, परिमाण	

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. घोष, मुकुल; भौतिक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
2. तिवारी जे पी एवं सिंह, बी.के, भौतिक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
3. सिंह, सविंदर; भूआकृतिविज्ञान. प्रवालिका प्रकाशन प्रयाग
4. दुबे वी.एस. एवं मिश्र, प्रभाशंकर; भूविज्ञान एक परिचय, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
5. तिवारी, दीपक राज; भूगतिकी एवं भूआकृतिविज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
6. राठौर, बी.एस. एवं तिगनाथ संजय; संरचनात्मक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल, 3rd 2018
7. Holmes, A. Doris L Holmes Edit., Principles of Physical Geology, Van Nostrand Reinhold, 1978.
8. Mahapatra, G.B. Text Book of Physical Geology, CBS, India, 2018
9. Mathur, S.M., Physical Geology of India, NBT India, 1991
10. Miller, William J., Physical Geology: An Introduction. D Van Nostrand Co.,5th Ed ., 1949
11. Mukerjee, P.K., Text Book of Geology. World Press Private Ltd, 2013
12. Thornbury, W.D., Principles of Geomorphology. New Age International, 2nd Edition, 1969
13. Billing, M.P., Structural Geology. Pearson Education, India, 3Rd Ed., Reprint, 2016

Suggested digital platform web links:

Suggested equivalent online courses:

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Internal Assessment:	Marks	External Assessment:	Marks
Class Interaction/ Quiz	10	Viva Voce on Practical	15
Attendance	05	Practical Record File	10
Assignments (Charts/ Model/ Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial Visits.	10	Table Work/ Experiments	50
TOTAL	**25**	**TOTAL**	**75**

DEPARTMENT OF GEOLOGY

Class: B. Sc. I Semester

Marks: 75+ (CCE) 25 = 100

Subject: Geology

Credit: 6

Paper: Minor

Code of the Paper:

Title of Paper: Crystal and Mineral Sciences

S1-GEO2T

Part A : Introduction for code C111	
Pre-requisite (if any)	To study this course, a student must have had the subject Math's Group or Biology Group in the class 12th.
Course Objectives	Studying the basics of mineralogy and crystallography helps in understanding and building the overall knowledge in Geology.
Course Learning Outcomes	1. Crystallography and Mineralogy are the Fundamental branches of Geology hence, by the learning about basics of Crystals and Minerals, students can understand these branches in a batter way.
	2. Student will able to understand the certain laws of Crystals because Crystals obey certain laws of nature. Also gain knowledge of symmetry elements of crystal and type of twinning present in crystals.
	3. Be able to know about the physical properties of minerals which make capable to identify rock forming minerals in laboratory as well as in field.
	4. Students will gain knowledge about polarizing microscope and able to identify minerals under microscope. Be able to gain the knowledge of optical properties of rock forming minerals.
	5. Be able to gain knowledge about the Physical-Chemical-Optical and other characteristics of minerals. Also able to understand Mineral composition, Silicate structure, Classification and Mineralogical properties of various Mineral Groups.

Part B :Content of the Course

As per HE Syllabus

Total numbers of lectures (in hours per week): 2 hours per week

Total Lectures: 60 hours

Unit	Topic	No. of Lectures
Unit-I	**Introduction to Geology:** 1. Definition of mineral and crystal; rock forming and ore minerals. 2. Crystal structure: unit cell, Bravais Lattices. 3. Elements of crystal. Forms of crystal. 4. Crystallographic axes and axial angles. 5. Weiss's Parameters and Miller's Indices systems of crystal notations.	12
इकाई-I	**क्रिस्टल विज्ञान का परिचय:** 1. खनिज और क्रिस्टल की परिभाषा; शैल निर्माणकारी और अयस्क खनिज। 2. क्रिस्टल संरचना: इकाई सेल, ब्राविस लैटीस।	

	3. क्रिस्टल के तत्व। क्रिस्टल के रूप। 4. क्रिस्टलीय अक्ष और अक्षीय कोण। 5. क्रिस्टल अंकन की वीस की पैरामीटर और मिलर की सूचकांक पद्धकतयाँ।	
Unit-II	Crystallography: 1. Laws of Crystallography. Interfacial angle and its measurement. 2. Crystal symmetry; plane of symmetry, axis of symmetry, centre of symmetry. 3. Classification of crystals into systems and classes. 4. Symmetry and forms of normal classes. 5. Twinning in crystals.	12
इकाई-II	**क्रिस्टल विज्ञान:** 1. क्रिस्टलविज्ञान के नियम। अंतराफलक कोण और इसकी माप। 2. क्रिस्टल सममिति; सममिति तल, सममिति अक्ष, और सममिति केंद्र। 3. क्रिस्टल का समुदायों और वर्गों में वर्गीकरण। 4. सामान्य क्रिस्टल वर्गों की सममिति और आकृतियाँ। 5. क्रिस्टल में यमलन।	
Unit-III	Minerals: 1. Silicate structures and classification. 2. Bonding in Minerals. 3. Isomorphism and solid solution, polymorphism & pseudomorphism. 4. Physical properties of minerals.	12
इकाई-III	**खनिज:** 1. सिलिकेट संरचनाएं और वर्गीकरण। 2. खनिजों में बंध। 3. समाकृतिकता और ठोस विलयन, बहुरूपता, और कूटरूपता। 4. खनिजों के भौतिक गुण।	
Unit-IV	Optical Mineralogy: 1. Refractive index, critical angle and total internal reflection. 2. Double refraction. Construction and working of Nicol prism, and introduction to Polaroid's. 3. Polarizing microscope-its parts and workings. 4. Optical properties of minerals.	12
इकाई-IV	**प्रकाशीय खनिज विज्ञान:** 1. अपवर्तनांक, क्रांतिक–कोण और पूर्ण–आंतरिक परावर्तन। 2. द्विअपवर्तन। निकोल प्रिज्म का निर्माण और कार्य, और पोलरॉइड का परिचय। 3. ध्रुवण सूक्ष्मदर्शी – इसके भाग और कार्य। 4. खनिजों के प्रकाशीय गुण।	
Unit-V	Minerals and Lithosphere: 1. Study of composition, classification, physical and optical properties of the following mineral groups- 1.1. Garnet and Mica, 1.2. Pyroxenes and Amphiboles, and 1.3. Feldspars and silica. 2. Introduction to composition of lithosphere. 3. General characteristics of igneous, metamorphic and sedimentary rock.	12
इकाई-V	**खनिज एवं स्थलमंडल:**	

	1. निम्नलिखित खनिज समूहों की संरचना, वर्गीकरण, भौतिक और प्रकाशीय गुणों का अध्ययन– 1.1. गार्नेट और अभ्रक। 1.2. पाइरोक्सीन और एम्फीबोल, तथा। 1.3. फेल्डस्पार और सिलिका। 2. स्थलमंडल के संघटन का परिचय। 3. आग्नेय, कायांतरित और अवसादी शैलों की सामान्य विशेषताएँ।	
	Keywords: Crystal, Mineral, System, Symmetry, Polarization, Microscope, Feldspar, Silica, Pyroxene, Amphibole, Mica, Lithosphere	
	सार बिंदु (की वर्ड)/टैग: क्रिस्टल, खनिज, समुदाय, सममिति, ध्रुवीकरण, सूक्ष्मदर्शी, फेल्डस्पार, सिलिका, पाइरोक्सिन, एम्फीबोल, माइका, स्थलमंडल	

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. जैश बी.सी., खनिज तथा क्रिस्टल विज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
2. अग्रवाल, ए.पी. एवं देवलिया, डी.के.; खनिज विज्ञान के सिद्धांत, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
3. तिवारी, दीपक राज; खनिज तथा क्रिस्टल विज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
4. Gribble, C.D.; Rutley's Elements of Mineralogy. CBS, 2005.
5. Ford W.E.; Dana's Text Book of Mineralogy. CBS, 2006.
6. Perkins, D.; Mineralogy, Prentice Hall India, 3rd ed. 2012.
7. Rathore, B.S.; Basics of Crystallography, Mineralogy and Geochemistry. Notion Press India, 2020.
8. Sharma, R.S. and Sharma, Anurag;Crystallography and Mineralogy – Concepts and Methods. Geol. Soc. Ind., Bengaluru, 2013.

2. Digital platform web links:

1. **https://www.mindat.org**
2. **https://www.mooc-list.com/tags/minerals**
3. **https://epgp.inflibnet.ac.in/Home**

Suggested equivalent online courses:

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	25
College Exam:	75

Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test	15
	Assignment/ Presentation	10
	Total	**25**
External Assessment: College Exam Section: Time: **2.00 Hours**	Section (A): Three Very Short Questions (50 words each)	03 x 03 = 09
	Section (B): Four Short Questions (200 words each)	04 x 09 = 36
	Section (C): Two Long Questions (500 words each)	02 x 15 = 30
	Total	**75**

DEPARTMENT OF GEOLOGY

Class: B. Sc. I Semester **Marks: 75+ 25 = 100**

Subject: Geology **Credit: 2**

Paper: Practical- (Minor)

Title of Paper: Crystal and Mineral Sciences **Code of the Paper: S1-GEO2P**

Part A : Introduction for Code- C111-2P	
Pre-requisite (if any)	This Practical course is related to theory course Paper-II
Course Objectives	Students will gain basic knowledge of crystal form , crystal symmetry and crystal parameters. They able to know about the physical and optical properties of mineral.
Course Learning Outcomes	1. Students will gain knowledge of symmetry elements of crystal.
	2. Students will gain fundamental knowledge of crystal forms.
	3. Students will gain basic knowledge Euler's theorem and their verification.
	4.This knowledge will make a student able to identify minerals on the basis of their physical properties
	5.This knowledge will make a student able to identify minerals on the basis of their optical properties

Part B :Content of the Course		
As per HE Syllabus		
Total numbers of lectures (in hours per week): 2 hours per week		
Total Lectures: 60 hours		
Unit	**Topic**	**No. of Lectures**
Unit-I	Study of symmetry elements of crystal (models) of normal classes.	6
इकाई-I	सामान्य वर्गों के क्रिस्टल मॉडल के समिति तत्वों का अध्ययन।	
Unit-II	Study of fundamental forms of crystal (models) of normal classes.	6
इकाई-II	सामान्य वर्गों के क्रिस्टल मॉडल के मूलभूत रूपों का अध्ययन।	
Unit-III	Verification of Euler's theorem.	6
इकाई-III	यूलर की प्रमेय का सत्यापन।	
Unit-IV	Study of physical properties of minerals.	6

इकाई-IV	खनिजों के भौतिक गुणों का अध्ययन।	
Unit-V	Study of the optical properties of important rock forming minerals using polarizing microscope.	6
इकाई-V	ध्रुवण सूक्ष्मदर्शी का उपयोग करके महत्वपूर्ण शैल निर्माणकारी खनिजों के प्रकाशीय गुणों का अध्ययन।	
	Key Words/ Tags: Symmetry, Crystal, Fundamental forms, Euler's theorem, Polarizing Microscope.	
	सार बिंदु (की वर्ड)/टैग: सममिति, क्रिस्टल, मौलिक रूप, यूलर का प्रमेय, ध्रुव सूक्ष्मदर्शी	

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. जैश बी.सी.; खनिज तथा क्रिस्टल विज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
2. अग्रवाल, ए.पी. एवं देवलिया, डी.के.; खनिज विज्ञान के सिद्धांत, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
3. तिवारी, दीपक राज; खनिज तथा क्रिस्टल विज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
4. माजरेकर, र.प्र.; प्रायोगिक भू–विज्ञान, भाग–1, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
5. Gribble, C.D.; Rutley's Elements of Mineralogy. CBS, 2005.
6. Ford W.E.; Dana's Text Book of Mineralogy. CBS, 2006.
7. Perkins, D.; Mineralogy, Prentice Hall India, 3rd ed. 2012.
8. Rathore, B.S.; Basics of Crystallography, Mineralogy and Geochemistry. Notion Press India, 2020.
9. Sharma, R.S. and Sharma, Anurag; Crystallography and Mineralogy – Concepts and Methods. Geol. Soc. Ind., Bengaluru, 2013.

2. Digital platform web links:

1. https://www.mindat.org

Suggested equivalent online courses:

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Internal Assessment:	Marks	External Assessment:	Marks
Class Interaction/ Quiz	10	Viva Voce on Practical	15
Attendance	05	Practical Record File	10
Assignments (Charts/ Model/ Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial Visits.	10	Table Work/ Experiments	50
TOTAL	**25**	**TOTAL**	**75**

DEPARTMENT OF GEOLOGY

Class: B. Sc. I Semester

Marks: 75+ (CCE) 25 = 100

Subject: Geology

Credit: 4

Paper: Open Elective

Code of the Paper:

Title of Paper: Elements of Geology

S1-GEO3T

Part A : Introduction for Code- O111-I	
Pre-requisite (if any)	To study this course, a student must have had the subject Math's Group or Biology Group in the class12th.
Course Objectives	This course enables the students to appreciate the dynamic nature of the Earth processes. They will also be appraised about the Ocean, Continents, Mountain and their origin. This course will also impart knowledge of various geomorphic processes operation on the earth and their effects on the land surface.
Course Learning Outcomes	1. Student will gain preliminary knowledge of Geology, its Branches and importance. and also able to understand origin Of the earth.
	2. Student will able to understand Solar System and Earth as dynamic body and interior of the Earth.
	3. Student will able to understand about Atmosphere, Hydrosphere and Biosphere. They also able to understand origin of Ocean, Continent and Mountains.
	4. Students will gain knowledge about Age of the Earth, Geological work and landforms of River and Ocean. They will also understand about Volcanoes, earthquakes and Geogenic hazards.
	5. Students will gain knowledge about Geological work of Winds, Underground water, glaciers and their landforms. They Also understand about Karst topography and Desert.

Part B :Content of the Course		
As per HE Syllabus		
Total numbers of lectures (in hours per week): 2 hours per week		
Total Lectures: 60 hours		
Unit	**Topic**	**No. of Lectures**
Unit-I	**Geology:** 1. Introduction to geology, its scope and branches. 2. Planetesimal hypothesis of origin of the Earth. 3. Earth's size shape, mass and density. 4. Rotation and revolution of the Earth.	12
इकाई-I	**भूविज्ञान:** 1. भूविज्ञान का परिचय, इसका अध्ययन क्षेत्र और शाखाएं। 2. पृथ्वी की उत्पत्ति की ग्रहाणु परिकल्पना। 3. पृथ्वी का आकार, आकृति, द्रव्यमान और घनत्व। 4. पृथ्वी का घूर्णन और परिक्रमा।	
Unit-II	Solar System:	12

	1. Introduction to the Solar system. 2. Terrestrial Planets and Jovian Planets. 3. Interior of the earth-crust, mantle and core. 4. Chemical and mineralogical composition of the Earth's crust.	
इकाई-II	**सौर मंडल:** 1. सौर मंडल का परिचय। 2. स्थलीय ग्रह और जोवियन ग्रह। 3. पृथ्वी की आतंरिक रचना–पर्पटी, प्रावार और क्रोड। 4. भू–पर्पटी का रासायनिक और खनिजात्मक संघटन।	
Unit-III	Earth's Spheres: 1. Introduction to Atmosphere. 2. Introduction to Hydrosphere. 3. Introduction to Biosphere. 4. Origin of Ocean, Continents and Mountains.	12
इकाई-III	पृथ्वी के मंडल. 1. वायुमंडल का परिचय। 2. जलमंडल का परिचय। 3. जैवमंडल का परिचय। 4. महासागरों, महाद्वीपों और पर्वतों की उत्पत्ति।	
Unit-IV	Geological Processes: 1. Age of the Earth based on radioactive methods. 2. Introduction to mineral and rocks. 3. Weathering and erosion processes. 4. Geological works of river and ocean.	12
इकाई-IV	भूवैज्ञानिक प्रक्रियाएं : 1. रेडियोधर्मी विधियों के आधार पर पृथ्वी की आयु। 2. खनिजों और शैलों का परिचय। 3. अपक्षय और अपरदन प्रक्रियाएं। 4. नदी और महासागर के भूवैज्ञानिक कार्य।	
Unit-V	Geological Processes: 1. Geological works of wind and groundwater. 2. Geological works of glaciers. 3. Volcanoes and earthquakes. 4. Geogenic hazards.	12
इकाई-V	भूवैज्ञानिक प्रक्रियाएं : 1. वायु और भूजल के भूवैज्ञानिक कार्य। 2. हिमनद के भूवैज्ञानिक कार्य। 3. ज्वालामुखी और भूकंप। 4. भूगर्भीय खतरे (हज़ार्ड)।	
	Keywords: Universe, Earth, Planet, Solar-system, Origin, Atmosphere, hydrosphere, Biosphere, Earthquake, Volcano, Hazards.	
	सार बिंदु (की वर्ड)/टैग: पृथ्वी, ग्रह, सौर–मंडल, उत्पत्ति, वायुमंडल, जलमंडल, जीवमंडल, भूकंप, ज्वालामुखी, हज़ार्ड।	
Part C :-Learning Resources		
Text Book , Reference Books, Other resources		
Suggested Readings:		

1. घोष, मुकुल; भौतिक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
2. तिवारी जे पी एवं सिंह, बी.के; भौतिक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
3. सिंह, सविंदर; भूआकृतिविज्ञान. प्रवालिका प्रकाशन प्रयाग
4. दुबे वी.एस. एवं मिश्र, प्रभाशकर; भूविज्ञान एक परिचय, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
5. तिवारी, दीपक राज; भूगतिकी एवं भूआकृतिविज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
6. Bangar, K.M., Principles of Engineering Geology; Standard Publication, 2009
7. Emiliani, C., Planet Earth, Cosmology, Geology and the Evolution of Life and Environment.
8. Holmes, A. Doris L. Holmes (Edit). Principles of physical Geology, Van Nostrand Reinhold, 1978.
9. Mahapatra, G.B., Text Book of physical Geology, CBS, India, 2018
10. Miller, William J., Physical Geology: An Introduction. D Van Nostrand Co.,5th Ed ., 1949
11. Mukerjee, P.K., Text Book of Geology. World Press Private Ltd, 2013
12. Singh, Parbin, Engineering and General Geology. S.K. Kataria & Sons. New Delhi, 2009
13. Thornbury, W.D., Principles of Geomorphology. New Age International, 2nd Edition, 1969

Ebook:

1. Jain Sreepat, Fundamentals of physical Geology. Springer India, 2013

2. Digital platform web links:

1. https://www.oas.org/dsd/publications/unit/oea66e/ch11.htm

Part D :Assessment and Evaluation		
As per HE Syllabus		
Suggested Continuous Evaluation Methods:		
Maximum Marks:	100	
Continuous Comprehensive Evaluation (CCE):	25	
College Exam:	75	
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test	15
	Assignment/ Presentation	10
	Total	**25**
External Assessment: College Exam Section: Time: **2.00 Hours**	Section (A): Three Very Short Questions (50 words each)	03 x 03 = 09
	Section (B): Four Short Questions (200 words each)	04 x 09 = 36
	Section (C): Two Long Questions (500 words each)	02 x 15 = 30
	Total	**75**

Govt. Holkar (Model Autonomous) Science College, Indore

DEPARTMENT OF GEOLOGY

B.Sc. II Semester Syllabus (Under NEP2020)

Session 2021-22

Class: B. Sc. II Semester | **Marks: 75+ (CCE) 25 = 100**

Subject: Geology | **Credit: 4**

Paper: Major

Title of Paper: Crystal and Mineral Sciences (Major) | **Code of the Paper: S2-GEO1T**

Part A: Introduction for code C111-II	
Pre-requisite (if any)	To study this course, a student must have had the subject Math's Group or Biology Group in the class 12th.
Course Objectives	Studying the basics of mineralogy and crystallography helps in understanding and building the overall knowledge in Geology.
Course Learning Outcomes	1. Crystallography and Mineralogy are the Fundamental branches of Geology hence, by the learning about basics of Crystals and Minerals, students can understand these branches in a batter way.
	2. Student will able to understand the certain laws of Crystals because Crystals obey certain laws of nature. Also gain knowledge of symmetry elements of crystal and type of twinning present in crystals.
	3. Be able to know about the physical properties of minerals which make capable to identify rock forming minerals in laboratory as well as in field.
	4. Students will gain knowledge about polarizing microscope and able to identify minerals under microscope. Be able to gain the knowledge of optical properties of rock forming minerals.
	5. Be able to gain knowledge about the Physical-Chemical-Optical and other characteristics of minerals. Also able to understand Mineral composition, Silicate structure, Classification and Mineralogical properties of various Mineral Groups.

Part B :Content of the Course		
As per HE Syllabus		
Total numbers of lectures (in hours per week): 2 hours per week		
Total Lectures: 60 hours		
Unit	**Topic**	**No. of Lectures**
Unit-I	**Introduction to Geology:** 1. Definition of mineral and crystal; rock forming and ore minerals. 2. Crystal structure: unit cell, Bravais Lattices. 3. Elements of crystal. Forms of crystal.	12

	4. Crystallographic axes and axial angles. 5. Weiss's Parameters and Miller's Indices systems of crystal notations.	
इकाई-I	**क्रिस्टल विज्ञान का परिचय:** 1. खनिज और क्रिस्टल की परिभाषा; शैल निर्माणकारी और अयस्क खनिज। 2. क्रिस्टल संरचना: इकाई सेल, ब्राविस लैटीस। 3. क्रिस्टल के तत्व। क्रिस्टल के रूप। 4. क्रिस्टलीय अक्ष और अक्षीय कोण। 5. क्रिस्टल अंकन की वीस की पैरामीटर और मिलर की सूचकांक पद्धकतयाँ।	
Unit-II	Crystallography: 1. Laws of Crystallography. Interfacial angle and its measurement. 2. Crystal symmetry; plane of symmetry, axis of symmetry, centre of symmetry. 3. Classification of crystals into systems and classes. 4. Symmetry and forms of normal classes. 5. Twinning in crystals.	12
इकाई-II	**क्रिस्टल विज्ञान:** 1. क्रिस्टलविज्ञान के नियम। अंतराफलक कोण और इसकी माप। 2. क्रिस्टल सममिति; सममिति तल, सममिति अक्ष, और सममिति केंद्र। 3. क्रिस्टल का समुदायों और वर्गों में वर्गीकरण। 4. सामान्य क्रिस्टल वर्गों की सममिति और आकृतियाँ। 5. क्रिस्टल में यमलन।	
Unit-III	Minerals: 1. Silicate structures and classification. 2. Bonding in Minerals. 3. Isomorphism and solid solution, polymorphism & pseudomorphism. 4. Physical properties of minerals.	12
इकाई-III	**खनिज:** 1. सिलिकेट संरचनाएं और वर्गीकरण। 2. खनिजों में बंध। 3. समाकृतिकता और ठोस विलयन, बहुरूपता, और कूटरूपता। 4. खनिजों के भौतिक गुण।	
Unit-IV	Optical Mineralogy: 1. Refractive index, critical angle and total internal reflection. 2. Double refraction. Construction and working of Nicol prism, and introduction to Polaroid's. 3. Polarizing microscope-its parts and workings. 4. Optical properties of minerals.	12
इकाई-IV	**प्रकाशीय खनिज विज्ञान:** 1. अपवर्तनांक, क्रांतिक–कोण और पूर्ण–आंतरिक परावर्तन। 2. द्विअपवर्तन। निकोल प्रिज्म का निर्माण और कार्य, और पोलरॉइडका परिचय। 3. ध्रुवण सूक्ष्मदर्शी – इसके भाग और कार्य। 4. खनिजों के प्रकाशीय गुण।	
Unit-V	Minerals and Lithosphere: 1. Study of composition, classification, physical and optical properties of the following mineral groups-	12

	1.1. Garnet and Mica, 1.2. Pyroxenes and Amphiboles, and 1.3. Feldspars and silica. 2. Introduction to composition of lithosphere. 3. General characteristics of igneous, metamorphic and sedimentary rock.	
इकाई-V	**खनिज एवं स्थलमंडल:** 1. निम्नलिखित खनिज समूहों की संरचना, वर्गीकरण, भौतिक और प्रकाशीय गुणों का अध्ययन– 1.1. गार्नेट और अभ्रक। 1.2. पाइरोक्सीन और एम्फीबोल, तथा। 1.3. फेल्डस्पार और सिलिका। 2. स्थलमंडल के संघटन का परिचय। 3. आग्नेय, कायांतरित और अवसादी शैलों की सामान्य विशेषताएँ।	
	Keywords: Crystal, Mineral, System, Symmetry, Polarization, Microscope, Feldspar, Silica, Pyroxene, Amphibole, Mica, Lithosphere	
	सार बिंदु (की वर्ड)/टैग: क्रिस्टल, खनिज, समुदाय, सममिति, ध्रुवीकरण, सूक्ष्मदर्शी, फेल्डस्पार, सिलिका, पाइरोक्सिन, एम्फीबोल, माइका, स्थलमंडल	

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. जैश बी.सी., खनिज तथा क्रिस्टल विज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
2. अग्रवाल, ए.पी. एवं देवलिया, डी.के., खनिज विज्ञान के सिद्धांत, मध्यप्रदेश हिन्दी ग्रथ अकादमी, भोपाल
3. तिवारी, दीपक राज; खनिज तथा क्रिस्टल विज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
4. Gribble, C.D.; Rutley's Elements of Mineralogy. CBS, 2005.
5. Ford W.E.; Dana's Text Book of Mineralogy. CBS, 2006.
6. Perkins, D.; Mineralogy, Prentice Hall India, 3rd ed. 2012.
7. Rathore, B.S.; Basics of Crystallography, Mineralogy and Geochemistry. Notion Press India, 2020.
8. Sharma, R.S. and Sharma, Anurag;Crystallography and Mineralogy – Concepts and Methods. Geol. Soc. Ind., Bengaluru, 2013.

2. Digital platform web links:

1. https://www.mindat.org

2. https://www.mooc-list.com/tags/minerals

3. https://epgp.inflibnet.ac.in/Home

Suggested equivalent online courses:

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	25
College Exam:	75

Internal Assessment:	Class Test	15
	Assignment/ Presentation	10

Continuous Comprehensive Evaluation (CCE): 25	**Total**	**25**
External Assessment: College Exam Section: Time: **2.00 Hours**	Section (A): Three Very Short Questions (50 words each)	03 x 03 = 09
	Section (B): Four Short Questions (200 words each)	04 x 09 = 36
	Section (C): Two Long Questions (500 words each)	02 x 15 = 30
	Total	**75**

DEPARTMENT OF GEOLOGY

Class: B. Sc. I Year **Marks: 75+ 25 = 100**

Subject: Geology **Credit: 2**

Paper: Practical- (Major)

Title of Paper: Crystal and Mineral Sciences **Code of the Paper: S2-GEO1P**

Part A : Introduction for Code- C111-2P	
Pre-requisite (if any)	This Practical course is related to theory course Paper-II
Course Objectives	Students will gain basic knowledge of crystal form , crystal symmetry and crystal parameters. They able to know about the physical and optical properties of mineral.
Course Learning Outcomes	1. Students will gain knowledge of symmetry elements of crystal.
	2. Students will gain fundamental knowledge of crystal forms.
	3.Students will gain basic knowledge Euler's theorem and their verification
	4.This knowledge will make a student able to identify minerals on the basis of their physical properties
	5.This knowledge will make a student able to identify minerals on the basis of their optical properties

Part B :Content of the Course		
As per HE Syllabus		
Total numbers of lectures (in hours per week): 2 hours per week		
Total Lectures: 60 hours		
Unit	**Topic**	**No. of Lectures**
Unit-I	Study of symmetry elements of crystal (models) of normal classes.	6
इकाई-I	सामान्य वर्गों के क्रिस्टल मॉडल के समिति तत्वों का अध्ययन।	
Unit-II	Study of fundamental forms of crystal (models) of normal classes.	6
इकाई-II	सामान्य वर्गों के क्रिस्टल मॉडल के मूलभूत रूपों का अध्ययन।	
Unit-III	Verification of Euler's theorem.	6
इकाई-III	यूलर की प्रमेय का सत्यापन।	
Unit-IV	Study of physical properties of minerals.	6
इकाई-IV	खनिजों के भौतिक गुणों का अध्ययन।	

Unit-V	Study of the optical properties of important rock forming minerals using polarizing microscope.	6
इकाई-V	ध्रुवण सूक्ष्मदर्शी का उपयोग करके महत्वपूर्ण शैल निर्माणकारी खनिजों के प्रकाशीय गुणों का अध्ययन।	
	Key Words/ Tags: Symmetry, Crystal, Fundamental forms, Euler's theorem, Polarizing Microscope.	
	सार बिंदु (की वर्ड)/टैग: सममिति, क्रिस्टल, मौलिक रूप, यूलर का प्रमेय, ध्रुव सूक्ष्मदर्शी	

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. जैश बी.सी.; खनिज तथा क्रिस्टल विज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
2. अग्रवाल, ए.पी. एवं देवलिया, डी.के.; खनिज विज्ञान के सिद्धांत, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
3. तिवारी, दीपक राज; खनिज तथा क्रिस्टल विज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
4. मांजरेकर, र.प्र.; प्रायोगिक भू–विज्ञान, भाग–1, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
5. Gribble, C.D.; Rutley's Elements of Mineralogy. CBS, 2005.
6. Ford W.E.; Dana's Text Book of Mineralogy. CBS, 2006.
7. Perkins, D.; Mineralogy, Prentice Hall India, 3rd ed. 2012.
8. Rathore, B.S.; Basics of Crystallography, Mineralogy and Geochemistry. Notion Press India, 2020.
9. Sharma, R.S. and Sharma, Anurag;Crystallography and Mineralogy – Concepts and Methods. Geol. Soc. Ind., Bengaluru, 2013.

2. Digital platform web links:

1. https://www.mindat.org

Suggested equivalent online courses:

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Internal Assessment:	Marks	External Assessment:	Marks
Class Interaction/ Quiz	10	Viva Voce on Practical	15
Attendance	05	Practical Record File	10
Assignments (Charts/ Model/ Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial Visits.	10	Table Work/ Experiments	50
TOTAL	**25**	**TOTAL**	**75**

DEPARTMENT OF GEOLOGY

Class: B. Sc. II Semester

Marks: 75+ (CCE) 25 = 100

Subject: Geology

Credit: 6

Paper: Minor

Code of the Paper:

Title of Paper: - Physical Geology (Minor)

S2-GEO2T

Part A : Introduction for Code- C111-I	
Pre-requisite (if any)	To study this course, a student must have had the subject Math's Group or Biology Group in the class 12th.
Course Objectives	This course enables the students to appreciate the dynamic nature of the Earth processes. They will also be appraised about the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift, plate tectonics. This course will also impart knowledge of various geomorphic processes operation on the earth and their effects on the land surface.
Course Learning Outcomes	1. Student will gain preliminary knowledge of Geology, its Branches and importance. They will understand Solar System and Earth as dynamic body and also able to understand about origin, age and interior of the Earth.
	2. Student will gain basics knowledge about the Concept of Plate tectonics, Mid-oceanic ridges and trenches, Island arcs, Isostasy. Continental drift and about Sea-floor Spreading.
	3. Student will able to understand the Earthquakes and Volcanoes. They Also know about basic principles of Geomorphology and rock weathering.
	4. Students will gain knowledge about Geological work of Rivers, Underground water, and wind and their landforms. They Also understand about Karst topography and Desert.
	5. Students will gain knowledge about Geological work and landforms of Glacier and Ocean. They will also understand about Unconformity and other geological structure.

Part B :Content of the Course		
As per HE Syllabus		
Total numbers of lectures (in hours per week): 2 hours per week		
Total Lectures: 60 hours		
Unit	**Topic**	**No. of Lectures**
Unit-I	**Introduction to Geology:** 1. Introduction to Geology, its branches and importance. 2. Introduction to Solar System; Star, Planet, satellite, asteroid and meteorite. 3. Origin of the Earth-Planetesimal hypothesis. 4. Interiors of the earth-crust, mantle and core.	12

	5. Radioactivity methods of age of the Earth. Geological Time Scale.	
इकाई-I	**भूविज्ञान का परिचय:** 1. भूविज्ञान का परिचय, इसकी शाखाएं एवं महत्व। 2. सौर मंडल का परिचय, तारा, ग्रह, उपग्रह, क्षुद्रग्रह और उल्कापिंड। 3. पृथ्वी की उत्पत्ति–ग्रहाणु परिकल्पना। 4. पृथ्वी की आतंरिक रचना–पर्पटी, प्रावार और क्रीड। 5. पृथ्वी की आयु की रेडियोधर्मी विधियां। भूवैज्ञानिक समय मापक।	
Unit-II	**Dynamic Earth:** 1. Concept and theories of Isostasy. 2. Continental drift and Sea floor spreading and evidences. 3. Concept of plate tectonics, tectonic plates and types, and plate boundaries. 4. Mid-oceanic ridges, trenches and island arcs.	12
इकाई-II	**गतिशील पृथ्वी:** 1. समस्थिति की संकल्पना और सिद्धांत। 2. महाद्वीपीय विस्थापन और समुद्र–तल प्रसार एवं साक्ष्य। 3. प्लेट विवर्तनिकी की अवधारणा, विवर्तनिक प्लेट और प्राकर, एवंप्लेट सीमाएं। 4. मध्य महासागरीय कटक, खाइयॉं और द्वीप–चाप।	
Unit-III	**Geomorphic Processes:** 1. Earthquakes- causes, effects and distribution. Seismic Zones of India. 2. Volcanoes: types and landforms. Volcanic zones of India. 3. Fundamental concepts of geomorphology. 4. Types of rock weathering. 5. Soil formation, soil profile and types of soil.	12
इकाई-III	**भू–आकृति प्रक्रियाएं:** 1. भूकंप–कारण, प्रभाव और वितरण। भारत के भूकंपी क्षेत्र। 2. ज्वालामुखी: प्रकार और भू–आकृतियॉं। विश्व के ज्वालामुखी क्षेत्र। 3. भू–आकृति विज्ञान की मूलभूत अवधारणाऍं। 4. शैल अपक्षय के प्रकार। 5. मृदा निर्माण, मृदा परिच्छेदिका और मृदा के प्राकर।	
Unit-IV	**Geological Works:** 1. Geological works of river, and its landforms. 2. Drainage system. Introduction to wetlands. 3. Geological works of groundwater, and karsts topography. 4. Geological works of wind and its landforms. Introduction to desert.	12
इकाई-IV	**भूवैज्ञानिक कार्य:** 1. नदी के भूवैज्ञानिक कार्य और इसकी स्थलाकृतियॉं। 2. अपवाह तंत्र। आर्द्रभूमि का परिचय। 3. भूजल के भूवैज्ञानिक कार्य और कार्स्ट स्थलाकृतियॉं। 4. वायु के भूवैज्ञानिक कार्य और इसकी स्थलाकृमियॉं। मरूस्थल का परिचय।	
Unit-V	**1. Geological works:** 1.1. Geological works of glacier, and its landforms. 1.2. Geological works of ocean, and coastal landforms. **2. Introduction to Structures:** 2.1. Unconformity: Definition and types. Overlap and Off lap.	12

	2.2. Brief introduction to fold, fault and joint.	
इकाई-V	**1. भूवैज्ञानिक कार्य:** 1.1. हिमनद के भूवैज्ञानिक कार्य और इसकी स्थलाकृतियों। 1.2. महासागर के भूवैज्ञानिक कार्य और तटीय स्थलाकृतियों। **2. संरचनाओं का परिचय:** 2.1. विषमविन्यास की परिभाषा एवं प्रकार। अतिव्यापन और अपन्यापन। 2.2. वलन, भ्रंश और संधि का संक्षिप्त परिचय।	
	Key Words/ Tags: Geology, Planet, Earth, Hypothesis, Plate-tectonics, Continent, Earthquake, Volcano, Drainage, Unconformity, Fold, Fault, Joint, Glacier, Wind, River.	
	सार बिंदु (की वर्ड)/टैग: भूविज्ञान, ग्रह, पृथ्वी, परिकल्पना, प्लेट–विवर्तनिकी, महाद्वीप, भूकंप, ज्वालामुखी, अपवाह तंत्र, विषमविन्यास, वलन, भ्रंश, संधि, ग्लेशियर, वायु, नदी।	

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

Text Book ,Referene Books, Other resources

1. घोष, मुकुल; भौतिक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
2. तिवारी जे पी एवं सिंह, बी.के; भौतिक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
3. सिंह, सविदर; भूआकृतिविज्ञान. प्रवालिका प्रकाशन प्रयाग
4. दुबे वी.एस. एवं मिश्र, प्रभाशंकर; भूविज्ञान एक परिचय. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
5. तिवारी, दीपक राज; भूगतिकी एवं भूआकृतिविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
6. राठौर, बी.एस. एवं तिगनाथ संजय; संरचनात्मक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल, 3rd 2018
7. Holmes, A. Doris L Holmes Edit., Principles of Physical Geology, Van Nostrand Reinhold, 1978.
8. Mahapatra, G.B. Text Book of Physical Geology, CBS, India, 2018
9. Mathur, S.M., Physical Geology of India, NBT India, 1991
10. Miller, William J., Physical Geology: An Introduction. D Van Nostrand Co.,5th Ed ., 1949
11. Mukerjee, P.K., Text Book of Geology. World Press Private Ltd, 2013
12. Thornbury, W.D., Principles of Geomorphology. New Age International, 2nd Edition, 1969
13. Billing, M.P., Structural Geology. Pearson Education, India, 3Rd Ed., Reprint, 2016 Ebook:
1. Jain Sreepat, Fundamentals of physical Geology. Springer India, 2013
2. Digital platform web links:
1. https://opentextbc.ca/physicalgeology2ed/front-matter/download-a-pdf/
2. https://archive.org/details/in.ernet.dli.2015.233340/page/n15/mode/2up
3. https://www.tulane.edu/~sanelson/eens1110/index.html [for introduction to folds, faults…]

Suggested equivalent online course:

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	25
College Exam:	75

Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test	15
	Assignment/ Presentation	10
	Total	**25**
External Assessment: College Exam Section: Time: **2.00 Hours**	Section (A): Three Very Short Questions (50 words each)	03 x 03 = 09
	Section (B): Four Short Questions (200 words each)	04 x 09 = 36
	Section (C): Two Long Questions (500 words each)	02 x 15 = 30
	Total	**75**

DEPARTMENT OF GEOLOGY

Class: B. Sc. II Semester **Marks: 75+ 25 = 100**

Subject: Geology **Credit: 2**

Paper: Practical- (Minor)

Title of Paper: Physical Geology **Code of the Paper: S2-GEO2P**

Part A : Introduction for Code- C111-1P	
Pre-requisite (if any)	This Practical course is related to theory course Paper-I
Course Objectives	This course enables the students to appreciate the dynamic nature of the Earth processes. This course will also impart knowledge of various geomorphic processes operation on the earth and their effects on the land surface.
Course Learning Outcomes	1. Students will acquire a solid base of knowledge of Geomorphic features with help of models, maps and photographs.
	2. They will get numbering of topographic maps on various scales.
	3. Student interprets various geomorphic landforms and drainage patterns on topographic maps.
	4. Student will gain basics knowledge about mountain ranges, lakes and rivers on the outline map of India.
	5. Student will plot seismic observatories on the outline map of India and they also plot epicenter and magnitudes of Major earthquakes of India.

Part B :Content of the Course		
As per HE Syllabus		
Total numbers of lectures (in hours per week): 2 hours per week		
Total Lectures: 60 hours		
Unit	**Topic**	**No. of Lectures**
Unit-I	Study of Geomorphic features from models, maps and photographs.	6
इकाई-I	भू–आकृतिक रचनाओं का मॉडलों, मानचित्र और छायाचित्र में अध्ययन।	
Unit-II	Numbering of topographic maps (survey of India Toposheet) on various Scales	6
इकाई-II	विभिन्न मापक पर स्थलाकृतिक मानचित्रों (सर्वे ऑफ इंडिया, टॉपोशिट) की क्रम–संख्या एवं विवरण का अध्ययन।	

Unit-III	Interpretation of various geomorphic landforms and drainage pattern on topographic maps.	6
इकाई-III	स्थलाकृतिक मानचित्र पर विभिन्न भू–आकृतिक स्थलाकृतियों और अपवाह तंत्र की व्याख्या।	
Unit-IV	Plotting of major mountain ranges, lakes and rivers on the outline map of India.	6
इकाई-IV	भारत के रेखा मानचित्र पर प्रमुख पर्वत – श्रृंखलाओं, झीलों और नदियों को दर्शाना।	
Unit-V	Plotting of seismic observatories on the outline map of India. Plotting of epicenters and magnitudes of major earthquakes of India.	6
इकाई-V	भारत के रेखा मानचित्र पर भूकंपीय वेधशालाओं को दर्शाना। भारत के प्रमुख भूकंपों के अधिकेंद्रों और परिमाणों को दर्शाना।	
	Key Words/ Tags: Geomorphic model, Topographic map, Landform, Drainage pattern, Earthquake, Seismic observatories, Epicentre, Magnitude	
	सार बिंदु (की वर्ड)/टैग: भू–आकृतिक मॉडल, स्थलाकृतिक मानचित्र, स्थलाकृतिक, अपवाह तंत्र विन्यास, भूकंप, भूकंपीय वेधशालाएं, उपरिकेंद्र, परिमाण	

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. घोष, मुकुल; भौतिक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
2. तिवारी जे पी एवं सिंह, बी.के; भौतिक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
3. सिंह, सविंदर; भूआकृतिविज्ञान. प्रवालिका प्रकाशन प्रयाग
4. दुबे वी.एस. एवं मिश्र, प्रभाशंकर; भूविज्ञान एक परिचय. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
5. तिवारी, दीपक राज; भूगतिकी एव भूआकृतिविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल
6. राठौर, बी.एस. एवं तिगनाथ संजय; संरचनात्मक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल, 3rd 2018
7. Holmes, A. Doris L Holmes Edit., Principles of Physical Geology, Van Nostrand Reinhold, 1978.
8. Mahapatra, G.B. Text Book of Physical Geology, CBS, India, 2018
9. Mathur, S.M., Physical Geology of India, NBT India, 1991
10. Miller, William J., Physical Geology: An Introduction. D Van Nostrand Co.,5th Ed ., 1949
11. Mukerjee, P.K., Text Book of Geology. World Press Private Ltd, 2013
12. Thornbury, W.D., Principles of Geomorphology. New Age International, 2nd Edition, 1969
13. Billing, M.P., Structural Geology. Pearson Education, India, 3Rd Ed., Reprint, 2016

Suggested digital platform web links:

Suggested equivalent online courses:

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Internal Assessment:	Marks	External Assessment:	Marks
Class Interaction/ Quiz	10	Viva Voce on Practical	15
Attendance	05	Practical Record File	10

Assignments (Charts/ Model/ Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey/ Industrial Visits.	10	Table Work/ Experiments	50
TOTAL	**25**	**TOTAL**	**75**

DEPARTMENT OF GEOLOGY

Class: B. Sc. II Semester **Marks: 75+ (CCE) 25 = 100**

Subject: Geology **Credit: 4**

Paper: Open Elective

Title of Paper: Minerals and Rocks **Code of the Paper: 211-O**

Part A : Introduction for Code- O111-II	
Pre-requisite (if any)	To study this course, a student must have had the subject Math's Group or Biology Group in the class 12th.
Course Objectives	Student study the basics of mineralogy their physical and optical properties. student also able to understand rock forming minerals to give a systematic knowledge to understanding the processes involved in the formation of igneous, sedimentary and metamorphic rocks. This course also deals different geological structures resulting from the action of various types of tectonic forces operating on rocks. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its application in the field. Student also understands the Geological Time Scale and mineral wealth of Madhya Pradesh.
Course Learning Outcomes	1. Students will gain knowledge about mineralogy and their classification.
	2. Students will gain knowledge about physical and optical properties of minerals.
	3. Student also understands the composition and types of magma. They also learn about rock cycle and Igneous rocks their properties.
	4. Student understands the sedimentary and metamorphic rocks. And also learn their types and classification
	5. Student will gain knowledge of the different rock structures and their mechanism. . Student also gains knowledge about the Geological Time Scale and Mineral Wealth of Madhya Pradesh.

Part B :Content of the Course		
As per HE Syllabus		
Total numbers of lectures (in hours per week): 2 hours per week		
Total Lectures: 60 hours		
Unit	**Topic**	**No. of Lectures**

Unit-I	**Mineralogy:** 1. Introduction to mineralogy. 2. Classification of minerals. 3. Silicate structures. 4. Common rock-forming minerals.	12
इकाई-I	**खनिज विज्ञान:** 1. खनिज विज्ञान का परिचय। 2. खनिजों का वर्गीकरण। 3. सिलिकेट संरचनाएं। 4. सामान्य शैल–निर्माणकारी खनिज।	
Unit-II	**Properties of Minerals:** 1. Physical properties of minerals. 2. Optical properties of minerals. 3. Isotropic and anisotropic minerals; their wave-surface and sections. 4. Common economic minerals and their uses: Gems and other precious minerals.	12
इकाई-II	**खनिजों के गुण:** 1. खनिजों के भौतिक गुण। 2. खनिजों के प्रकाशीय गुण। 3. समदैशिक और विषमदैशिक खनिज; उनके तरंग–पृष्ठ और काट। 4. सामान्य आर्थिक खनिज और उनके उपयोग; रत्न और अन्य बहुमूल्य खनिज।	
Unit-III	**Igneous Rocks:** 1. Igneous rocks-Definition, types and characteristic properties. 2. Rock cycle. 3. Composition and types of magma. 4. Forms of igneous rocks.	12
इकाई-III	**आग्नेय शैल:** 1. आग्नेय शैल–परिभाषा, प्रकार और लाक्षणिक गुण। 2. शैल चक्र। 3. मैग्मा का संघटन और प्राकर। 4. आग्नेय शैलों के रूप।	
Unit-IV	**Sedimentary and Metamorphic Rocks:** 1. Sedimentary rocks and their classification. 2. Environments of sediment depositions. 2. Metamorphism and metamorphic agents. 3. Types of metamorphism.	12
इकाई-IV	**अवसादी और कायांतरित शैलें :** 1. अवसादी शैल और उनका वर्गीकरण। 2. अवसाद निक्षेपण के पर्यावरण। 3. कायांतरण और कायांतरण के कारक। 4. कायांतरण के प्रकार।	
Unit-V	**Structures Mineral Wealth:** 1. Introduction to folds and faults. 2. Introduction to joints and unconformity.	12

	3. Geological Time Scale. 4. Mineral wealth of Madhya Pradesh.	
इकाई-V	**संरचनाएं एवं खनिज संपदा:** 1. वलन और भ्रंश का परिचय। 2. संधि और विषमविन्यास का परिचय। 3. भूवैज्ञानिक समय पैमाना। 4. मध्य प्रदेश की खनिज संपदा।	
	Keywords: Rock, Mineral, Igneous, Metamorphic, Sedimentary, Deposition, Environment, Structure, Mineral-Wealth.	
	सार बिंदु (की वर्ड) / टैग: शैल, खनिज, आग्नेय, कायांतरित, अवसादी, निक्षेपण, पर्यावरण, संरचना, खनिज सम्पदा।	

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1दुबे वी.एस. एवं मिश्र, प्रभाशंकर; भूविज्ञान–एक परिचय, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल

2. जैश बी.सी.; खनिज तथा क्रिस्टल विज्ञान, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल

3. अग्रवाल, ए.पी. एवं देवलिया, डी.के., खनिज विज्ञान के सिद्धांत, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल

4. अग्रवाल, ए.पी. एवं देवलिया, डी.के., शैलिकी विज्ञान के सिद्धांत, मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल

5. राठौर, बी.एस. एवं तिगनाथ संजय; संरचनात्मक भूविज्ञान. मध्यप्रदेश हिन्दी ग्रंथ अकादमी, भोपाल, 3rd 2018

6. Bangar, K.M., Principles of Engineering Geology; Standard Publication, 2009

7. Cornelis Klein and Anthony Philpotts, Earth Materials- Introduction to Mineralogy and Petrology, Cambridge University Press 2013

8. Ford W.E., Dana's Text Book of Mineralogy. CBS, 2006

9. Gribble, C.D., Rutley's Elements of Mineralogy. CBS, 2005

10. Grotzinger, John and Thomas, H. Jordan, Understanding Earth, W.H. Freeman and company, New York. 6th Ed, 2010

11. Mukerjee, P.K., Text Book of Geology. World Press Private Ltd, 2013

12. Perkins, D., Mineralogy, Prentice Hall India, 3rd ed. 2012

13. Rathore, B.S., Basics of Crystallography and Geochemistry. Nation Press India, 2020

14. Sharma, R.S. & Sharma, Amurag; Crystallography and Mineralogy – Concepts and Methods. Geol Soc. Ind., Bengaluru, 2013

15. Winter, John D. Principles of Igneous and Metamorphic Petrology, Pearsons Education, 2014

2. Digital platform web links:

1.https://ibm.gov.in/writereaddata/files/03202018150002PNG_AR_2017.pdf...(for Petroleum and Natural Gas occurrences in India, 2018)

2. https:ibm.gov.in/writereaddata/files/10192020104607Coal_2019_R.pdf…(for Coal and Lignite occurrences in India. 2020)

Suggested equivalent online courses:

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks:	100
Continuous Comprehensive Evaluation (CCE):	25

College Exam:	75	
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 25	Class Test	15
	Assignment/ Presentation	10
	Total	**25**
External Assessment: College Exam Section: Time: **2.00 Hours**	Section (A): Three Very Short Questions (50 words each)	03 x 03 = 09
	Section (B): Four Short Questions (200 words each)	04 x 09 = 36
	Section (C): Two Long Questions (500 words each)	02 x 15 = 30
	Total	**75**

Govt. Holkar (Model Autonomous) Science College, Indore

DEPARTMENT OF GEOLOGY

2021-22

Class: B. Sc. II Year | **Marks: 40+ (CCE) 10 = 50**

Subject: Geology | **Paper: Theory -I**

Title of Paper: Petrology | **Code of the Paper: C211-I**

Part A : Introduction for code-C211-I	
Pre-requisite (if any)	-
Course Objectives	To give a systematic knowledge and understanding of the processes involved in the formation of igneous, sedimentary and metamorphic rocks, their textures, structures, classifications and their importance.
Course Learning Outcomes	1. The student will gain knowledge about the processes of formation of rocks.
	2. The student will gain knowledge of the forms, structures and textures of the rocks.
	3. The student will gain knowledge about the classification of rocks.
	4. The student will be able to identify common Igneous, Sedimentary and Metamorphic rocks using hand specimens and also under microscope.
	5. The student will also learn about the different types of map symbols used to show different rock types on map.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	1. Introduction to Petrology. General classification of rocks. 2. Phase and Component, Crystallization and Phase Equilibrium of Monar (Unicomponent) (Silica), Binary (Bicomponent) (Albite-Anorthiteand Diopside-Anorthite) and Ternary (Tricomponent) (Diopside-Albite-Anorthite) silicate system. 3. Definition, Origin and Composition of Magma. 4. Reaction Principle- Bowen's reaction series. 5. Forms of Igneous rocks.
	1. शैलिकी का परिचय। शैलों का सामान्य वर्गीकरण। 2. प्रावस्था एवं घटक, एक–घटकीय (सिलिका), द्विघटकीय (एल्बाइट–एनॉर्थाइट, औरडाइऑप्साइड–एनॉर्थाइट) एवं त्रिघटकीय (डाइऑप्साइड–एल्बाइट–एनॉर्थाइट) सिलिकेट सिस्टम का क्रिस्टली करण एवं प्रावस्था संतुलन। 3. मैग्मा की परिभाषा, उत्पत्ति एवं संघटन।

	4. अभिक्रिया सिद्धांत–बॉवेन अभिक्रिया श्रृंखला। 5. आग्नेय शैलों के रूप।
Unit-II	1. Structures of Igneous rocks. 2. Textures and Micro structures of Igneous rocks. 3. Classifications of Igneous rocks. 4. Mineralogical characteristics of Acid, Alkaline, Basic and Ultra basic rocks. 5. Origin of igneous rocks: Magmatic differentiation and Assimilation.
इकाई-II	1. आग्नेय शैलों की संरचनाएँ । 2. आग्नेय शैलों के गठन एवं सूक्ष्म सरचनाएँ । 3. आग्नेय शैलोंका वर्गीकरण। 4. अम्लीय, अल्कलाइन, बेसिक एवं अल्ट्राबेसिक शैलों के खनिजीय गुण। 5. आग्नेय शैलों की उत्पत्ति–मैग्मीय विभेदन एवं स्वांगीकरण।
Unit-III	1. Origin, Transportation and Deposition of Sediments. 2. Environmental conditions of Sediment deposition. 3. Concept of Sedimentary Facies. 4. Concept of Lithification and Diagenesis. 5. Structures of Sedimentary rocks.
इकाई–III	1. अवसादी शैलों के गठन। 2. अवसादी शैलों का वर्गीकरण। 3. कायान्तरण के कारक एवं प्रकार। 4. कायान्तरण की श्रेणी एवं कायान्तरण खनिज कटिबन्ध। 5. कायान्तरित शैलों की सरचनाएँ एवं गठन।
Unit-IV	1. Textures of Sedimentary rocks. 2. Classification of Sedimentary rocks. 3. Agents and Kinds of Metamorphism. 4. Grade of Metamorphism and Metamorphic mineral zones. 5. Structures and Textures of Metamorphic rocks.
इकाई–IV	1. अवसादी शैलों के गठन। 2. अवसादी शैलों का वर्गीकरण। 3. कायान्तरण के कारक एवं प्रकार। 4. कायान्तरण की श्रेणी एवं कायान्तरण खनिज कटिबन्ध। 5. कायान्तरित शैलों की सरचनाएँ एवं गठन।

Unit-V	1. Classification of Metamorphic rocks. 2. Definition and Types of Metamorphic Facies. 3. Progressive Metamorphism of Argillaceous sediments. 4. Progressive Thermal Metamorphism of Impure Limestones. 5. Lithological Symbols.
इकाई-V	1. कायांतरित शैलों का वर्गीकरण। 2. कायांतरित संलक्षणाओं की परिभाषा एवंप्रकार। 3. मृण्मय अवसादोंकाप्रगामीकायांतरण। 4. अशुद्ध चूना पत्थरों का प्रगामीतापीय कायांतरण। 5. अश्म विज्ञानीय प्रतीक।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

शैलिकी के सिद्धांत : अंबिका प्रसाद अग्रवाल एवं डी.के. देवलिया
शैलिकी के सिद्धांत : जी.डब्ल्यू. टिरैल(अनुवाद–ए.जी. झिंगरन)

Igneous Petrology: M.K. Bose
Metamorphic Petrology: B. Bhasker Rao
Metamorphism and Metamorphic Rocks of India: S. Ray
Petrology: H. William, F.J. Turner and E.M. Gilbert
Principles of Petrology: G.W. Tyrell
Sedimentary Rocks : F.J. Petti john
Text Book of Sedimentary Petrology :V.K. Verma and C. Prasad

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks:	50
Continuous Comprehensive Evaluation (CCE):	10
College Exam:	40

Internal Assessment:	Class Test	05
Continuous Comprehensive	Assignment/ Presentation	05
Evaluation (CCE): 10	**Total**	**10**
External Assessment:	Section (A): Multiple Choice Questions	05 x 01 = 05
College Exam Section: 40	Section (B): Long Questions (200 words each)	05 x 07 = 35
Time: **3.00 Hours**	**Total**	**40**

DEPARTMENT OF GEOLOGY

Class: B. Sc. II Year | **Marks: 40+ (CCE) 10 = 50**

Subject: Geology | **Paper: Theory -II**

Title of Paper: Structural Geology | **Code of the Paper: C211-II**

Part A : Introduction for code-C211-II	
Pre-requisite (if any)	
Course Objectives	The course deals with geological structures resulting from the action of various types of tectonic forces operating on rocks. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its application in the field.
Course Learning Outcomes	1. The course deals with the study of geological structures resulting from the various kinds of forces applied on the rocks.
	2. The student will gain knowledge of the geometry of the rock structures and will be able to identify structures and do various measurements with Clinometer Compass
	3. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its application in the field.
	4. Identification of measurements of structures is fundamental to geological mapping. This course also helps to learn how to interpret geological maps.
	5. This course also helps to know how to use structures and help students appreciate the dynamic nature of the Earth.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	1. Definition and Scope of Structural Geology. 2. Identification of Bedding. Concept of Dip and Strike. 3. Clinometers compass and Brunton compass: Working and Use. 4. Study of Outcrops, Effects of Dip and Slope on Outcrops. 5. Recognition of Top and Bottom of beds. 6. Concept of Rock deformation.
इकाई-I	1. संरचनात्मक भूविज्ञान की परिभाषा एवं अध्ययन क्षेत्र।

	2. संस्तरण की पहचान। नति एवं नतिलम्ब की अवधारणा। 3. क्लाइनो मीटर कम्पास एवं ब्रन्टन कम्पास: कार्य प्रणाली एवं उपयोग। 4. दृश्याशों का अध्ययन, दृश्याशों पर नतितथाढाल के प्रभाव। 5. संस्तरों के शीर्ष तथा तल की पहचान। 6. शैल विरूपण की अवधारणा।
Unit-II	1. Fold morphology. 2. Geometric and Genetic classification of Folds. 3. Recognition of Folds in the Field and on Geological maps. 4. Effect of Folds on Outcrops. 5. Elementary idea of Mechanics of Folding.
इकाई-II	1. वलन की आकारिकी। 2. वलन का ज्यामितिक एवं जननिक वर्गीकरण। 3. स्थल क्षेत्र तथा भूवैज्ञानिक मानचित्र में वलन की पहचान। 4. दृश्याशों पर वलन के प्रभाव। 5. वलन क्रिया विधि की आरम्भिक अवधारणा।
Unit-III	1. Fault morphology. Slip and Separation. 2. Geometric and Genetic classification of Faults. 3. Recognition of Faults in the Field and on Geological maps. 4. Effect of Faults on Outcrops. 5. Elementary idea of Mechanics of Faulting.
इकाई–III	1. भ्रंश आकारिकी । सर्पण और अलगाव। 2. भ्रंशों का ज्यामितिक एवं जननिक वर्गीकरण। 3. स्थलक्षेत्र तथा भूवैज्ञानिक मानचित्र में भ्रंशों की पहचान । 4. दृश्याशों पर भ्रंशों के प्रभाव। 5. भ्रंशन क्रिया विधि की आरम्भिक अवधारणा।
Unit-IV	1. Joint morphology. Geometric and Genetic classification of Joints. 2. Foliation: Terminology, kinds, origin and relation to major structures. 3. Lineation: Terminology, kinds, origin and relation to major structures. 4. Structural Symbols.
इकाई–IV	1. संधि की आकारिकी। संधि का ज्यामितिक एवं जननिक वर्गीकरण। 2. पत्रण: पारिभाषिक शब्दावली, प्रकार, उत्पत्ति एवं वृहत संरचनाओं से संबंध। 3. रेखण: पारिभाषिक शब्दावली, प्रकार, उत्पत्ति एव वृहत संरचनाओं से संबंध।

	4. संरचनात्मक प्रतीक।
Unit-V	1. Types of unconformity. 2. Outlier and Inlier. Overlap (Onlap) and Offlap. 3. Recognition of Unconformity in the Field and on the Geological maps 4. Elementary concept of Tectonics. Tectonic framework of Peninsular India, Indo – Gangetic Plains and Extra–Peninsular India.
इकाई-V	1. विषमविन्यास के प्रकार। 2. पुरान्तः शायी तथा नवान्तः शायी। अतिव्यापन तथा अपव्यापन। 3. स्थल क्षेत्रों व भूवैज्ञानिक मानचित्रों मे विषम विन्यास की पहचान। 4. विवर्तनिकी की आरंभिक अवधारणा। प्रायद्वीपीय भारत, सिंधुगंगा के मैदान तथा प्रायद्वीपीय भारत का विवर्तनिकी विन्यास।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

संरचनात्मक भूविज्ञान– एक परिचय: बी. एस. राठौर एवं संजय तिगनाथ
संरचनात्मक भूविज्ञान : डी.के. श्रीवास्तव
प्रायोगिक भूविज्ञान (भाग–2) : आर.पी. मांजरेकर

Structural Geology: Billings, M.P.
Theory of Structural Geology: Gokhale, N.W.
Exercises on Geological Maps and Dip-Strike: Gokhale, N.W.
Outlines of Structural Geology: Hills, E.S.
Structural Geology: Hobbs, Means and Williams
Geological Maps: Chiplonkar, G. W. and Powar, K. B.
Structural Geology: Twiss and Moore.

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): 10
College Exam: 40

Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**

उच्चशिक्षा विभाग, मध्यप्रदेश शासन
स्नातक कक्षाओं के लिये वार्षिक–परीक्षा पद्धति अनुसार पाठ्यक्रम
केन्द्रीय अध्ययनमण्डल द्वारा अनुशंसित तथा मध्य प्रदेश के राज्यपाल द्वारा अनुमोदित
सत्र 2021 – 22 से प्रभावशील

Department of Higher Education, Govt.of Madhya Pradesh
Under Graduate Year-wise Syllabus
As Recommended by Central Board of Studies and Approved by the Governor of Madhya Pradesh
w.e.f. Session 2021– 22

बी. एससी. भाग– 2 / B. Sc. Part - 2
भूविज्ञान / GEOLOGY
प्रायोगिककार्य / Practical Work
अधिकतमअंक / Maximum Marks : 50

I –शैल विज्ञान / Petrology :

1. निम्नलिखित शैलों का स्थूलदर्शी अध्ययन (खनिजीय संगठन, गठन, उत्पत्ति एवं वितरण) –ग्रेनाइट, डायोराइट, गेब्रो, ड्यूनाइट, सायनाइट, नेफेलीन–साइनाइट, डोलेराइट, पेग्मेटाइट, रायोलाइट, बेसाल्ट। संगुटिकाश्म, संकोणाश्म, बलुआपत्थर, शेल, चूनापत्थर। शिस्ट, नीस, फिलाइट, स्लेट, क्वार्ट्जाइट, संगमरमर एवं चार्नोकाइट।
2. निम्नलिखित शैलों का सूक्ष्मदर्शी अध्ययन(खनिजीय संगठन, गठन, सूक्ष्म संरचनाएं एवं उत्पत्ति)–ग्रेनाइट, डायोराइट, गेब्रो, ड्यूनाइट, सायनाइट, नेफेलीन–सायनाइट, डोलेराइट, बेसाल्ट। बलुआ पत्थर, चूनापत्थर। संगमरमर, शिस्ट, नीस एवं क्वार्ट्जाइट।
3. भारत के रूप रेखा मानचित्र में प्रमुख शैलों का आलेखन।

1. Megascopic study of the following rocks (Mineralogical composition, Texture, Origin and Distribution) - Granite, Diorite, Gabbro, Dunite, Syenite, Nepheline-Syenite, Dolerite, Pegmatite, Rhyolite, Basalt. Conglomerate, Breccia, Sandstone, Shale, Limestone. Schist, Gneiss, Phyllite, Slate, Quartzite, Marble and Charnockite.
2. Study of thin section of the following rocks. (Mineralogical composition, Texture, Microstructure and Origin) - Granite, Diorite, Gabbro, Dunite, Syenite, Nepheline-syenite, Dolerite, Basalt, Sandstone, Limestone,Marble, Schist, Gneiss and Quartzite.
3. Plotting of important rocks in Outline map of India.

II– संरचनात्मक भूविज्ञान / **Structural Geology :**

1. क्लाइनोमीटर कम्पास, ब्रन्टन कम्पास की सहायता से नति एवं नतिलम्ब की माप।
2. भूवैज्ञानिक मानचित्रों के परिच्छेद एवं विवेचना।
3. तीन बिन्दु अभ्यास एवं दश्यांशों को पूर्ण करना।
4. प्राथमिक अवसादी एवं आग्नेय संरचनाओं का अध्ययन।
5. संरचनात्मक प्रादर्शों का अध्ययन।

1. Measurement of dip and strike using Clinometer Compass and Brunton compass.

2. Interpretation and drawing of sections of simple geological maps.
3. Three point exercise and completion of outcrops.
4. Study of primary sedimentary and igneous structures.
5. Study of Structural models.

Govt. Holkar (Model Autonomous) Science College, Indore

DEPARTMENT OF GEOLOGY

2021-22

Class: B. Sc. III Year **Marks: 40+ (CCE) 10 = 50**

Subject: Geology **Paper: Theory -I**

Title of Paper: Paleontology and Stratigraphy **Code of the Paper: C311-I**

Part A : Introduction for code-C311-I	
Course Objectives	To impart knowledge of the concepts in stratigraphy, correlation, and paleontology would enable the students to understand the changes that occurred in the history of the earth and relate them to their field observations and, in understanding the framework of the stratigraphy of India
Course Learning Outcomes	1. The student will gain knowledge about fossils and fossilisation and able to identify morphology of various groups of invertibrate fossils and plant fossils.
	2. Students will gain knowledge about the importance of fossils in establishing age of rock units, stratigraphic correlation and its application in hydrcarbon exploration.
	3. Ability to understand diverse geology of India with standard geological time scale and enable to understand the framework of the stratigraphy of India
	4. Be able to decipher the geological history of an area from a geological map. Understand the age and significance of depositional sequences.
	5. Students will gain knowledge about economic mineral deposits and fossil content associated with various stratigraphic units of India.
Part B: Content of the Course	
Particulars/ विवरण	
Unit-I	1. Introduction to Palaeontology. 2. Essential conditions for fossilization and Modes of fossilization. 3. Geological uses of fossils, Index fossils and their importance. 4. Morphology and Geological history of Graptolites, Foraminifera and Trilobites.
इकाई-I	1. जीवाश्म विज्ञान का परिचय। 2. जीवाश्मन की आवश्यक परिस्थितियाँ एवं जीवाश्मन की विधियाँ। 3. जीवाश्मों के भूवैज्ञानिक उपयोग, सूचक जीवाश्म एवं उनका महत्व। 4. ग्रेप्टोलाइट्स, फोरामिनिफेरा एवं ट्राइलोबाइट्स की आकारिकी एवं भूवैज्ञानिक इतिहास।
Unit-II	Morphology and Geological history of following: 1. Echinoids. 2. Brachiopods. 3. Lamellibranchs. 4. Gastropods. 5. Cephalopods.
इकाई-II	निम्नलिखित की आकारिकी एवं भूवैज्ञानिक इतिहास: 1. इकिनॉइड्स। 2. ब्रकिओपोड्स। 3. लेमिलिब्रेंक्स। 4. गेस्ट्रोपोड्स। 5. सिफेलोपोड्स।

Unit-III	1. Introduction to Stratigraphy: Basic concept of Lithostratigraphic and Chronostratigraphic Units, Geological Time Scale. 2. Principles of Stratigraphy. Criteria for correlation. 3. Stratigraphy, Geographic distribution and Economic importance of Dharwar Supergoup. 4. Stratigraphy, Geographic distribution and Economic importance of Sausar Group, Chilpighat Group and Bundelkh and Gneissic Complex.
इकाई–III	1. संस्तर विज्ञान का परिचय: अश्मस्तरिक एवं कालानुक्रमस्तरिक इकाईयों के विषय में आरंभिक जानकारी, भूवैज्ञानिक कालमापक। 2. संस्तर विज्ञान के सिद्धांत। सह संबंध के अभिलक्षण। 3. धारवाड महासंघ का संस्तर विज्ञान, भौगोलिक वितरण एवं आर्थिक महत्व। 4. सौसरसंघ, चिल्पीघाट संघ एवं बुन्देलखंडनी सिककॉम्प्लेक्स का भौगोलिक वितरण एवं आर्थिक महत्व।
Unit-IV	1. Cuddapah Supergroup: Stratigraphy, Geographic distribution and Economic importance. 2. Vindhyan Supergroup: Stratigraphy, Geographic distribution and Economic importance. 3. Gondwana Supergroup: Stratigraphy, Geographic distribution, Palaeoclimate and Economic importance. 4. Jurassic rocks of Kutch: Stratigraphy, Geographic distribution and fossil contents. 5. Cretaceous rocks of Tamilnadu: Stratigraphy, Geographic distribution and Fossil contents.
इकाई–IV	1. कडप्पा महासंघ: संस्तरविज्ञान, भौगोलिक वितरण एवं आर्थिक महत्व। 2. विन्ध्य महासंघ: संस्तरविज्ञान, भौगोलिक वितरण एवं आर्थिक महत्व। 3. गोंडवाना महासंघ: संस्तरविज्ञान, पुराजलवायु, भौगोलिक वितरण एवं आर्थिक महत्व । 4. कच्छ क्षेत्र की जुरासिक शैलें: संस्तरविज्ञान, भौगोलिक वितरण एवं जीवाश्म अंश । 5. तामिलनाडु क्षेत्र की क्रिटेशस शैलें : संस्तरविज्ञान, भौगोलिक वितरण एवं जीवाश्म अंश ।
Unit-V	1. Bagh Beds and Lameta Beds: Stratigraphy, Geographic distribution and fossil contents. 2. Deccan Traps: Stratigraphy, Geographic distribution and Age. 3. Tertiary rocks of Assam: Stratigraphy, Geographic distribution and Economic importance. 4. Siwalik Group: Stratigraphy, Geographic distribution and Vertebrate fossils. 5. Study of Important Stratigraphic Monuments and Fossil Parks of India.
इकाई-V	1. बाघ संस्तर एवं लमेटासंस्तर: संस्तरविज्ञान, भौगोलिक वितरण एवं जीवाश्म अंश । 2. डेक्कन ट्रेप : संस्तरविज्ञान, भौगोलिक वितरण एवंआयु । 3. असम के तृतीय महायुग शैलें: संस्तरविज्ञान, भौगोलिक वितरण एवं आर्थिक महत्व । 4. शिवालिक समूह: संस्तरविज्ञान, भौगोलिक वितरण एवं कशेरूकीय जीवाश्म । 5. भारत के महत्वपूर्ण संस्तरविज्ञानीय स्मारक एवं जीवाश्म उद्यानों का अध्ययन ।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

- जीवाश्म विज्ञान एवं संस्तर विज्ञान: अंबिका प्रसाद अग्रवाल एवं डी.के. देवलिया
- भारत वर्ष का भूविज्ञान: अंबिका प्रसाद अग्रवाल
- जीवाश्म विज्ञान: आर.पी. मिश्रा
- अकशेरूकी एवं कशेरूकी जीवाश्म विज्ञान: दीपक राज तिवारी
- प्रायोगिक भूविज्ञान भाग तीन: डी.सी. गुप्ता, व्ही.एल. पुनवटकर एवं आर.एस. रघुवंशी
- An Introduction to Invertebrate Paleontology:P.C. Jain and M.S. Ananthraman
- Historical Geology of India: Ravindra Kumar
- Introduction to Palaeontology: A.N. Davis
- Invertebrate Palaeontology: H. Woods
- Geology of India: R. Vaidhyanadhan and M. Ramakrishna [Vol. 1 & 2]

Part D :Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Continuous Comprehensive Evaluation (CCE): 10 College Exam: 40		
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: 40 Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**

Govt. Holkar (Model Autonomous) Science College, Indore

DEPARTMENT OF GEOLOGY

2022-23

Class: B. Sc. III Year **Marks: 40+ (CCE) 10 = 50**

Subject: Geology **Paper: Theory -II**

Title of Paper: Earth Resources and Applied Geology **Code of the Paper: C311-II**

Part A : Introduction for code-C311-II	
Course Objectives	To give knowledge of occurrence and distribution of economic minerals. This will also make students to learn about the basics of geology for mineral exploration, mining and engineering projects.
Course Learning Outcomes	1. The student will gain knowledge about earth resources and primary and secondary processes of mineral formation
	2. Gain knowledge about origin, mode of occurrence,grade and specification of ores and industrial minerals of India. Be able to understand Geology and associated mineral wealth of our country and state.
	3. Ability to understand geology and othervarious aspects of fossil fuels and atomic mineral deposits of the India. Also gain knowledge about mineral economics
	4. Gain knowledge of the applied aspects of Geology in the field of prospecting, exploration and exploitation of minerals and learns about mineral beneficiation.
	5. Student will gain preliminary knowledge about groundwater geology. Be able to understand importance of geological investigations in civil engineering projects and application of GIS and remote sensing in geological studies.
Part B: Content of the Course	
Particulars/ विवरण	
Unit-I	1. Introduction to Economic Geology, Classification of Mineral Deposits,Geological Thermometers. 2. Magmatic concentration Process. 3. Hydrothermal Process. 4. Oxidation and Supergene Sulphide Enrichment Processes. 5. Mechanical concentration Process.
इकाई-I	1. आर्थिक भूविज्ञान का परिचय, खनिज निक्षेपोंका वर्गीकरण, भूवैज्ञानिक तापमापी । 2. मैग्मीय सान्द्रणप्रक्रम । 3. उष्णजलीय प्रक्रम । 4. ऑक्सीकरण एवं ऊर्ध्वजनित सल्फाइड समृद्धिप्रक्रम । 5. बलकृत सान्द्रणप्रक्रम ।
Unit-II	1. Study of the following Metallic mineral deposits of India with reference to their Mode Of occurrence, Ore-minerals, Geographic distribution and Economic uses: Iron, Manganese, Chromium, Copper, Lead-Zinc and Aluminum. 2. Study of the following Non-metallic mineral deposits of India with reference to their Mode of occurrence, Mineralogical characters, Geographic distribution and Economic uses: Mica, Magnesite, Talc, Barites, Asbestos, Kyanite, Diamond, Corundum, Beryl, Fluoriteand Gypsum.
इकाई-II	1. भारत के संदर्भ में निम्नलिखित धात्विक खनिज निक्षेपों की प्राप्ति अवस्था, अयस्क खनिज, भौगोलिक

	वितरण एवं आर्थिक उपयोगों का अध्ययनः लौह, मैंगनीज, क्रोमियम, तांबा, सीसा–जस्ता, एल्युमिनियम । 2. भारत के संदर्भ में निम्नलिखित अधात्विक खनिज निक्षेपों की प्राप्ति अवस्था, खनिजीय गुण, भौगोलिक वितरण एवं आर्थिक उपयोगों का अध्ययनः अभ्रक, मैग्नेसाइट, टाल्क, बेराइट, एस्बेस्टॉस, कायनाइट, डायमण्ड, कोरण्डम, बेरिल, फ्लोराइट एवं जिप्सम ।
Unit-III	1. Types of Coal, Origin of Coal, Coal and Lignite Deposits of India. Origin, Migration and Entrapment of Natural liquid Hydrocarbons [Petroleum]. 2. Structural and Stratigraphic Traps. Onshore and Off-shore Petroliferous Basins of India. 3. Mineral Wealth of Madhya Pradesh with special reference to Mode of Occurrence, Geological and Geographical distribution. 4. National Mineral Policy with New up dations.
इकाई–III	1. कोयले के प्रकार, कोयले की उत्पत्ति, भारत के कोयला एवं लिग्नाइटनिक्षेप। 2. प्राकृतिक तरल हाइड्रोकार्बन (पेट्रोलियम) की उत्पत्ति, प्रव्रजन एवं संचयन। संरचनात्मक एव संस्तरित तेल संचय आवरण (ट्रेप)। भारत के स्थलीय एवं उपतटीय खनिज तेल और प्राकृतिक गैस निक्षेप–क्षेत्र । 3. मध्यप्रदेश की खनिजसंपदाः प्राप्तिअवस्था, भूवैज्ञानिक एवंभौगोलिक वितरण के विशेष संदर्भ में। 4. राष्ट्रीय खनिज नीति नये संशोधनों के साथ ।
Unit-IV	1. Engineering Geology and its importance. Engineering properties of rocks. 2. Geological conditions for Construction of Dam sand Reservoirs. 3. Geological conditions for Construction of Tunnels. 4. Hydrologic Cycle and Occurrence of Under groundwater. Quality of Groundwater. 5. Hydrological properties of rocks. Classification of Aquifers.
इकाई–IV	1. अभियांत्रिकी भूविज्ञान एवं उसका महत्व। शैलों के अभियांत्रिकी गुण। 2. बांध एवं जलाशय निर्माण के लिये भूवैज्ञानिक परिस्थितियाँ। 3. सुरंग के निर्माण के लिये भूवैज्ञानिक परिस्थितियाँ। 4. जल–चक्र एवं भूमिगत जल की उपस्थिति, भूजल की गुणवत्ता । 5. शैलों के भूजलीय गुण, जल भृत संस्तरों का वर्गीकरण ।
Unit-V	1. Introduction to Mineral Exploration. Surface and Subsurface exploration methods. 2. Elementary idea about Surface and Underground Mining methods. 3. Environmental impact due to Over exploitation of Mineral resources. 4. Introduction to Aerial Photography. Types of Aerial photographs. Elements of Aerial photo-interpretation. 5. Elementary idea about Remote Sensing and Geographical Information System (GIS).
इकाई-V	1. खनिज अण्वेशण का परिचय। खनिज अण्वेशण की सतही एवं अधोसतही विधियाँ। 2. खनन की सतही एवं भूमिगत विधियों की प्रारंभिक जानकारी। 3. खनिज स्त्रोतों के अत्यधिक दौहन के पर्यावरणीय प्रभाव। 4. हवाई छायाचित्रण का परिचय। हवाई छायाचित्रों के प्रकार। हवाई छायाचित्रों के विवेचना तत्व। 5. सुदूर संवेदन एवं भौगोलिक सूचना तंत्र की सामान्य अवधारणा।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

- आर्थिक भूविज्ञानः कृष्ण गोपाल व्यास
- आर्थिक एवं व्यावहारिक भूविज्ञानः आर.पी. मांजरेकर
- भौमजल विज्ञानः एल.के. रिछारिया
- प्रारंभिक खनिकीः बी.के. सिंह
- प्रायोगिक भूविज्ञान भाग तीन : डी.सी. गुप्ता, व्ही.एल. पुनवटकर एवं आर.एस. रघुवंशी
- Economic Mineral Deposits of India: Umeshwar Prasad
- Ore Deposits of India: K.V.G. K. Gokhale and T. C. Rao
- India's Minerals Resources: S. Krishnaswami
- Groundwater Hydrology: D.K. Todd
- Text Book of Engineering Geology: N.C. Kesavulu

- Courses in Mining Geology: R.N.P. Arogyaswami
- Principles and Applications of Photogeology: S.N. Pandey
- Geoinformatics for Environmental Management: M. Anji Reddi
- Remote Sensing and Image Interpretation : J. M. Lilles and R. M. Kieffer
- Remote Sensing Principles and Interpretation :F. F. Sabins
- Geographical Information Systems :T. K. Chang

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks:	50	
Continuous Comprehensive Evaluation (CCE):	10	
College Exam:	40	
Internal Assessment:	Class Test	05
Continuous Comprehensive Evaluation (CCE): 10	Assignment/ Presentation	05
	Total	**10**
External Assessment:	Section (A): Multiple Choice Questions	05 x 01 = 05
College Exam Section:	Section (B): Long Questions (200 words each)	05 x 07 = 35
Time: **3.00 Hours**	**Total**	**40**

Govt. Holkar (Model Autonomous) Science College, Indore

DEPARTMENT OF GEOLOGY

2022-23

बी. एससी. भाग– 3 / B. Sc. Part - 3

भूविज्ञान / GEOLOGY

प्रायोगिक कार्य / Practical Work

अधिकतम अंक / Maximum Marks : 50

I - जीवाश्म विज्ञान एवं संस्तर विज्ञान / Palaeontology and Stratigraphy:

1. निम्नलिखित जीवाश्मों का अध्ययन :
   न्यूमूलाइटिस, केल्सियोला, जैफरेंटिस, माइक्रेस्टर, हेमिएस्टर, सिडेरिस, प्रॉडक्टस, टेरेब्रेटुला, रिंकोनेल्ला, स्पिरिफिर, ग्रैफिया, पेक्टेन, वीनस, कार्डिटा, आर्का, ट्राइगोनिया, सेरिथियम, कोनस, फाइसा, म्यूरेक्स, नाटिका, साइप्रिया, ट्रोकस, ट्यूरिटेला, बेलेमनाइट्स, आर्थोसिरेस, नॉटिलस, गोनियाटाइट्स, सिरेटाइट्स,एकेन्थोसिरस, पेरिसफिंक्टिस, केलेमीन, पैराडॉक्साइड्स, फेकॉप्स, मोनोग्रेप्टस एवंडाइप्लोग्रेप्टस।
   ग्लॉसप्टेरिस, गंगामॉप्टेरिस, वर्टीब्रेरिया, साइजोन्यूरा, टीलोफिलम।
2. भारत के रेखा–मानचित्र में संस्तर विज्ञान की विभिन्न इकाईयों को दर्शाना।
3. लाक्षणिक गुणधर्मों के आधार पर शैलों की संस्तर विज्ञानी पहचान तथा कालानुक्रम।
4. भारत के रेखा–मानचित्र में संस्तर विज्ञानीय स्मारक एवं जीवाश्म उद्यानों का अंकन एवं अध्ययन।

1. Study of the following fossils:
   Nummulites, Calceola, Zaphrentis, Micraster, Hemiaster, Cidaris, Productus, Terebratula, Rhynchonella, Spirifer, Gryphaea, Pecten,Venus, Cardita, Arca, Trigonia, Cerithium, Conus, Physa, Murex, Natica, Cyprea,Trochus, Turritella,Belemnites, Orthoceras, Nautilus, Goniatites, Ceratites, Acanthoceras, Perisphinctes,Calymene, Paradoxides, Phacops, Monograptus and Diplograptus.
   Glossopteris, Gangamopteris, Vertebraria, Schizoneura and Ptilophyllum.
2. Distribution of Important Stratigraphic Units in Outline Map of India.
3. Stratigraphic Identification and Sequencing of Rocks on the basis of their diagnostic characteristics.
4. Study and Marking of Stratigraphic Monuments and Fossil Parks in Outline Map of India.

II - भूसंसाधन एवं व्यावहारिक भूविज्ञान / Earth Resources and Applied Geology :

1. निम्नलिखित आर्थिक खनिजों के भौतिक गुण, रासायनिक संघटन, प्राप्ति अवस्था, वितरण एवं उपयोग:
   मैग्नेटाइट, हेमेटाइट, लिमोनाइट, गोएथाइट, सिडेराइट, पाइराइट, इल्मेनाइट, पायरोलुसाइट, सिलोमिलेन,ब्राउनाइट, क्रोमाइट, चेल्कोपायराइट, कोवेलाइट, बोर्नाइट, गैलेकाइट, एज्यूराइट, क्यूप्राइट, गैलेना, स्फेलेराइट, केसिटेराइट, वुल्फ्रेमाइट, मॉलिब्डेनाइट, स्टिब्नाइट,ऑर्पिमेन्ट, रिअलगार,बॉक्साइट, ऐपेटाइट, एस्बेस्टॉस, बेराइट,केल्साइट, चाइनाक्ले, कोरंडम, फ्लुओराइट, ग्रेफाइट, जिप्सम, गार्नेट, कायनाइट, लेपिडोलाइट, मस्कोवाइट, क्वार्ट्ज, सिलिमेनाइट, टाल्क, मेग्नेसाइट, वोलास्टोनाइट एवं फायरक्ले।
2. भारत के रेखा–मानचित्र में आर्थिक खनिजों का वितरण।
3. महत्वपूर्ण शैलों के भौमजलीय गुणोंका अध्ययन।
4. भौम–जलस्तर मानचित्रों का बनाना तथा उनकी विवेचना।
5. परिष्कृत उत्पादों में कच्चेमाल के रूप में उपयोग में लाए गए खनिजों की पहचान।
6. हवाई छायाचित्रों एवं उपग्रह से प्राप्त छवियों की अवलोकन द्वारा विवेचना।

1. Physical properties, Chemical composition, Mode of Occurrence, Distribution and Uses of following Economic Minerals.
   Magnetite, Hematite, Limonite, Goethite, Siderite, Pyrite, Ilmenite, Pyrolusite, Psilomelane, Braunite, Chromite, Chalcopyrite, Covellite, Bornite, Malachite, Azurite, Cuprite, Galena, Sphalerite, Cassiterite, Wolframite, Molybdenite, Stibnite, Orpiment, Realgar, Bauxite, Apatite, Asbestos, Barite, Calcite, Chinaclay, Corundum, Fluorite, Graphite, Gypsum, Garnet, Kyanite, Lepidolite, Muscovite, Quartz, Sillimanite, Talc, Magnesite, Wollastonite and Fireclay.
2. Distribution of Economic minerals in Outline Map of India.
3. Study of Hydrological Properties of Important rocks.
4. Preparation and Interpretation of Water table maps.
5. Identification of Raw materials and minerals as various Finished products.
6. Visual Interpretation of Aerial Photographs and Satellite images.

Department of Geology
Govt. Holkar [Model, Autonomous] Science College, INDORE, M.P.
Academic Session: 2021 - 22

Class: M. Sc. I Sem

Subject: Geology **Paper: Theory -I**

Title of Paper: Geodynamics **Code of the Paper: G11**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G11	
Course Objectives	This course enables the students to appreciate the dynamic nature of the Earth processes. They will also be appraised about the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift, plate tectonics.
Course Learning Outcomes	1. The student will gain knowledge about the origin and age of the earth. The student will also gain knowledge about the dynamic nature of the earth.
	2. The student will gain knowledge of the interior of the earth and the natural phenomenon of volcanism and earthquakes.
	3. The student will also gain knowledge about the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift and plate tectonics.
	4. The student will also gain knowledge about the present and past magnetic properties of the earth.
	5. The student will also learn the implications of the modern concept of plate tectonics on various phenomenon such as volcanism, earthquakes and formation oftopographic features of global scale.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Solar System and its Origin. Earth as a member of solar system and its Origin. Geochronology and Age of the Earth. Seismology: Seismic waves, Intensity and Magnitude. Types, Causes and Effects of Earthquakes. Tsunamies. Seismographs and Determination of Earthquake Epicentre. Global Distribution of Earthquakes. Seismic zones of India.
Unit-II	Seismic waves as Probes of Earth's Interior. Internal structure of the Earth, Seismic Tomography. Volcanology: Types of Volcanoes, Types of Eruptions, Volcanic Products, Causes of Volcanism, Global distribution of Volcanoes, Volcanism in India.
Unit-III	Geosynclines: Classification and Evolution of Geosyncline, Classification and Origin of Mountains. Isostasy : Concept, Isostatic adjustment and Isostatic models.
Unit-IV	Continental Drift: Concept, Theories and Evidence of continental drift. Polar Wandering. Palaeomagnetism. Sea-floor Spreading. Mid-oceanic Ridges. Oceanic Trenches.
Unit-V	Plate Tectonics: Concept and Types of plate boundaries, Features associated with various plate margins. Causes, rate and direction of plate movements. Island Arcs: General features, Origin and Evolution of Island Arcs.

Part C:- Learning Resources
Text Book , Reference Books, Other resources
Suggested Readings: 1. Active Tectonics - *Edward A. Keller* 2. Tsunami and its Hazards in the Indian and Pacific Oceans - *S. K. Okal, E. A. Borrero* 3. Principles of Physical Geology - *A. Holmes* 4. Seismology and Plate Tectonics - *David Gubbins.* 5. Physical Geology - *W. J. Miller* 6. Physical Geology of India - *S. M. Mathur* 7. Essentials of Geology - *R. Wicander, J. S. Mouroe* 8. Physical Geology - *C. C. Plummer, D. Mcheary* 9. The Dynamic Earth - *J. Wyllie* 10. Earthquake studies in Peninsular India - *H. K. Gupta, G. D. Gupta* 11. Physical Geology - *E. H. Spencer* 12. Physical Geology - *Leet and S. Judson* 13. The Making of India : Geodynamic Approach – *K. S. Valdiya*

Class: M. Sc. I Sem

Subject: Geology **Paper: Theory -II**

Title of Paper: Structural Geology **Code of the Paper: G12**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G12	
Course Objectives	The course deals with geological structures resulting from the action of various types of tectonic forces operating on rocks. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its application in the field.
Course Learning Outcomes	1. The course deals with the study of geological structures resulting from the diastrophic movement and various farces acted on the rocks.
	2. The student will gain knowledge of the geometric and genetic classification of various structures with the help of Brunton and Clinometer compass.
	3. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its applications in the field.
	4. Identification of measurement of structures is fundamental to geological mapping. This course also help to develop understanding of geological maps and their interpretation, various laboratory and filed techniques of interpretation of the map.
	5. The course also helps to know how to use structures and help students appreciate the dynamic nature of the earth.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Rock failure: Principles and Mechanics of Rock Deformation. Primary structures and their significance. Top and bottom criteria. Unconformities : types and recognition. Stress and strain ellipsoids and its applications. Stratigraphic sequence Indicators. Overlaps and Offlaps.
Unit-II	Ductile deformations. Geometry of folds surface: Single and multi-layered. Folds: elements, classification, mechanism and their recognition in the field and on the geological maps. Compaction folds and contemporaneous deformation.Effects of folds on outcrops. Kinematics of folding.
Unit-III	Brittle deformation. Geometry of faults. Faults: elements, classification, mechanism and their recognition in the field and on the geological maps. Causes of faulting. Collapse structures. Kinematics of faulting.
Unit-IV	Foliation - types and relation to major structures. Lineation - type and relation to major structures. Outcrops - their trends in relation to structure and slope. Fractures and Joints.
Unit-V	Principles of structural mapping. Structural problems in the field and laboratories with reference to attitude of faults and folds. Principles of structural analysis. Fabric elements and their graphical representation.Emplacement of Plutons, Plutons and Granite tectonics.

Part C :-Learning Resources	
Text Book , Reference Books, Other resources	
1. Structural Geology	- *M. P. Billings.*
2. Structural Geology	- *S. Hills*
3. Theory of Structural Geology	- *M. W. Gokhale*
4. Geological Maps	- *G.W. Chiplonkar& K.B. Powar*
5. Structural Geology	- *Robert J. Twiss, E. M. Moores.*
6. Structural Geology of Rocks and Regions	- *G. H. Davis, S. J. Reynolds*

7. Structural Geology - *Donald M. Ragan*
8. Manual of Problems : Structural Geology - *N. W. Gokhale*
9. Manual of Geological Maps - *N. W. Gokhale*
10. Basic Methods of Structural Geology - *Stephen Marshale*
11. 3-D Structural Geology - *Groshong Jr., Richard H.*
12. Mechanics of Tectonic Faulting - *Mandl*
13. Folding and Fracturing of Rocks - *J. G. Ramsay*
14. Introduction to small scale geological structure - *G. Willson*
15. Elements of Geological map reading and Interpretation - *D. S. Bhattacharyya, T. C. Bagchi*
16. Structural and Tectonic principles - *Peter C. Badgley*
17. Structural Geology - *Hobbs and Meads*
18. Structural Geology - *R.P. Singh*
19. Structural Geology : Fundamentals of Modern Developments - *S. K. Ghosh*
20. Analysis of Geological Structures - *N. J. Price, J. W. Cosgrove*
21. An Introduction to Structural Geology - *A. K. Jain*

DEPARTMENT OF GEOLOGY

Class: M. Sc. I Sem

Subject: Geology **Paper: III**

Title of Paper: Indian Stratigraphy **Code of the Paper: G13**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G13	
Course Objectives	To impart knowledge of the concepts in stratigraphy, correlation, and paleontology would enable the students to understand the changes that occurred in the history of the earth and relate them to their field observations and also, in understanding the framework of the stratigraphy of India.
Course Learning Outcomes	1. The student will gain knowledge about the geology of India with emphasis on the Stratigraphy of Peninsualar and extra peninsular India. Also gain knowledge about tectonic features of Indian subcontinent.
	2. Be able to understand that how the rocks have been classified in geological sequences in lithostratigraphic units in terms of chronostratigraphic divisions.
	3. Gain knowledge of Precambrian Geology, tectonics and associated economic mineral resources of Archeans of south, central, eastern and north-western part of India and also about the geology of Proterozoic basins and associated mineral resources
	4. Able to know about what are major boundaries in geological time scale and discuss the events related to the boundaries. Be able to understand the Indian stratigraphy of Paleozoic era including stratigraphy and fossils of the lower Palaeozoics of extra peninsular India and paleoclimate, plant fossils and coal deposits of Gondwana supergroup.
	5. The student learnsabout Indian stratigraphy of Mesozoic era includes cretaceous and Jurassic rocks of India, associated fossils and mineral resources. Be able to understand the stratigraphy of Cenozoic era including Deccan volcanics, Siwaliks and associated fossils, tertiary rocks and associated hydrocarbons of northeast India.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Criteria for the Stratigraphic classification and Correlation. Litho, Bio and Chrono-stratigraphic Untis. Geological Time Scale. Orogenic cycles of the Indian Stratigraphy. Tectonic framework of India. Sequence Stratigraphy.
Unit-II	Ice-ages in the Indian Stratigraphy: Precambrian, Permo-Carboniferous and Pleistocene Ice-ages and their evidences. Archaean (Azoic) History of India: Distributions and Stratigraphy of the Archaeans of South India, Madhya Pradesh, Rajasthan, Jharkhand and Orissa.
Unit-III	Precambrain (Proterozoic) History of India: Distribution and Stratigraphy of the Cuddapah and Vindhyan Supergroups. Paleozoic History of India: Distribution and Stratigraphy of Salt Range and Spiti. Origin and age of Saline Formation. Precambrian – Cambrian Boundary problems.

Unit-IV	Mesozoic History of India: Distribution and Stratigraphy of Triassic of Spiti. Jurassic of Cutch (Kachchh) and Cretaceous of South India. Bagh Beds, Lameta Beds. Deccan Traps. Permo – Triassic Boundary Problems.
Unit-V	Palaeoclimat. Classification, Distribution and Stratigraphy of the Gondwana Supergroup. Cenozoic History of India: Tertiary of Assam and its economic importance. Siwaliks and its vertebrate fossil record. K-T Boundary Problems.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

1. Geology of India and Burma - *M. S. Krishnan*
2. Geology of India - *D. M. Wadia*
3. Himalayan Geology (Vol. I) - *A. G. Jhingran*
4. India Paleozoic stratigraphy - *V. J. Gupta*
5. Indian Mesozoic Stratigraphy - *V. J. Gupta*
6. Indian Cenozoic Stratigraphy - *V. J. Gupta*
7. Quaternary Geology : Indian Perspective - *V. B. Mathur*
8. Cretaceous Stratigraphy : An Update - *A. Govindan*
9. Geology of India - *A. K. Dey*
10. Basic Concepts of Historical Geology - *E. W. Spencer*
11. Stratigraphic Principles and Practice - *J. M. Weller*
12. Historical Geology and Stratigraphy of India - *Ravindra Kumar*
13. Archean Geology - *C. S. Pichamuthy*
14. Indian Stratigraphic Nomenclature - *V. J. Gupta*
15. Indian Pre-Cambrian Stratigraphy - *V. J. Gupta*
16. A Manual of the Geology of India And Burma (Vol. I - IV) - *E. H. Pascoe*
17. Precambrain Geology of India - *S. M. Nagvi, J. J. W. Roger*
18. Principles of Sedimentology and Stratigraphy - *Sam Jr. Boggs.*

DEPARTMENT OF GEOLOGY

Class: M. Sc. I Sem

Subject: Geology **Paper: IV**

Title of Paper: Mineralogy and Geochemistry Course **Code of the Paper: G14**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G14	
Course Objectives	Studying the basics of mineralogy and crystallography helps in understanding and building the overall knowledge in Geology.
Course Learning Outcomes	1. Students will gain knowledge about the physical properties of Metallic and Non-metallic minerals which help in mineral search in field. Students will understand the various Classification Schemes related to Mineralogists and Economic geologists.
	2. With the help of Classification and Mineralogical properties of various Mineral Groups. Students will able to learn theoretical and practical aspects of these Rock-forming mineral groups including Gemstones.
	3. With the help of various Principles of Optics, students can learn the Optical Classification of Rock-forming minerals. Knowledge of optical properties of minerals, make enable students to identify mineral under polarizing microscope.
	4. Students will gain knowledge of some more important Optical properties of minerals which ultimately set the students mind towards research in future.
	5. Geochemistry play vital role in understanding the Geochemical processes of our planet. Study of Meteorites and other terrestrial materials help in understanding the Cosmic nature of our Solar System and Universe. Study of radioactive isotopes help in understanding the age determination of rocks.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Minerals and their Classification. Bonding in Minerals. Ionic substitution, Solid solution, and Exsolution. Isomorphism, Polymorphism and Pseudomorphism. Order-Disorder phenomenon. Silicate structure and Classification of Silicates. Mineralogical properties and Mode of Occurrence of : **[i]Sulfides :** (AX, A_2X, AX_3 types), **[ii] Oxides :** (XO, X_2O, XO_2, X_2O_3, X_3O_4 types), **[iii] Sulfates**(Anhydrous and Hydrous) and **[iv] Carbonates** [Calcite, Aragonite and Dolomite].
Unit-II	Atomic structure, chemistry, physical and optical properties of the following rock-forming mineral groups: Mica Group, Garnet Group, Alumino-silicates [Kyanite, Sillimanite and Andalusite], Pyroxene Group, Amphibole Group, Feldspar Group, Feldspathoid Group, Precious and Semi-precious minerals.
Unit-III	General principles of Optics. Double Refraction and Birefringence. Optical classification of minerals. Polarizing microscope and optical accessories.Formation of Interference colours.Concept of Uniaxial and Biaxial Indicatrix. Interference figures of Uniaxial and Biaxial minerals. Optic sign and its determination.
Unit-IV	Pleochroism and Determination of Scheme of Plochroism. Isotropism and Anisotrpoism. Extinction and its types. Interference colours, Interference figures and their types. Refractive Index and its measurement. Optic anomalies. Optic axial angle and its determination.

Unit-V	Geochemistry: Definition and Scope of Geochemistry. Cosmic abundance of major, minor, trace and rare earth elements. Meteorites and other extraterrestrial materials. Primary geochemical differentiation of the earth. Geochemical classification of elements. Concept of Geochemical cycle.Laws of Thermodynamics.Radioactive decay series of U/Th-Pb, Rb-Sr and K-Ar.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

1. The Practical Study of Crystals Minerals and Rocks - *Cox, Price and Harte*
2. Rutleys Elements of Minerology - *C. D. Gribble*
3. Mineralogy - *Berry Mason, Dietrich*
4. A course of Mineralogy - *A. Betekhin.*
5. Mineralogy - *Krus Hunt, Ramsdell*
6. Mineralogy - *J. Sinkankas*
7. A Collectors Guide to Minerals and Gemstones - *J. Sinkankas*
8. Principles of Mineralogy - *W.H.Blackburn, W. H. Dennen.*
9. Geochemistry for Everybody - *G. Fersman.*
10. Dana's manual of Mineralogy - *Cornelins S. Hurlbut*
11. Elements of Crystallography and Mineralogy - *F. A Wade, R. B. Mattox*
12. Text Book of Mineralogy - *E. S. Dana*
13. Optical Mineralogy - *Phillips, W.R. and Griffin D. T.*
14. Manual of mineralogy - *Klein, C and Huarlbut*
15. Atlas of Rock - Forming Minerals in Thin Section - *W. S. Mackenzie, C.* Guilford
16. An Introduction to Rock Forming Minerals - *W.A.Deer,R.A.Howie,J. zussman*
17. Practical Approach to Crystallography and Mineralogy – *RabindraNathHota.*
18. Geochemistry - *Rankama and Sharma*
19. Geochemistry - *Wedepohl*
20. Principles of Geochemistry - *Brain Mason, K. B. Moore.*
21. Geochemistry of Lithosphere - *A. A. Beus*
22. Encyclopedia of Geochemistry - *C. P. Marshal, R. W. Fairbridge.*

M.Sc. - I Semester [Based on SBCS]
GEOLOGY

Practical Examinations :

Practical – 01 : Structural Geology

Max. Marks : 75 **Credits : 03**

1. Geometric methods to solve the problems related to Dip, Strike and Fault attitudes.
2. Completion of outcrops on the geological maps.
3. Drawing of Geological cross sections along given section lines on the geological maps.
4. Study of three dimensional models showing various structural features.

Sessional Marks: 15

Practical – 02: Mineralogy and Geochemistry

Max. Marks : 75 **Credits : 03**

1. Megascopic and microscopic study of common rock-forming minerals with emphasis on association and genesis.
2. Determination of Pleochroic scheme, Order of Interference Colours, Birefringence, Optic sign of Elongation.

Sessional Marks: 15

Department of Geology
Govt. Holkar [Model, Autonomous] Science College, INDORE, M.P.
Academic Session: 2021 - 22

Class: M. Sc. II Sem

Subject: Geology **Paper: I**

Title of Paper: Geomorphology **Code of the Paper: G21**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G21	
Course Objectives	The objective of this course is to impart complete knowledge of various geomorphic processes. Objective is to give knowledge about the mechanism of operation of various geomorphic agents, along with the relationship of landforms with climate and other geological parameters. Imparting the knowledge of classification and distribution of landforms is also one of the important objectives of this course.
Course Learning Outcomes	1. Student will learn the historical perspective and development of geomorphology, i.e. the study of landforms.
	2. Student will the learn about the various geomorphic processes that shape the landforms present around us.
	3. Students will learn to identify the landforms and will be able to understand the origin and evolution of landforms and will be able to understand the role of structure, stage and time in shaping the landforms
	4. Student will be well versed with the different types of landforms of India.
	5. Student will learn to perform drainage basin analysis. Student will also learn the relevance of applied aspects of Geomorphology to various other fields.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Geomorphology : Principles and Significance. Geomorphic processes and their parameters. Cycle of erosion : Davis' and Plank' cycle of erosion. Rejuvenation. Slope forming processes : Landslides, Soil creep and Soilfluction.
Unit-II	Fluvial Agency : Types of rivers. Valley development - Base level and its varieties. Cross profiles of valleys. Classifications of valleys, Drainage Patterns and their significance. Fluvial Landforms : Erosional and depositional.
Unit-III	Glaciers : Types of Glaciers. Erosional and Depositional Glacial Landforms.Glacio-fluvial features. Arid cycle of erosion. Wind aeolian agency. Landforms of aeolian Erosion and Deposition.
Unit-IV	Karst Topography : Important areas of Karst. Conditions essential for development of Karst features, Characteristic of Karst region. Various Karst features.Karst geomorphic cycle.Marine erosion. Topographic feature resulting from marine erosion and marine depositions. Depth zones of Oceans.
Unit-V	Morphometric Analysis of Terrain and its significance. Morphometric analysis of Drainage Basin : its parameters and significance. Geomorphic features of Indian Subcontinent.

	Applications of Geomorphology.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

01	Principles of Geomorphology	- W. D. Thornbury.
02	Geomorphology	- Arthur L. Bloom
03	Surface Process and Land forms	- D. J. Easter Brook
04	Geomorphology	- Enayat Ahmad
05	Laboratory Manual in Physical Geology	- R. Busch.
06	Principles of Physical Geology	- A. Holmes
07	Geomorphology	- V. K. Sharma
08	Rocks and Landforms	- A. J. Gerrard
09	A Text Book of Geomorphology	- P. G. Worcester
10	Physical Geology	- W. J. Miller
11	Physical Geology of India	- S. M. Mathur
12	Essentials of Geology	- R. Wicander, J. S. Mouroe
13	Physical Geology	- C. C. Plummer, D. Mcheary
14	Earthquakestudies in Peninsular India	- H. K. Gupta, G. D. Gupta
16	Physical Geology	- E. H. Spencer
17	Physical Geology	- Leet and S. Judson
18	Geomorphology	- A. L. Bloom
19	Geomorphology	- Savendra Singh

DEPARTMENT OF GEOLOGY

Class: M. Sc. I Sem

Subject: Geology **Paper: II**

Title of Paper: Igneous and Metamorphic Petrology **Code of the Paper: G22**

Max. Marks: 75 **Credits: 04**

Part A : Introduction for code-G22	
Course Objectives	The course deals with Petrological aspects.. The student will gain knowledge of the various rocks, understand the classification according to their various factors and its application in the field.
Course Learning Outcomes	1. The course deals with various aspects like origin of magma and composition structures, textures and forms of rocks.
	2. The student will gain knowledge of various rocks (igneous, sedimentary and metamorphic). Will be able to study rocks under microscope as well as in hand specimens.
	3. The student will gain knowledge of the farms, texture, structures and interpretation of crystallisation. Its important in the field studies.
	4. Students will get field knowledge of igneous, sedimentary and metamorphic rocks. Petrological studies also deles with petrochemical calculations and crystalisationhistary.
	5. Thes courses helps to know the various rocks, types mode of occurrences and petrogenatic significance.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Magma : its Composition, factors affecting composition and Origin.Thermodynamics of magmatic crystallization. Phase rule and equilibrium in silicate systems. Study of one, Two and three component systems. Magmatic differentiation and assimilation.
Unit-II	Forms and structures of igneous rocks. Classification of Igneous rocksincluding IUGS system. Bowen reaction series.Origin of Basaltic and Granitic magmas.Textures of igneous rocks and interpretation of crystallisation history.Layered igneous structures.Petrochemical calculations and variation diagrams.Diversity of Igneous rocks.
Unit-III	Indian occurrence, petrography and origin of important igneous rocks –Granites, Basalts, Andesites, Ultrabasic rocks.Kimberlites, Carbonatite, Nephelinesyenites, Lamprophyres and Pegmatites.
Unit-IV	Agents and Kinds of Metamorphism.Concept of equilibrium in metamorphism.Metamorphic differentiation.Metamorphic reactions and Nucleation.Textures, Structures and Classification of metamorphic rocks.Zones and Grades of metamorphism.Metamorphic Phase Rules.
Unit-V	Metamorphic facies: Elementary idea and Classification. Study of different types of Metamorphism: Contact, Regional, Thermal, Retrograde etc. Metasomatism and its types.Indian occurrences and Petrogenetic significance of the following suits of rocks :with particular reference to –Schists and Gneisses. Migmatitesand their Origin.Eclogites,

	Charnoickites, Khondalites,Gondites and Amphibolites.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

1. Igneous and Metamorphic Petrology - *Turner and Verhoogen.*
2. Igneous Petrology - *A. R. Mc. Birney.*
3. Petrography - *Howel Williams.*
4. Petrogenesis of Metamorphic Rocks - *G. F. Winkler.*
5. Metamorphic Process - *R. H. Vernon.*
6. Metamorphic Petrology - *J. Turner.*
7. Petrology of Igneous Rocks - *F. H. Hatch and A. K. Wells.*
8. Petrology for students - *A. Harkar.*
9. Petrology of the Metamorphic Rocks - *R. Mason.*
10. Principles of Petrology - *G. W. Tyrell.*
11. Petrology - *Walter T. Huang.*
12. Study of Rocks in Thin Sections - *Howel Williams, F. J. Turner and C. M. Gilbert.*
13. Petrology for students - *G. A. Chinner*
14. Metamorphism - *A. Harkar*
15. A descriptive Petrology of Igneous Rocks - *A. Johannsen*
16. Metamorphic Rocks - *S. C. Chatterjee*
17. Igneous and Metamorphic Petrology - *M. G. Best*
18. Introduction to Igneous and Metamorphic Petrology - *John Winter*
19. Atlas of Igneous Rocks and Textures -*McKenzie,Donaldson Guilford.*
20. Petrology to Petrogenesis - *M. J. Hibbard.*
21. Metamorphism and Metamorphic Rocks of India -*S. Ray*
22. Petrogenesis of Metamorphic Rocks - *Bucher, K & Frey, M.*
23. Metamorphic crystallization - *VerlagKretz, R,*
24. Igneous Petrology - *Me Birney, A.R,*
25. Igneous and Metamorphic Petrology - *Phillipots, A.*
26. An Introduction to Metamorphic Petrology - *Yardley,B. W.*
27. Metamorphism and Metamorphic Rocks - *Miyashiro*
28. Ultramafic Rocks - *Wyllie, P J*
29. Introduction to Petrology - *P J Heffer Baily, B*
30. Introduction of Igneous & Metamorphic Petrology – *J. D. Winter*
31. Metamorphic Petrology : Concepts and Methods – *Ram S. Sharma*

DEPARTMENT OF GEOLOGY

Class: M. Sc. I Sem

Subject: Geology **Paper: III**

Title of Paper: Sedimentology **Code of the Paper: G23**

Max. Marks: 75 **Credits: 04**

Part A : Introduction for code-G23	
Course Objectives	The course deals with various sedimentary structures resulting from the action of various types of agents operating on rocks. The student will gain knowledge of the geometry of the rock structures and Classification, understand the mechanism of the evolution of rock structures and its application in the field.
Course Learning Outcomes	1. Students will gain knowledge about the Processes of Sedimentation. They will understand about origin of Sediments and Lithification and Diagenesis. Gain knowledge about classification and nomenclature of the common sediments and Classification of Sedimentary rocks.
	2. Student will understand about Origin, classification and significance of primary, secondary and organic sedimentary structures and understand Classification of Sandstone Limestone and Dolomite. Be able to understand significance of sedimentary structures in paleocurrent studies.
	3. Student will understand and gain knowledge about Textures of sedimentary rocks and their genetic significance. Granulometric analyses of clastic particles, data and interpretation of nature of sediments.
	4. Student will understand and gain knowledge about elements and types of depositional environments: Continental transitional and marine environments.
	5. Student will gain knowledge regarding Provenance and mineral stability, Concept and types of sedimentary provenance. Separation and significance of heavy minerals. They will understand tectonic framework of sedimentation (Kay's classification of tectonic elements) and Cyclothem, Graphical representation of Sedimentary rocks and their Interpretation. Heavy mineral analysis of sediments and its interpretation.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Processes of Sedimentation. Origin of Sediments. Modes of transport of sediments. Stoke's and Impact Laws of sediment settling. Lithification and Diagenesis. Classification and nomenclature of the common sediments (rudites, arenites and argillites).Classification of Sedimentary rocks.
Unit-II	Origin, classification and significance of primary, secondary and organic sedimentary structures. Classification of Sandstone, Limestone and Dolomite. Significance of Sedimentary Structures in Paleocurrent studies.

Unit-III	Textures of sedimentary rocks and their genetic significance. Granulometric analyses of clastic particles, statistical measurement, representation of data and interpretation of nature of sediments. Diagenesis.
Unit-IV	Elements and types of Depositional environments: Continental (Fluvial, Lacustrine, Aeolian and Glacial). Transitional and Marine environments. Evaporates and Volcano-clastic sediments.
Unit-V	Provenance and mineral stability.Concept and types of Sedimentary provenance. Separation and significance of heavy minerals, light minerals and insoluble residue in the provenance analyses.Tectonic framework of sedimentation (Kay's classification of tectonic elements).Cyclothem.

Part C: -Learning Resources

Textbook, Reference Books, Other resources

1. Petrology of Sedimentary Rocks - *J. T. Greansmith.*
2. Sedimentary Petrology - *V.K. Verma and P. Prasad*
3. Sedimentary Rocks - *Pettijohn*
4. Sedimentary Structures - *J. D. Collinson and D. B.* Thompson
5. Origin of Sedimentary Rocks - *Harway Blatt*
6. Practical Manual of Sedimentary Petrology - *S. K. Babu, D. K. Sinha*
7. Procedures in Sedimentary Petrology - *R. V. Karver*
8. Principles of Sedimentology and Stratigraphy - *Sam Boggs Jr.*
9. Encyclopedia and Sediments and Sedimentary Rocks - *G. V. Middleton*
10. A Practical Approach to Sedimentology - *R. C. Lindholm*
11. Principles of Sedimentology - *Friedman, Sanders*
12. Applied Sedimentalogy - *Selley*
13. Introduction to Sedimentalogy - *S. Sengupta.*
14. Sedimentology and Stratigraphy - *G. Nichols.*
15. Principles of Physical Sedimentation - *J. R. L. Allen.*
16. Origin of Sedimentary Rocks - *H. Batt, G. V. Murray, R. C. Middleton.*
17. Sedimentary Environments - *Reading H. G.*
18. Sedimentary Petrology - *Pettijohn, F. J.*
19. Sand and Sandstones - *Pettijohn, Potter and Seiver*

DEPARTMENT OF GEOLOGY

Class: M. Sc. I Sem

Subject: Geology **Paper: IV**

Title of Paper: Paleobiology **Code of the Paper: G24**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G24	
Course Objectives	The objective of this course is to givecomplete knowledgeabout themode of fossilisation and morphological characteristics of animal and plant fossils, so student can learn and identify the fossils in thelaboratory as well as in the field.Objective is to impart knowledge about the evolutionary trends, geological distribution and uses and application of fossils.
Course Learning Outcomes	1. The student will gain knowledge about the different aspects of fossils and fossilisation.Palaeobiolgy would enable the students to understand the appearance and evolution of life through the geologic time.
	2. The student will gain knowledge about significance of fossil in establishing relative geological ages of rock units, stratigraphic correlations and classification as well as in palaeogeography and other geological studies.
	3. Be able to learn and understand the morphological features, evolutionary trends and geological history and distribution of invertebrate, vertebrate, plant, and microfossils.
	4. Study of invertebrate, vertebrate, plant, and microfossils enable students to identify andclassify the fossils embedded in rock outcrops in the field.
	5. The students will able to understand the Concept of micropalaeontology,and applications of microfossils in Fossil-fuel Exploration. Be able to learnsPalaeobotany and Palynology and characteristic features ofGondwana flora.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Invertebrate Palaeontology: Fossils and their Preservation, Nomenclature and Classification. Use of fossils in Correlation, Age Determination, Palaeoclimate, Paleogeography and Organic Evolution.Classification, Evolution, Geological History of Trilobites, Graptolites, Echinoids and Corals.
Unit-II	Invertebrate Palaeontology: Classification, Evolution, Geological History of Brachiopodes, Gastropodes, Lamellibranchs and Cephalopodes.
Unit-III	Vertebrate Palaeontology: Succession of the Vertebrate Life through the Geological Time. Evolutionary History of Human, Elephant, and Horse.
Unit-IV	Micropaleontology: Classification and Separation of Microfossils. Applications of microfossils in Fossil-fuel Exploration. Morphology and Geological History of Foraminifers.
Unit-V	Concept of Paleobotany and Palynology. Plant life through geological ages. Characteristic features of Lower and Upper Gondwana flora.

Part C:-Learning Resources	
Text Book, Reference Books, Other resources	
1. An Introduction to Paleontology	- *A. Morley Davies*
2. Principles of Paleontology	- *Raup and Stanley*
3. Invertebrate Paleontology	- *Shrock*

4. Elements of Paleontology	- *Claude Babin*
5. Invertebrate Paleontology	- *E N. K. Clarkson*
6. Paleontology Invertebrate	- *H. Woods*
7. A Text Book of Paleontology	- *A. K. Sen*
8. Paleontology	- *V. K. Agrawal, Usha Gupta*
9. Tertiary Faunas	- *A Morley Davies.*
10. Invertebrate Palaeontology	- *Moore, Lalihsr and Fischer*
11. Palaeontology - the Record of Life	- *Stearn C. W. and Carrol R. L.*
12. Textbook of Palaeontology	- *Ananthraman and Jain*
13. Palaeontology	- *Andrew*
14. Vertebrate Paleontology	- *Alfred Sherwood Romer.*
15. Vertebrate Palaeontology	- *Roger A. S.*
16. Fossils Plants	- *A. C. Seward*
17. Aspects of Micropalaeontology	- *Banner F. T. and Lord A. R.*
18. Principles of Zoological Micropaleontology	- *J. W. Neale*
19. Microfossils	- *Jones D. J.*
20. Principles of Micropalaeontology	- Glassner M. P.
21. Introduction to Marine Micropalaeontology	- *Haq B. U. and Boersma A.*
22. Elements of Palaeontology	- *S. K. Shah*

Department of Geology
Govt. Holkar [Model, Autonomous] Science College, INDORE, M.P.
Academic Session : 2021 - 22

M.Sc. - II Semester [Based on CBCS]
GEOLOGY

Practical Examinations :

Practical –03: Petrology

Max. Marks : 75 **Credits:03**

1. Preparation of thin sections of rocks.
2. Identification of Igneous, Sedimentary and Metamorphic rock by Megascopic studies
3. Microscopic studies of Igneous, Sedimentary and Metamorphic rock with emphasis on textural and genetic aspects.
4. Plotting and Construction of Variation diagrams.
5. Petrochemical Calculations of Rocks.
6. Modal analysis and Classification of rocks.
7. Graphical representation of Sedimentary rocks and their Interpretation.
8. Heavy mineral analysis of sediments and its interpretation.
9. Construction of ACF diagrams from Chemical analysis.
10. Distribution of Rocks in India.

Sessional Marks : 15

Practical –04 : Paleontology and Stratigraphy

Max. Marks : 75 **Credits:03**

Study and preparation of Palaeogeographical maps of various Supergroups and Groups.

1. Plotting of various Stratigraphic formations on Outline Map of India.
2. Megascopic study of Stratigraphic rocks of India.
3. Megascopic study and Geological distribution of Important Invertebrate, Vertebrate and Plant fossils.
4. Sketching and Labelling of Important genera of Invertebrate, Vertebrate and Plant fossils.
5. Preparation of Microfossil slides and Study of Microfossils.
6. Description and Demarcation of important Geoheritage Sites i.e. Geo-parks, Geo-tourism, Geo-marvels, Geo-monuments etc. in Outline Map of India.

Sessional Marks : 15

Department of Geology
Govt. Holkar [Model, Autonomous] Science College, INDORE, M.P.
Academic Session: 2021 - 22

Class: M. Sc. III Sem

Subject: Geology **Paper: I**

Title of Paper: Economic Geology **Code of the Paper: G31**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G31	
Course Objectives	The objective of this course is to give complete knowledge about economically useful metallic and nonmetallic industrial minerals, rocks, mineral fuels and fossil fuels. Objective is to impart knowledge about the primary and secondary processes, mode of occurrence, uses, specifications of industrial minerals, geological and geographical distribution of minerals in the country.
Course Learning Outcomes	1. The student will gain knowledge of different aspects of mineralising fluid and physical and chemical principles of mineral and ore deposition. primary processes of mineral deposits foramation.
	2. In-depth explanation is given to understand primary processes of formation of mineral deposit. Form size, texture, structure and mineral assemblages of the genetic groups of minerals.
	3. Be able to gain knowledge about ore minerals, Origin, mode of occurrence, association, economic uses, geological distribution and Indian occurrences of the minerals of important ores.
	4. Be able to understand mineralogy, origin, mode of occurrences, association, geologicaldistribution and Indian occurrences, and economic uses of important nonmetallic and industrial minerals of India.
	5. The students will gain knowledge about all aspects of fossil fuels: liquid and gaseous hydrocarbons and coal,Geology of productive coal and oil fields of India. Be able to know about geological aspects of atomic minerals and their deposits in Indiaand Nuclear power stations of the country and future prospects.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Introduction : Ore Gangue and mineral deposits, physical and chemical behaviour of mineralising fluid. Migration and accumulation of minerals, Metals, Fuel. Physical and chemical principles of ore deposition.
Unit-II	Processes of formation of mineral and ore deposits, classification of processes of ore deposition. primary processes, magmatic processes, pegmatitic and pneumatolitic processes, contact metasomatism and ore deposition, Hydrothermal and zones of mineral deposits (Hydrothermal, Mesothermal and Epithermal). Form size, texture, structure and mineral assemblages of the above genetic groups of minerals.
Unit-III	Metallic ore deposits and their study with reference to (i) Mode of occurrence, (ii) Association, (iii) Distribution in India, (iv) Specification and uses of the following - Iron, Manganese, Chromium, Nickel, Copper, Lead, Zinc, Aluminium, Tin, Tungsten, Gold and Silver.
Unit-IV	Origin, mode of occurrence, association, specification and grades for uses in industries and Indian occurrences of the following Non metallic minerals :

	Mica, Vermiculite, Asbetos, Barytes, Gypsum, Kyanite, Beryl, Magnesite, Talc, Graphite, Fluorite, Ochres, Corundum and Diamond. Introduction to Coal, Types of Coal, Origin of coal, Indian and International classification of coal, Geology of productive Coal and Lignite fields of India. Distribution of coal in India. Coal Bed Methane.
Unit-V	Introduction to liquid and gaseous hydrocarbons. Origin, Migration and Accumulation (Oil traps) of petroleum and natural gas. Distribution of petroliferous basins of India. Geology of productive oil fields of India. Atomic minerals: mode of occurrence, association and distribution in India. Nuclear power stations of the country and future prospects.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings

1. Economic Mineral Deposits - M. Bateman
2. India's Mineral Resources - S. Krishnaswamy
3. Ore Geology and Industrial Minerals - A. M. Evans
4. Minerals of India - D. N. Wadia
5. Industrial Minerals and Rocks of India - S. Deb
6. Gold in India - B. P. Radhakrishnan, L. C. Curtis
7. Diamonds in India - T. M. Babu
8. Gems and Gem Industry in India - R.V. Karanth
9. Ore Deposits - K.V. G. K. Gokhale, T. G. Rao
10. Petroleum Geology - F. K. North
11. An Introduction to Coal Preparation Practice - G. G. Sarkar
12. Economic Geology - Umeshwar Prasad

DEPARTMENT OF GEOLOGY

Class: M. Sc. III Sem

Subject: Geology **Paper: II**

Title of Paper: Mineral Exploration **Code of the Paper: G32**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G32	
Course Objectives	The objective of this course is to give complete knowledge about sequence of mineral exploration and various techniques used in mineral exploration. Objective is to impart knowledge about reconnaissance, geological mapping, geophysical and geochemical methods of mineral exploration and drilling investigation carried out during exploration.
Course Learning Outcomes	1. Student can learn proper mineral sampling method. With the knowledge of Assay value calculation, Mineral reserve computation and Classification, student learn qualitative measurement, quantity determination etc. about the mineralization.
	2. Student will able to understand the sequences of Mineral Exploration program.Student can learn about the Reconnaissance and Detailed geological mapping, Students also learn how such mineralization can be prospected.
	3. With the knowledge of geochemistry student will able to understand the various methods of Geochemical exploration.
	4. Various Geophysical practices have proved indispensable for hidden mineral deposits and in the areas of scanty exposures. Student will gain knowledge about the latest Geophysical mineral exploration techniques.
	5. After the study and interpretation of different Exploration techniques, finally Drilling investigations are carried out to delineate the sub-surface mineral body. Student will gain knowledge and able to understand the various drilling methods.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Guides for Mineral search. Principles of sampling, Sampling of surface exposures, mine working and drill-hole sampling. Channel sampling, Chip sampling, Bulk sampling, Placer sampling and other sampling methods. Setting sample patterns, Sample records. Averaging assays. Calculation of Grade and Tonnage. Methods of Ore reserve Calculation. Classification of Mineral Reserves.
Unit-II	Geological prospecting and exploration. Sequences in mineral exploration - Reconnaissance and data recording, Airborne and satellite imagery. Mapping of surface geology. Detailed geological prospecting by Pits, Trenches, Shafts, Tunnels, Drilling. Prospecting for Placer deposits.
Unit-III	Geochemical prospecting for Matallic mineral deposits. Principles of Dispersion of Elements. Path-finder elements. Geochemical survey - Soil, Rock and Vegetation surveys. Geobotanical methods. Geochemical techniques for Petroleum and Natural Gas exploration. Some case studies related to Geochemical exploration.
Unit-IV	Geophysical practices in mineral exploration – Gravity, Magnetic, Electrical, Electromagnetic. Induced Polarization, Seismic, Radiometric and Thermal methods. Borehole Geophysics and Tomography. Well logging methods. Geophysical Mapping. Geophysical exploration for

	Base-metals, Radioactive Minerals and Groundwater.
Unit-V	Drilling in exploration: Types of Drilling - Churn drilling, Diamond drilling. Deviation of Boreholes. Geologist's duties at Drill site. Choice of a drilling method. Drill-hole Sampling and Reduction. Drill-hole Patterns and Sequences. Bore-hole planning for exploration.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

1. Introduction to Geophysical Prospecting - M. B. Dobrin
2. Principles of Applied Geophysics - B. S. Parasnis.
3. Exploration and Mining Geology - William C. Peters
4. Drilling Technology Hand book - Chugh
5. Encyclopedia of Applied Geology - Finkal
6. Geological Prospecting and Exploration - B. M. Kreiter
7. Geophysical Practice in Mineral Exploration and Mapping - T. S. Ramakrishna
8. Practical Manual of Exploration and Prospecting - S. K. Babu, D. K. Sinha
9. Handbook of Mineral Exploration and Ore Petrology : Techniques and Applications – R. Dhana Raju
10. Handbook of Geochemistry : Techniques and Applications in Mineral Exploration – R. Dhana Raju
11. Geophysical Mapping in Mineral Exploration and Mapping – T. S. Ramakrishna

DEPARTMENT OF GEOLOGY

Class: M. Sc. I Sem

Subject: Geology **Paper: III**

Title of Paper Photogeology and Remote Sensing (Elective - 1) **Code of the Paper: G33A**

Max. Marks : 75 **Credits: 04**

Part A : Introduction for code-G33A	
Course Objectives	The objective of this course is to give complete knowledge about the techniques of remote sensing as well as aerial photo and satellite image interpretation. Objective is to impart knowledge about remote sensing platforms and sensors, geological and geomorphological interpretation and application of photogeology and remote sensing techniques in mineral and groundwater exploration.
Course Learning Outcomes	1. The student will gain knowledge of the fundamental principles and techniques of Remote Sensing.
	2. Student will learn about the different types of Remote Sensing platforms and sensors.
	3. Student will learn to interpret geology, geomorphology and geological structures from the aerial photographs and satelite images.
	4. Student will also learn how to use the Remotely Sensed data for Mineral exploration and Groundwater exploration.
	5. Student will also learn how to use the Remotely Sensed data for preparing Landuse and Landcover maps.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Definition of photogeology and aerial photography. Advantages and limitations of photogeology. Types of aerial photographs and their applications. Fundamental principles and techniques in aerial photography. Types of aerial cameras. Factors affecting aerial photography. Planning of aerial phtography and flight procedures. Scale of aerial photographs.
Unit-II	Annotations of aerial photographs. Flight strips and mosaics. Stereoscopic vision. Different types of viewing instruments. Vertical exaggeration. Elements of photogrammetry, relief displacement, image parallax, and parallax measurement. Measurement of height, dip and thickness of strata from the aerial photographs by parallax instrument. Orthophotographs.
Unit-III	Basic concepts of remote sensing. Advantages and limitations of remote sensing. Electromagnetic spectrum and radiation principles. Interaction of electromagnetic radiations with the atmosphere and the earth's surface. Spectral signatures, spectral bands, and atmospheric windows. Remote Sensing systems - Active and Passive remote sensing. Remote sensing sensors multi-spectrum scanners, thermal scanners, and microwave scanners. Important characteristics of Indian remote sensing satellite (IRS series).
Unit-IV	Principles of Visual interpretation techniques of aerial photos and satellite imagery. Instruments required for visual interpretation of satellite imagery. Interpretation of Aerial photos and Multispectral, Thermal, SLAR and SAR imagery. Interpretation of geology,

	geomorphology and structures from aerial photographs and satellite imagery.
Unit-V	Applications of Photogeology and Remote sensing in mineral exploration and ground water exploration, engineering project and land use / land cover mapping.

Part C: -Learning Resources

Text Book, Reference Books, Other resources

1. Principles and Applications of Photogeology - S. M. Pandey.
2. Textbook of Remote Sensing - C. S. Agrawal and P. K. Garg.
3. Elements of Photogrammetry - P. R. Wolf.
4. Photogeology and Regional Mapping - J. A. E. Allum.
5. Handbook of Aerial Photography and Interpretation - K. K. Rampal.
6. Interpretation of Air photos and Remotely Sensed Imagery - Robert H. Arnold.
7. Fundamentals of Remote Sensing and Air Photo Interpretation - Thomas Avery, Gradon Lennis.
8. Remote Sensing and Image Interpretation -Thomas M. Lillesand, R. W. Kiefer.
9. Aerial Photography and Image Interpretation for Resource Management - D. P. Paine.
10. Photogeology - V. C. Miller.

DEPARTMENT OF GEOLOGY

Class: M. Sc. I Sem

Subject: Geology **Paper: III B**

Title of Paper: Computer Applications in Geology (Elective - 1) **Code of the Paper: G33B**

Max. Marks: 75 **Credits: 04**

Part A : Introduction for code-G33 B	
Course Objectives	The objective of this course is to give knowledge about the basics of computer operating system, hardware and types computer software. Objective is to impart general knowledge about computer programming languages, database management system and applications of computers in geological studies.
Course Learning Outcomes	1. Student will learn about eh fundamental concepts about computer and operating system.
	2. Student will learn about the hardware and peripheral devices and also about the types of computer software.
	3. Student will gain a general idea about programming languages, interpreters and compiler. He will also learn about MS-DOS and Windows operating system.
	4. Student will learn the basics of computer programming using Visual Basic and C++ and Visual basic.
	5. Student will learn about the popular database management systems like Oracle and will also learn about the applications of computers in geological studies.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Introduction to computers. Structure of computer. Hardware and software components. Classification and types of computers. Capabilities and limitations of computers. Computer organization.
Unit-II	General working of computer. Input and output devices, magnetic media devices, optical devices. Printers. Keyboard device. VDU, Scanners and digitizers, plotter. Types of Software.
Unit-III	Computer languages. Number system. ASCII. Machine language, high level language. Assembler. Interpreter. Compilers. Flowchart. Decision Table. Algorithms. MS-DOS, Windows, MS- Office.
Unit-IV	Basic programming concept. Variable constants, procedures, conditional statements and loops. Visual Basic, C++, DBMS and Oracle.
Unit-V	Computer applications for various geological studies. Preparation of contour maps by surfer. Graphical interpretations. GIS overview.
Part C :-Learning Resources	
Text Book , Reference Books, Other resources	

DEPARTMENT OF GEOLOGY

Class: M. Sc. III Sem

Subject: Geology **Paper: IV**

Title of Paper: Hydrogeology (Elective - 2) **Code of the Paper: G34A**

Max. Marks: 75 **Credits : 04**

Part A: Introduction for code-G34 A	
Course Objectives	The objective of this course is to give complete knowledge about groundwater geology Objective is to impart knowledge about hydrological properties of rocks, occurrence and distribution of ground water, aquifer and its types, quality of ground water, artificial recharge methods of groundwater and about saline water intrusion.
Course Learning Outcomes	1. The student will learn knowledge about the hydrogeology and their various parameters and also know how water gets into ground (recharge), how its flow in the subsurface and how ground water interacts with the surrounding soil and rocks.
	2. Student will understand the different Hydrological properties of rocks. They understand and finding solutions of water problems in the Earth surface. Student know about aquifers and their types.
	3. Gain knowledge about the quality and quantity of surface water, ground water and their availability in various purposes. Student learns about different artificial recharge methods of groundwater.
	4. Student able to learn various water quality criteria for drinking purpose and irrigation purpose and also know how to plot chemical data on Graph and their importance.
	5. Gain knowledge about a problem of saline water intrusion in coastal area and they know about how to control the sea water intrusion and their management.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Scope and Importance of Hydrogeology; Groundwater in the Hydrologic Cycle; Hydro meteorological Properties: Precipitation, Evaporation, Infiltration and Runoff and their determination. Occurrence of Groundwater: Origin and Age of Groundwater; Vertical distribution of Groundwater: Zone of aeration and Zone of saturation.
Unit-II	Hydrological properties of Rocks : Porosity, Permeability, Specific yield, Specific retention, Storage coefficient and their determination. Types of Aquifers: Unconfined, Confined, Perched and Leaky aquifer. Geological formations as aquifer in: Alluvial Deposits, Igneous, Sedimentary and Metamorphic rocks.
Unit-III	Darcy's law and its range of validity; Method of pumping tests and analysis of test data. Water level fluctuations; Ground Water flow in Confined, Unconfined and Radial. Ground Water

	Steady, Unsteady and Radial flaw in confined and unconfined aquifers. Ground Water flow directions - flow nets, flow in relation to ground water contours, Water table contour maps. Ground water exploration methods.
Unit-IV	Chemical composition of Ground Water, Ground Water Quality – Physical Characters, Chemical and Biological Characters. Water Quality Criteria for Drinking water, Water quality Standards. Water quality criteria for Irrigational purpose and Classification of Irrigation water. Graphical representation of Chemical data of water samples, Ground water Pollution.
Unit-V	Occurrence of Saline water intrusion in coastal aquifers, Control of sea water intrusion. Water logging - its causes and remedial measures. Conjunctive use of surface and ground Water. Artificial recharge of Groundwater. Concept of Rain water Harvesting, Ground water management in Urban and Rural areas.

Part C:-Learning Resources

Text Book , Reference Books, Other resources

1. Ground Water Hydrology - David keith Todd and Larry W. May's
2. Applied Hydrology - Mutreja
3. Hydrology – H. M. Raghunath
4. Ground Water and Tube Wells - S.P. Garg
5. Hydrogeology - K.R. Karanth
6. Introduction to Hydrology - Warren Viessman Jr. Gary L. Lewis, John W. Knapp.
7. Applied Hydrogeology - C.W. Fetter
8. Hydrogeology - S.N. Davies and De Wiest.
9. Ground Water - R.A. Freeze. J.A. Cherry.

DEPARTMENT OF GEOLOGY

Class: M. Sc. III Sem

Subject: Geology **Paper: IV**

Title of Paper: Engineering Geology and Geotechniques (Elective - 2) **Code of the Paper: G34 B**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G34 B	
Course Objectives	The objective of this course is to give complete knowledge about Engineering geology, geotechnical investigations, and interpretations forsite selection of civil engineering projects. Objective is to impart knowledge about engineering properties of soil and rocks, seismic zoning, and design of engineering projects, as well as field and laboratory techniques of geological investigations.
Course Learning Outcomes	1. Student will understand the importance of geological studies in civil engineering projects.
	2. Student will learn the importance of the engineering properties of soils and rocks.
	3. Student will also learn how to do the geological investigations for site selection of civil engineering projects.
	4. Student will also learn the importance of seismic zoning and its relation to design of buildings and other engineering projects.
	5. Student will learn about the various field and laboratory techniques used for investigations in engineering projects.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Scope of Geology in Civil engineering. Engineering geological investigations for civil engineering projects. Engineering properties of rocks and soils. Soil classification. Physical characters of building stones, metal and concrete aggregates; Use of remote sensing in Engineering Geology.
Unit-II	Preliminary geological investigations for the various engineering projects : Dams, Reservoirs, Hydroelectric power projects and Bridges. Geological and Engineering details of major Dams and Bridges of India.
Unit-III	Geological investigations for the various engineering projects : Tunnels, Highways, Pipelines and Airfield engineering. Causes for mishaps and failures of these engineering projects.
Unit-IV	Mass movements with special emphasis on landslides and cause of hill-slope instability; Earthquake and seismicity, Seismic zones of India, Aseismic design of building; Influence of geological conditions on foundation and design of buildings.

Unit-V	Geophysical methods for the selection of engineering sites; Exploratory drilling, study and construction of subsurface sections based upon drilling data; Core logging: core recovery, preservation of cores, R.Q.D. analyses; Preparation and presentation of geotechnical reports.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

1. Engineering Properties of Soils and Rocks - Bell, F.G. (1981) Butterworths Publication, London.
2. Fundamentals of Engineering Geology - Bell, F.G. (1993) Butterworths Publication, London.
3. Physical and Engineering Geology (6th Ed.) - Garg, S. K. (2009) Khanna Publishers, New Delhi.
4. Engineering Geology: Case Histories, Geological Survey of India (1975), Misc. Publ., No. 29.
5. Text Book of Engineering Geology - Gupte, R. B. (2002) Vidyarthi Griha Prakashan, Pune.
6. An Introduction to Geophysical Exploration (3rd Ed.) - Keary, P., Brooks, M. and Hill, I. (2002) Blackwell.
7. Text Book of Engineering Geology (2nd Ed.) - Kesavulu, N. C. (2009) MacMillan Publishers India Ltd.
8. Principles of Engineering Geology and Geotechnics - Krynine, D. P. and Judd, W.R. (1998) CBS Publishers & Distributors, New Delhi.
9. Engineering Geology for Civil Engineering - Reddy, D.V. (1998) Oxford & IBH Pub.Co. Pvt. Ltd., Delhi.
10. The Geological Interpretation of Well Logs (Rev. Ed.) - Rider, M.H. (1986) Whittles Publishing, Caithness.
11. Elements of Engineering Geology (2nd Ed.) - Ries, H. and Watson, T.L. (1947) John Wiley & Sons, New York.
12. Geology in Engineering - Schultz, J.R. and Cleaves, A.B. (1951) John Willey and Sons, New York.
13. Engineering and General Geology - Singh, P. (1994) S.K. Kataria and Sons, Delhi.
14. Applied Geophysics - Telford, W.M., Geldart, L.P., Sherrif, R.E. and Keys, D.A. (1976) Cambridge Univ. Press.
15. Rock Mechanics for Engineers (3rd Ed.) - Verma, B.P. (1997) Khanna Publishers, New Delhi.
16. Rock Mechanics: Theory and Applications with case Histories - Wittke, Walter (1990). Springer – Verlag Publication.

DEPARTMENT OF GEOLOGY

Class: M. Sc. III Sem

Subject: Geology **Paper:**

Title of Paper: Remote Sensing (Open Elective Paper) **Code of the Paper: G35**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G35	
Course Objectives	The objective of this course is to give complete knowledge about the fundamentals of remote sensing. Objective is to impart knowledge about remote sensing platforms and sensors and fundamentals of image interpretation and applications of remote sensing. One of the objective is also to make the students aware of Geographic information system.
Course Learning Outcomes	1. The student will gain knowledge of the fundamental principles and techniques of Remote Sensing.
	2. Student will learn about the fundamental techniques of Aerial photography.
	3. Students will learn about Remote Sensing Platforms and sensors.
	4. Student will learn about image interpretation techniques.
	5. Student will also learn about types of maps, applications of Remote Sensing and fundamentals of GIS.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Overview of Remote Sensing : Definition of terms, Concepts and types of remote sensing, Electromagnetic Radiation, Radiometric Terms and Definitions, Radiation Laws, EM Spectrum, Sources of EMR, Interactions of EM Radiation with atmosphere and target, Atmospheric windows, Imaging Spectrometry: Spectral signature for various land cover feature.
Unit-II	Photogrammetry fundamentals: Optics, Aerial Cameras (Metric and Non metric)camera, Types of photographs (vertical, tilted, oblique) Definitions, Geometry of aerial photographs (Fiducial marks, Principle point, nadir point, focal length, flying height, tilt of photograph, Stereoscopy, Scale of aerial photograph (Definition, scale of Map Vs. Scale of Photo. Relief displacement. Orthophoto.
Unit-III	Platforms: Types of platforms - ground, airborne and space borne platforms. Sensors-Types and classification of Sensors, Imaging modes, Characteristics of optical sensors, Sensor resolution- spectral, spatial, radiometric and temporal. Sources of RS data, Global and Indian data products.
Unit-IV	Visual image Interpretation: Principles of visual Interpretation of aerial photos and satellite imagery, Recognition Elements and Interpretation keys for Visual Interpretation, Techniques of Visual Interpretation and Basic Interpretation Equipment, Interpretation of Multispectral Imagery.
Unit-V	Types of maps : Topographic and thematic maps, basic characteristics of map, cartographic representation of geographic objects, elementary idea about image processing. Applications of

	Remote Sensing. Elementary idea about Geographic Information system (GIS).

Part C:-Learning Resources

Text Book, Reference Books, Other resources

1. Principles and Applications of Photogeology - *S. M. Pandey.*
2. Text Book of Remote Sensing - *C. S. Agrawal and P. K. Garg.*
3. Elements of Photogrammetry - *P. R. Wolf.*
4. Photogeology and Regional Mapping - *J. A. E. Allum.*
5. Handbook of Aerial Photography and Interpretation - *K. K. Rampal.*
6. Interpretation of Air photos and Remotely Sensed Imagery - *Robert H. Arnold.*
7. Fundamentals of Remote Sensing and Air Photo Interpretation – *Thomas Avery, Gradon Lennis.*
8. Remote Sensing and Image Interpretation - *Thomas M. Lillesand, R. W. Kiefer.*
9. Aerial Photography and Image Interpretation for Resource Management - *D. P. Paine.*
10. Photogeology - *V. C. Miller.*

Department of Geology
Govt. Holkar [Model, Autonomous] Science College, INDORE, M.P.
Academic Session : 2021 - 22

M.Sc. - III Semester [Based on CBCS]
GEOLOGY

Practical Examinations:

Practical – 05 : Economic Geology & Mineral Exploration

Max. Marks : 75 Credits : 3

Study and comment on various genetic group of deposits based on texture, structure and association.

1. Determination of mineral formula and ore mineral species on the basis of chemical analytical data.
2. Study of industrial minerals with reference to grade, specification, uses and distribution.
3. Geographic and Geological distribution of economic mineral deposits in Outline Map of India and World.
4. Geographic distribution of mineral based industries in Outline Map of India.
5. Study of finished products related to metallic and industrial minerals.
6. Assay value and Mineral Reserve calculations.

Sessional Marks : 15

Practical – 06 : Internship/Field work and practical Based on Elective Paper (Photogeology & Remote Sensing/Computer Applications in Geology/Hydrogeology/ Engineering Geology & Geotechniques)

Max. Marks : 75 **Credits : 3**

Photogeology and Remote Sensing :

1. Study of stereoscopic test vision chart.
2. Determination of stereoscopic constant.
3. Transfer of principal points on tracing sheet from aerial photographs.
4. Plotting of fight direction.
5. Determination of height. dips and thickness of strata on aerial photographs using parallax bar.
6. Calculation of number of photographs covering an area.
7. Determination of relief displacement.
8. Determination of scale of aerial photographs.
9. Study and interpretation of aerial stereo - Pairs for geology, geomorphology and structure.
10. Study of annotations on satellite imagery.
11. Determination of Scale of imagery.
12. Identification and tracing of various cultural features on the satellite imagery.
13. Estimation of dips and slopes.
14. Study and interpretation of satellite imagery for geology, geomorphology and structures.

15. Preparation of Land use / Land cover map.

Computer Applications in Geology:

1. Parts of computer
2. Operating system basics –file naming, file management and data transfer
3. Programming basics –using c language. Programme structure, variable naming and types, decision and loops.
4. Exposure to software for Geology – Surfer, QGIS.

Engineering Geology and Geotechniques:

1. Study of engineering properties of rocks/ soil with reference to their use in engineering projects.
2. Study of models and maps of important engineering structures such as tunnels and dams;
3. Interpretation of geological maps for various engineering geology projects, Preparation of subsurface sections based on drilling data.
4. Geographic distribution of Important Engineering Projects [as Dams, Tunnels, Bridges, Highways, Pipelines etc.] in Outline Map of India.

Hydrogeology:

1. Preparation of water table contour maps by given depth to bed rocks.
2. Delineation of hydrological boundaries on water table contour maps.
3. Chemical analysis for Alkanity, Acidity, pH and Electrical conductivity of water Samples.
4. Classification of ground water for domestic and irrigation purposes.
5. Graphical representation of chemical analysis data.
6. Calculation of porosity, specific yield, specific retention and ground water storage.
7. Calculation of specific capacity of well.
8. Interpretation of resistivity survey data and preparation of curves.
9. With the help of pumping test data, calculation of transmissibility and storage coefficient of aquifer.
10. Determination of aquifer characteristics with the help of mechanical analysis data.

Sessional Marks: 15

Department of Geology
Govt. Holkar [Model, Autonomous] Science College, INDORE, M.P.
Academic Session: 2021 - 22

Class: M. Sc. IV Sem

Subject: Geology **Paper: I**

Title of Paper: Ore Geology **Code of the Paper: G41**

Max. Marks: 75 **Credits: 04**

Part A: Introduction for code-G41	
Course Objectives	The objective of this course is to give complete knowledge about various aspects of ore geology. Objective is to impart knowledge about the geological processes of ore formation, ore microscopy, mode of occurrence, uses, specifications of industrial minerals, concept of mineral economics, National mineral policy and war related strategic, essential, critical minerals.
Course Learning Outcomes	1. The student will gain knowledge about the different aspects of ore genesis, geothermobarometric, paragenesis and zoning and learns about metallogenetic provinces and epochs with special reference to India.
	2. Student will able to understand secondary processes of formation of mineral deposits with relevant examples of Indian mineral deposits.
	3. Study of ore microscopy enable students to understand the concept of ore microscopy, ore textures and optical properties of ore minerals under reflected light. Gain knowledge about significance of ore microscopy in ore genesis and ore beneficiation.
	4. Be able to understand origin, mode of occurrences, association, specification, grades of non-metallic minerals used in various industries namely cement, fertilizer, abrasive, paint pigments, glass and refractory industry.
	5. Study of mineral economics, national mineral policy and mineral concession rules enable students to understand that how minerals play vital role in economy of country. Student will learn about significance of minerals for a nation in defense and war in terms of strategic, critical and essential minerals.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Classification of ore deposits, controls of mineral and ore deposition (chemical, mineralogical, structural, stratigraphic). Geothermobarometric. Paragenesis and zoning in mineral deposits metallogenetic provinces and epochs with Indian examples.
Unit-II	Secondary processes of ore formation: 1. Metamorphic Processes (Regional / Contact) 2. Sedimentary processes (Sedimentary, Evaporation, Placer formation) 3. Oxidation and supergene enrichment of sulphides ; Forms, size, textures, structures and mineral assemblages of the above genetic groups of minerals.

Unit-III	Ore petrology - Introduction, Optical properties of minerals, Texture, structures and Paragenesis. Study of ore minerals of copper, iron, lead, zinc, maganese, nickel and aluminium under ore microscope.
Unit-IV	Study of the following minerals with special reference to mode of occurrence, association, distribution, specification and uses of- Minerals used as abrasives. Minerals and materials used in the cement and building construction. Minerals used in the fertilizer industry. Minerals used in the Refractory Industry. Minerals used in the Glass industry. Minerals used in the chemical, paints and pigment industries.
Unit-V	Mineral economics - Introduction, national mineral policy, significance of mineral in the national economy. Principles of mineral economics (Demand, supply and substitutes). Fundamental mineral concession rules of India. Strategic, critical and essential minerals. Production and price of major minerals in India.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings

1. Mineral Economics - *R. K. Sinha and N. L. Sharma*
2. Some Aspects of Mineral Development in India - *K.V. Subbarao, D. Rajasekhar Reddy*
3. Ore Petrology - *R L. Stanton*
4. Geology of Mineral Deposits - *V. I. Smirnov*
5. Ore Microscopy and Ore Petrography - *J. R. Craig, D. J. Vanghan*
6. A Treatise on Industrial Minerals of India - *R. K. Sinha*
7. Ore Deposits - *Park and MacDiarmid.*
8. Economic Mineral Deposits - *M. Bateman*
9. Introduction to Ore Microscopy - *J. P. Shrivastava and Nishi Rani*

DEPARTMENT OF GEOLOGY

Class: M. Sc. IV Sem

Subject: Geology **Paper: II**

Title of Paper: Applied Geology **Code of the Paper: G42**

Max. Marks : 75 **Credits : 04**

Part A : Introduction for code-G42	
Course Objectives	The objective of this course is to impart complete knowledge about applied aspects of Geology. Objective is to give knowledge about the application of Geological know how in the mineral exploration, in the mining operations, in the site selection of civil engineering projects, in groundwater geology, in environmental geology and study of remote sensing and GIS.
Course Learning Outcomes	1. Students will gain knowledge about the Prospecting, Exploration, Quality and Quantity evaluation of mineral deposits, Exploitation and various open cast and underground mining methods.
	2. Students can learn various Coal mining methods, Underground Geological Mapping, Students will gain idea about the different methods of mineral Dressing and stages of mineral Concentration.
	3. Students get know about engineering properties of Rocks and Soil etc. Students also learn whether the proposed site for Engineering is Topographically, Lithologically, Structurally, environmentally is suitable and socially viable or not.
	4. Students will be able to gain knowledge of Groundwater Geology, Hydrological properties of rocks and Groundwater Exploration techniques. Will also know about Groundwater Provinces and Zones of India. Students will also gain knowledge about Environmental Geology.
	5. Remote Sensing and GIS are the advanced tools used in most of the sectors including Geology. Students will gain Basic knowledge, advantages and limitations of Remote Sensing. GIS is integral part of remotesensing hence students can learn general idea about GIS and popular GIS software's.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Mining methods - Introduction to Mine Openings, Mine Supports. Methods of Breaking Rocks. Mine atmosphere and Ventilation. Alluvial Mining and Open cast mining methods. Underground mining methods-Gophering, Breast stopping, Underhand and Overhand stopping, Glory-hole method.
Unit-II	Coal mining methods. Underground geological mapping and Assembling mine Geological data. Principles of Mineral dressing and Methods of Ore concentration. Flow-charts of Ore dressing for Iron, Manganese, Gold, Copper and Phosphorite in India.
Unit-III	Engineering Geology : Engineering properties of Rocks and Soil. Geologists' role at Engineering Projects. Engineering Geology of Dam sites, Tunnels, Canals, Highways and Bridges. Engineering Geology in Mining.
Unit-IV	**Groundwater:** Hydrological properties of Soils and Rocks. Hydrological Cycle and its implicationsof Wells their Design and Construction. Exploration of Groundwater .Groundwater Provinces of India.

	Environmental Geology: Fundamentals of Environmental Geology, Geological Hazards - Landslides and their Protection. Problems related to volcanic activities, Earthquakes and Floods. Human impacts on Soil, Groundwater, Vegetation and Environment.
Unit-V	Basic concepts of Remote Sensing. Advantages and Limitations of Remote Sensing. Electromagnetic Spectrum and Radiation principles. Interaction of Electromagnetic Radiations with the Atmosphere and the Earth's surface. Remote Sensing Sensors. Indian Remote Sensing Satellites. Applications of Remote Sensing. Fundamentals of GPS. General idea about GIS. Popular GIS software.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

1. Mining Geology - *R.N.P. Arogyaswamy.*
2. Applied Hydrology - *Mutreja.*
3. Hydrology - *Raghunath.*
4. Ground water Hydrology - *David Keith Todd.*
5. Mining of Mineral Deposits - *L. Shevyakov.*
6. Geology for Engineers - *J. M. Trephehem.*
7. Ground water and Tube wells - *S. P. Garg.*
8. Geology and Engineering - *R. F. Legget.*
9. Hydrogeology - *K. R. Karanth.*
10. Principles of Engineering Geology and Geotechniques- *Kryning and Judd.*
11. Engineering Geology Principles and Practice - *David George.*
12. Environmental Geology - *Coates.*
13. Exploration and Environment - *P. K. Raman.*
14. Natural Resources and Environment - *V. Aswathanarayana.*
15. Engineering Geology – *D. Venkat Reddy*
16. Engineering and General Geology – *Parbin Singh*
17. Fundamentals of Geographic Information System - *Michael N. Demers*
18. Text Book of Remote Sensing - *C. S. Agrawal and P. K. Garg*

DEPARTMENT OF GEOLOGY

Class: M. Sc. IV Sem

Subject: Geology **Paper: III**

Title of Paper Environmental Geology (Elective -3) **Code of the Paper: G43 A**

Max. Marks: 75 **Credits: 04**

Part A : Introduction for code-G43A	
Course Objectives	The objective of this course is to impart complete knowledge about the various aspects of Environmental geology. Objective is to give knowledge about the natural and manmade environmental issues and problems related to Geology and application of remote sensing and GIS in environmental Geology and also give knowledge about watershed management.
Course Learning Outcomes	1. Student learns about various concepts of Environmental Geology and their scope and importance. Also gain knowledge about Global warming and environmental problems in India.
	2. Student able to understand environmental impact of large dam, River water disputes, mining, soil and land degradation etc. on environment.
	3. Student learns about Air, water and soil pollution and their environmental effects. They also understand natural hazards Earthquakes, volcanoes, floods, cyclones and Drought and their impact on environment.
	4. Student learns how to manage and control various natural and manmade induced hazards. They also understand the management of solid waste, wastewater etc.
	5. Student learns about application of Remote Sensing and Geographical Information System (GIS) in environmental geology. Student gain knowledge about watershed management, waste land reclamation, land use pattern, Rainwater Harvesting Techniques and different acts related to environmental protection and water pollution.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Concept of Environmental Geology: Scope and Importance of Environmental Geology. Environmental Problems in India; Global Warming its causes and effects on Environment.
Unit-II	Global and Indian Scenario of water Resources, Environmental impact of Large Dams; River water disputes; Impact of mining activities on environment; Causes of soil and land degradation and its impact on environment.
Unit-III	Air, Water and soil pollution and its environmental effects. Natural Hazards: Earthquakes, Volcanoes, Floods, Cyclones and Drought and their impact on environment. Nuclear Hazards and it impact on environment. Natural disaster reduction and management.
Unit-IV	Role of Individual in sustainable environmental management; Conservation and Management of natural resources; Man induced Hazards; Urban environmental problem causes and remedies: flooding and Runoff in cities, Solid waste management; Waste Water Management.
Unit-V	Application of Remote sensing and Geographical Information system (GIS) in environmental Geology. Watershed Management Technologies; Wasteland reclamation: Introduction, Land

	use pattern; Strategies for waste land development; Rainwater Harvesting Techniques; Environmental Protection acts and Water pollution Acts.

Part C:- Learning Resources	
Text Book, Reference Books, Other resources	
1. Environmental Geology	- *Errol G. Kelly*
2. Environmental Geology	- *Edward A. Keller*
3. Environmental Geology	- *Carla W. Montgomery*
4. The Dynamic Earth System	– *A. M. Patwardhan*
5. Geological Hazards	– *K.Smith*
6. Text Book in Environmental Science	– *V. Subramanyam*
7. Environmental Geology	- *K. S. Valdiya*
8. Introduction to Environmental Geology	– *Y. Anjaneyulu*
9. Environmental Science	– *Y. K. Singh*

DEPARTMENT OF GEOLOGY

Class: M. Sc. IV Sem

Subject: Geology **Paper: III B**

Title of Paper: Mineral Processing and Technology [Elective - 3] **Code of the Paper: G43 B**

Max. Marks: 75 **Credits: 04**

Part A: Introduction for code-G43 B	
Course Objectives	The objective of this course is to impart complete knowledge about mineral processing and beneficiation techniques. Objective is to give knowledge about the different mineral processing and mineral dressing methods, Crushing, separation, froth flotation methods and important beneficiation flow sheets of Indian mineral deposits.
Course Learning Outcomes	1. The student will gain knowledge about the different aspects of mineral processing and mineral technology and able to understand the significant physical and chemical characteristics of ore minerals and Industrial minerals which are significant in mineral processing.
	2. The student will gain significant knowledge about terminology in mineral processing and mineral dressing processes like Liberation, Comminution, Crushing, Grinding, Sizing.
	3. Be able to learn and understand the various mineral separation Processes like Gravity concentration methods, tabling, jigging, heavy media separation, sedimentation, dewatering techniques.
	4. The student will gain knowledge and understand about Forth Flotation, Magnetic separation and Electrostatic separation methods.
	5. Be able to know and understand the Beneficiation flow sheets of Indian deposits like Coal, Copper, Lead-Zinc, Iron and Rock Phosphate.

Part B: Content of the Course	
As per HE Syllabus	
Particulars	
Unit-I	Introduction and scope of mineral processing technology physical and chemical characteristics of ore minerals and Industrial minerals, Terminology in mineral/Processing.
Unit-II	Liberation, Comminution, Sizing and Classification: Liberation and its significance, comminution and sizing, lairs of comminution, Crushing and Grinding –types and equipment. Washing Sorting and hand picking, Laboratory and industrial Screening equipment, Classification – Mechanical and hydraulic, Sizing and Sorting classifiers – Mechanical and Hydraulic, Sizing and Sorting classifiers.
Unit-III	Mineral separation Processes: Gravity concentration methods, Tabling, Jigging, Heavy media separation, sedimentation, dewatering techniques, Thickener, Filtration and Drying.
Unit-IV	Forth Flotation: Physico-Chemical principles, reagents like – collectors, modifiers and frothers, Magnetic separation and Electrostatic separation.
Unit-V	Beneficiation flow sheets of Coal, Ores of Copper, Lead, Zinc, Iron, Rock Phosphate with reference to Indian deposits.
Part C:-Learning Resources	

Text Book, Reference Books, Other resources	
1. Principles of Mineral Dressing	– A.M. Gaudin
2. Mineral Processing Technology	– S.K. Jain
3. Extraction of Nonferrous metals	– H.S. Ray and K.P. Abraham
4. Experiments in Mineral Processing	– S. V. Venkatachalam

DEPARTMENT OF GEOLOGY

Class: M. Sc. IV Sem

Subject: Geology **Paper: IV**

Title of Paper: Fuel Geology [Elective - 4] **Code of the Paper: G44 A**

Max. Marks: 75 **Credits: 04**

Part A: Introduction for code-G44 A	
Course Objectives	The objective of this course is to give knowledge about mineral fuels and fossil fuels. Objective is to give knowledge about various geological aspects of the coal, hydrocarbon and radioactive atomic mineral deposits, geology of existing fossil fuel and atomic mineral deposits of India and mining methods used in coal exploitation.
Course Learning Outcomes	1. By the study of Coal, student will learn about the Physical and Chemical properties of Coal, also able to understand Coal Petrography and different theories related to Origin of Coal.
	2. Students will learn about the Indian and International classification of coal, Preparation practices for Washing, Carbonization, Gasification, Hydrogenation, and Briquetting of Coal.
	3. Study of surface and/or underground coal mining methods, students can also learn about mining procedure. Students will also gain knowledge of coal prospecting and about the Coal Bed Methane.
	4. Students will learn about the Origin, Migration and Accumulation of Liquid and Gaseous hydrocarbons. Students also learn about the Petroleum Geology of important Oil and Gas fields of India.
	5. Students can learn about the Geology of Radioactive minerals and associated rock types. Methods of Exploration for new atomic mineral deposits. Geology of existing atomic mineral deposits. Students will gain knowledge about nuclear power stations of India.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Physico-Chemical Characteristics of Coal. Proximate and Ultimate Analysis. Rank and Varieties of Coal. Macroscopic Ingredients and Microscopic Constituents. Origin of Coal.
Unit-II	Classification of Coal. Preparation of Coal for Washing. Carbonization, Gasification and Hydrogenation, Briquetting of Coal.
Unit-III	Geology and Structures of Productive Coalfields of India. Methods of Coal Prospecting. Estimation of Coal Reserve. Surface and Subsurface Methods of Coal Mining. Coal Bed Methane.
Unit-IV	Origin, Migration and Accumulation (Oil-traps) of Petroleum and Natural Gas. Kerozene. Geology and Structure of the Productive Oil Fields of India. Status of Oil and Natural Gas in India. Shale Gas. Gas Hydrates.
Unit-V	Atomic minerals: Mode of occurrence, Association and Geographical distribution in India. Methods of Prospecting. Productive Horizons in India. Nuclear Power Stations of the Country and Future Prospects.
Part C :-Learning Resources	

Text Book , Reference Books, Other resources
1. Dahlkamp, F.J., 1993: Uranium Ore Deposits. Springer Verlag 2. Durance, E.M., 1986: Radioactivity in Geology: Principles and Applications. 3. Ellis H. Holson GD and Tiratsoo, E.N., 1985: Introduction of petroleum Geology. Gulf Pub 4. Nettleton L.L.: Geophysical Prospecting for Oil 5. North F.K., 1985: Petroleum Geology. Allen and Unwin 6. Selley, R.C., 1998: Elements of Petroleum Geology. Academic Press 7. Singh, M.P.1998: Coal and Organic Petrology. Hindustan Publications ND 8. Tissot, B.P. and Welt, D.H., 1984: Petroleum Formation and Occurrence. Springer-Verlag 9. Coal Resources of India, 1971: Memoir of Geological Survey of India. 10. Diessel Claus F. K., 1992: Coal-Bearing Depositional Systems. Springer-Verlag 11. Singh, R. M., 1987 : Proceedings of National Seminar on Coal Resources of India. Department of Geology, Banaras Hindu University. 12. Chandra, D., 1989 : The Story of Coal. DevSahityaKutir Pvt. Ltd., Calcutta 13. Chandra, D., 1989 : The Story of Petroleum. DevSahityaKutir Pvt. Ltd., Calcutta 14. DhannaRaju, R., 2005: Radioactive Minerals. Geological Society of India, Bangalore. 15. Sarkar, G. G., 1986: An Introduction to Coal Preparation Practice. Oxford and IBH Publishing Co., Calcutta. 16. Acharyya, S. K., 2000: Coal and Lignite Resources of India : An Overview.Geological Society of India, Bangalore. 17. Pareek, H. S., 2008: Coal in India. Geological Society of India, Bangalore. 18. Acharyya, S. K. and Mukhopadhyay, G., 2014: Coal and Lignite Basins of India. Geological Society of India, Bangalore. 19. Levorsen, A. I., 1985: Geology of Petroleum. 20. Pareek, H. S., 2004: Progress of Coal Petrology in India. Memoir No. 57, Geological Society of India, Bangalore.

DEPARTMENT OF GEOLOGY

Class: M. Sc. IV Sem

Subject: Geology **Paper: IV**

Title of Paper: Project In House [Elective - 4] Course Code: G44B **Code of the Paper: G44 B**

Max. Marks : 75 **Credits: 04**

Part A : Introduction for code-G44 B	
Course Objectives	The objective of this course is to give geological field knowledge which includes geological mapping, sampling, geomorphological studies, mineralogical and geochemical analysis, petrographic studies. Objective is to learn research methodology and develop dissertation writing skill
Course Learning Outcomes	**Skills to be learned:** The student will gain knowledge and able to learn various geological aspects during field project and also understand basic knowledge of geological mapping and laboratory work.

Department of Geology
Govt. Holkar [Model, Autonomous] Science College, INDORE, M.P.
Academic Session: 2021 - 22
M.Sc. - IV Semester [Based on CBCS]
GEOLOGY

Practical Examinations:
Practical –07: Applied Geology, Ore Geology and Viva on Field Work

Max.Marks: 75 **Credits: 3**

1. Drilling log Problems, Correlation and Interpretation of Subsurface Data.
2. Interpretation of Geological maps for Engineering projects.
3. Study of Engineering and Hydrological properties of common rock types.
4. Geographical distribution of Important Engineering Projects [as Dams, Tunnels, Bridges, Highways, Pipelines etc.] in Outline Map of India.
5. Megascopic studies of Ore Minerals.
6. Ore-microscopic Studies of Polished Ore sections.
7. Viva Voce on Field Work.

Sessional Marks : 15

Practical –08 : Based on Elective papers of Environmental Geology/ Fuel Geology / Mineral Processing and Technology.

Max.Marks : 75 **Credits : 3**

Environmental Geology:

1. Marking of Seismic Zones and Epicenters in Outline Map of India.
2. Marking of different natural disasters in Outline Map of India and their Impacts on Environment.
3. Marking of Safe, Unsafe and Hazardous areas in Outline Map of India with respect to Fluoride, Arsenic, Lead-Zinc and other heavy metals.
4. Determination of Rainwater harvesting potentiality.

Fuel Geology :

1. Study and Identification of Varieties of Coal.
2. Study and Identification of Macro and Microlithotypes of Coal.
3. Determination of Fixed Carbon, Fuel Ratio, Calorific Value etc. on the basis of Proximate Analytical data.
4. Coal and Petroleum reserve estimation problems.
5. Marking of Coal fields and Coal Washeries, Petroleum Fields and Petroleum Refineries, Atomic Mineral Deposits and Nuclear Power Plants/Reactors, Headquarters of Organizations/Institutes etc. in the Outline Map of India.

Mineral Processing and Technology:

1. Study of different Mineral beneficiation Techniques/Processes and Machinery/equipment used in it.
2. Draw Flow-charts of beneficiation of Lead-Zinc, Copper, Iron, Manganese, Aluminium, Diamond, Radioactive minerals etc.
3. Draw Flow-charts of Smelting Techniques used in Metal Industries.
4. Draw Flow-charts of Limestone beneficiation and Cement manufacturing techniques.

Sessional Marks: 15

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Horticulture

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

GOVT. HOLKAR (MODELAUTONOMOUS) SCIENCE COLLEGE, INDORE
DEPARTMENT OF HORTICULTURE
Syllabus Session: 2021-22
Subject: Horticulture
Course Title -Fundamentals of Horticulture
B. Sc. I Semester (MAJOR)

Paragraph	Topics
I	Horticulture: Definition, Branches, Scope, Importance, History, Present status and Problems
	Inter relation of horticulture to agriculture, Apiculture,sericulture and other relevant disciplines of science
	Significance of horticulture to mankind.
II	Fruits- Types and importance of horticulture fruits.
	Seed definition- Types and different classes of horticultural seeds.
	Seed structure - Dicot and monocot
	Seed germination- Types and requirements for germination.
	Plant Hormones, their function.
III	Characteristics of good quality of seeds. Determination of seed quality.
	Factors effecting quality of seeds.
	Purity, Vigour, Viability and Factors effecting seed germination, Rouging, Isolation distance, Thinning procedures.
IV	Seed sowing methods.
	Irrigation systems and methods, water requirement for plant.
	Drainage- Objectives, system of drainage, Difference between irrigation and drainage.
	Manures- FYM, Compost, Green Manures.
	Bio-fertilizers- Basic concept of bio - fertilizer and growth promoting micro-organism.
V	Plant propagation-type, by seeds.
	Different types of vegetative propagations- Rooting, Cutting, and Layering. Graftage - grafting.
	Advantages and disadvantages of propagation by seeds and vegetative propagation in important crops.
	Visit to commercial nursery

Practical

1	Acquaintance with honey bee species, morphology, structural adaptation, biology-castes-bee keeping equipment, bee forage plants.
2	Mulberry- morphology and cultivation. Anatomy and biology of silk worm, rearing appliance and method of rearing, enemies and disease of silk worm.
3	Seed germination - Dicot and monocot.
4	Experiments based on different types of vegetative propagations- Cutting, Layering, budding, grafting, special propagating material.
5	Different protocols of seed germination.

Course Title -Horticulture Production
B.Sc. I Semester (MINOR)

Paragraph	Topics
I	High-tech Horticultural production (Micro-Irrigation, Protected Cultivation, Precision Farming, High Density Planting, Integrated Nutrient Management, Integrated Pest Management, Organic Farming) High-tech Horticultural production, Care & Hardening of plants.
II	Floriculture - Scope & importance, soil and climatic requirement and cultivation practices. Economics importance of greenhouse production of Gerbera, Carnation, Roses, Orchids. Propagation techniques, packing and marketing, enhancingand delaying period of bloom by special methods. Floral decoration, Florist shop management. Visit to Commercial green house.
III	Commercial Production - Commercial production of the following - in relation to propagation, post plantation care, harvesting, post-harvest management & varieties - Tuber-potato, Vegetable- Tomato, Fruits - Mango, Grapes and Coconut- products like coco peat/ Coir etc., Spice/condiment- chili. Medicinal plants- Aloe Vera, Stevia rebaurdiana (Madura), Aromatic plant- Citronella, Patchouli
IV	Post Harvesting Technology – Maturity-Factors responsible for maturity & ripening methods used for delaying ripening. Harvest-time of harvest, harvesting and handling of harvested products. Storage of fresh produce- Types of storage of fruits & vegetables Fruit & vegetables preservation technology. Marketing-grading, packing & transportation. Ways of increasing the market value and shelf life of horticultural produce.
V	Entrepreneurship in Horticulture - Horticultural business management and Entrepreneurshipdevelopment. Horticulture as a business - definition and nature,organization, planning and operation of Horticulture farm Business.

practical

S. No	Lab Assignments
1	Study of different horticulture tools.
2	Determine the Cost of establishment of a mist chamber,greenhouse, glass house, polyhouse and their maintenance.
3	Green house plants- information regarding to soil, temperature, irrigation, fertilizer requirements and propagation methods for anthurium, Gerbera, Orchids, Tuberose, Carnation, Rose, Capsicum.
4	Identification of important horticultural plants - Herbs, Shrubs, Trees, Climbers, Lianas, Epiphytes, Creepers, Aquatic plants, Succulents - foliage any 2 and flowering any 2.
5	Conducting market survey to the demand for product, preparing advertisements for popularization of product, news writing, preparing project proposals and individual, group presentation.
6	Study of preparing balance sheet, SWOT analysis of an enterprise, Visit to Successful Entrepreneur / enterprises and Preparation of project report, preparing balance sheet.
7	Identification of commercially important floricultural crops.

Course Title -Fundamentals of Horticulture

B. Sc. I Semester (Open elective)

Paragraph	Topics
I	Horticulture: Definition, Branches, Scope, Importance, History, Present status and Problems Inter relation of horticulture to agriculture. Apiculture,sericulture and other relevant disciplines of science Significance of horticulture to mankind.
II	Fruits- Types and importance of horticulture fruits. Seed definition- Types and different classes of horticultural seeds. Seed structure - Dicot and monocot Seed germination- Types and requirements for germination. Plant Hormones, their function.
III	Characteristics of good quality of seeds. Determination of seed quality. Factors effecting quality of seeds. Purity, Vigour, Viability and Factors effecting seed germination, Rouging, Isolation distance, Thinning procedures.
IV	Seed sowing methods. Irrigation systems and methods, water requirement for plant. Drainage- Objectives, system of drainage, Difference between irrigation and drainage. Manures- FYM, Compost, Green Manures. Bio-fertilizers- Basic concept of bio - fertilizer and growth promoting micro-organism.
V	Plant propagation-type, by seeds. Different types of vegetative propagations- Rooting, Cutting, and Layering. Graftage - grafting. Advantages and disadvantages of propagation by seeds and vegetative propagation in important crops. Visit to commercial nursery

S. No	Lab Assignments
1	Acquaintance with honey bee species, morphology, structural adaptation, biology-castes-bee keeping equipment, bee forage plants.
2	Mulberry- morphology and cultivation. Anatomy and biology of silk worm, rearing appliance and method of rearing, enemies and disease of silk worm.
3	Seed germination - Dicot and monocot.
4	Experiments based on different types of vegetative propagations- Cutting, Layering, budding, grafting, special propagating material.
5	Different protocols of seed germination.

Course Title -Horticulture Production
B.Sc. II Semester (Major)

Paragraph	Topics
I	High-tech Horticultural production (Micro-Irrigation, Protected Cultivation, Precision Farming, High Density Planting, Integrated Nutrient Management, Integrated Pest Management, Organic Farming) High-tech Horticultural production, Care & Hardening of plants.
II	Floriculture - Scope & importance, soil and climatic requirement and cultivation practices. Economics importance of greenhouse production of Gerbera Carnation, Roses, Orchids. Propagation techniques, packing and marketing, enhancingand delaying period of bloom by special methods. Floral decoration, Florist shop management. Visit to Commercial green house.
III	Commercial Production - Commercial production of the following - in relation to propagation, post plantation care, harvesting, post-harvest management & varieties - Tuber-potato, Vegetable- Tomato, Fruits - Mango, Grapes and Coconut- products like coco peat/ Coir etc., Spice/condiment- chili. Medicinal plants- Aloe Vera, Stevia rebaurdiana (Madura), Aromatic plant- Citronella, Patchouli
IV	Post Harvesting Technology – Maturity-Factors responsible for maturity & ripening methods used for delaying ripening. Harvest-time of harvest, harvesting and handling of harvested products. Storage of fresh produce- Types of storage of fruits & vegetables Fruit & vegetables preservation technology. Marketing-grading, packing & transportation. Ways of increasing the market value and shelf life of horticultural produce.
V	Entrepreneurship in Horticulture - Horticultural business management and Entrepreneurshipdevelopment. Horticulture as a business - definition and nature,organization, planning and operation of Horticulture farm Business.

S. No	Lab Assignments
1	Study of different horticulture tools.
2	Determine the Cost of establishment of a mist chamber,greenhouse, glass house, polyhouse and their maintenance.
3	Green house plants- information regarding to soil, temperature, irrigation, fertilizer requirements and propagation methods for anthurium, Gerbera, Orchids, Tuberose, Carnation, Rose, Capsicum.
4	Identification of important horticultural plants - Herbs, Shrubs, Trees, Climbers, Lianas, Epiphytes, Creepers, Aquatic plants, Succulents - foliage any 2 and flowering any 2.
5	Conducting market survey to the demand for product, preparing advertisements for popularization of product, news writing, preparing project proposals and individual, group presentation.
6	Study of preparing balance sheet, SWOT analysis of an enterprise, Visit to Successful Entrepreneur / enterprises and Preparation of project report, preparing balance sheet.
7	Identification of commercially important floricultural crops.

Course Title -Fundamentals of Horticulture

B. Sc. II Semester (Minore)

Paragraph	Topics
I	Horticulture: Definition, Branches, Scope, Importance, History, Present status and Problems
	Inter relation of horticulture to agriculture. Apiculture,sericulture and other relevant disciplines of science
	Significance of horticulture to mankind.
II	Fruits- Types and importance of horticulture fruits.
	Seed definition- Types and different classes of horticultural seeds.
	Seed structure - Dicot and monocot
	Seed germination- Types and requirements for germination.
	Plant Hormones, their function.
III	Characteristics of good quality of seeds.
	Determination of seed quality.
	Factors effecting quality of seeds.
	Purity, Vigour, Viability and Factors effecting seed germination, Rouging, Isolation distance, Thinning procedures.
IV	Seed sowing methods.
	Irrigation systems and methods, water requirement for plant.
	Drainage- Objectives, system of drainage, Difference between irrigation and drainage.
	Manures- FYM, Compost, Green Manures.
	Bio-fertilizers- Basic concept of bio - fertilizer and growth promoting micro-organism.
V	Plant propagation-type, by seeds.
	Different types of vegetative propagations- Rooting, Cutting, and Layering. Graftage - grafting.
	Advantages and disadvantages of propagation by seeds and vegetative propagation in important crops.
	Visit to commercial nursery

Practical

1	Acquaintance with honey bee species, morphology, structural adaptation, biology-castes-bee keeping equipment, bee forage plants.
2	Mulberry- morphology and cultivation. Anatomy and biology of silk worm, rearing appliance and method of rearing, enemies and disease of silk worm.
3	Seed germination - Dicot and monocot.
4	Experiments based on different types of vegetative propagations- Cutting, Layering, budding, grafting, special propagating material.
5	Different protocols of seed germination.

Commercial Horticulture Production technology (Open Elective)
B.Sc. II Semester

Paragraph	Topics
I	High-tech Horticultural production, Care & Hardening of plants.
II	Floriculture – Scope & importance, soil and climatic requirement and cultivation practices. Economics importance of greenhouse production of Gerbera, Roses, Orchids. Propagation techniques, packing and marketing,
III	Commercial Production - Commercial production of the following - in relation to propagation, post plantation care, harvesting, post-harvest management & varieties - Tuber- potato, Vegetable- Tomato, Fruits - Mango, Grapes and Coconut- products like coco peat/ Coir etc., Spice/condiment- chili.
IV	Post Harvesting Technology – Maturity-Factors responsible for maturity & ripening methods, Marketing-grading, packing & transportation.
V	Entrepreneurshipdevelopment. Horticulture as a business - definition and nature, organization, planning and operation of Horticulture farm Business.

Suggested Readings –

1. Kumar N. – 1997, Introduction to horticulture, Raj Laxmi Publications, Nagercoil.
2. Chandra R & M. Mishra – 2003, Micro propogation of horticulture crops, International book distribution Co. Lucknow.
3. Hartman, H.T.E. and Kester D.E.-1996 plant propogation principles and practices prentice hall of India ltd. New delhi.
4. Vijay Kumar Umrao – 2008, Horticulture terms definition and terminology, I.B.D. Publishers, dhradun.
5. Chatopadhyay P.K.-2001, Text book of pomology, Kalyani Publishers, New Delhi.
6. Jacob John, P. -2008, hand book of post harvest management of fruits and vegetables, K. Usha, Thakur etc, I.C.A.R. New Delhi.
7. Yadav p.k., Fruit production technology, International book distributers.
8. Mohd. Anis and Naseem Ahmad, Plant Tissue culture, propogation, conservation and crop improvement.
9. Biswas and Mukharjee, Text book of soil science, Mc. Graw Hill publications.
10. Parthsarthi, V.A. – 2001, Biotechnology of horticulture crops Vol.-1,2,3 Navprakash, Kolkata
11. Richard Bird, the kichan garden book, anees publish

GOVT. MODEL AUTONOMOUS HOLKAR SCIENCE COLLEGE, INDORE (M.P)

Syllabus 2020-2021

ACCORDING TO NEW PATTERN OF DEPT. OF HIGHER EDU. OF MP.

B.Sc. IInd Year, *HORTICULTURE*

Paper I – Establishment and management of orchard and nursery

Maximum Marks : 85

Unit-I

1. Orchard – Establishment of Orchard
   (a) Selection of site (b) Selection of fruit (c) Layout
   (d) Preliminary operation (e) Plantation System
2. Management of orchard.
   A. Management of Newly established Orchard- Safety, Training, Intercropping, Filler Plant, Care.
   B. Management of Fruiting Orchard- Training, Prunning, Manuring & Fertilization, Irrigation, Plant Protection, Fruit Harvesting.
3. Rejuvenation of Fruit Orchard.

ईकाई 1

1. फल उद्यान– फल उद्यान की स्थापना
   अ. स्थान का चयन ब. फल का चयन स. प्रारूप / विन्यास
   द. प्रारम्भिक तैयारी ई. रोपण की विधियां
2. फलोद्यान का प्रबंधन
   अ. नवीन रोपित उद्यानों का प्रबंधन– सुरक्षा, वृक्षों की सधाई, अन्तरासस्य, पूरक वृक्ष, सामान्य देखभाल।
   ब. फलित उद्यानों का प्रबंधन– काट–छाट / कृतन, कर्षण, खाद एवं उर्वरक देना, सिंचाई, पौध संरक्षण, फलों की तुडाई
3. फलोउद्यान का जीर्णोद्धार या पुनजीवन

Unit - II

1. Vegetable - classification of vegetables
2. Establishment and Management of vegetable farm
3. Types of Vegetable Gardening- Kitchen/home gardening, Market gardening, Truck gardening, Forcing gardening, Processing gardening, Seed Production gardening, Floating gardening.
4. Ornamental Garden- Establishment and Different Style

ईकाई 2

1. सब्जी – सब्जियों का वर्गीकरण
2. सब्जी फार्म की स्थापना एवं सब्जी फार्म का प्रबन्ध।
3. सब्जी बागवानी के प्रकार– गृह वाटिका बागवानी, बाजार बागवानी, ट्रक बागवानी, बेमौसमी बागवानी, प्रसंस्करण बागवानी, बीज उत्पादन बागवानी, प्लवन बागवानी
4. शोभाकारी उद्यान– स्थापना और विभिन्न शैलियां

Unit - III

1. Seed bed – Characteristics of seed bed
2. Nursery - Importance, Scope
3. Establishment and layout of nursery
4. Working and management of nursery
5. Protected Cultivation

ईकाई 3

1. बीज शैय्या – बीज शैय्या के लक्षण।
2. नर्सरी – महत्व एवं सम्भावना।
3. नर्सरी की स्थापना एवं विन्यास।
4. नर्सरी की कार्यप्रणाली एवं प्रबंधन
5. संरक्षित खेत

Unit IV

1. Horticultural tools
   (a) Layout tools (b) Intercultural tools
   (c) Plantation tools (d) Thinning and Heading tools
   (e) Packing tools (f) Irrigation tools
   (g) Spray and Dusting tools
2. lawn - (a) Selection of site (b) Characteristics of planned good lawn.

ईकाई 4

1. उद्यानिकी के साधन–
   अ. रेखांकन के साधन ब. अंत सस्य के साधन
   स. रोपण के साधन द. विरलन एवं छटाई के साधन
   ग. पैकिंग के साधन इ. सिंचाई के साधन
   फ. छिडकाव एवं भुरकाव के साधन
2. हरियाली (लॉन) – अ. स्थान का चुनाव ब. अच्छे योजनाबद्ध लॉन की विशेषताऐं

Unit V

1. Weeds - Definition characteristics
2. Classification of weeds and crop-weed relationship
3. Herbicides – Types, time of application
4. Terminologies:
   (a) Active ingredients (b) Acid equivalent
   (c) Polarity: Polar and non-polar (d) LD-50 and ED 50 values for crops

ईकाई 5

1. खरपतवार – परिभाषा, लक्षण
2. खरपतवार का वर्गीकरण और फसल से संबंध
3. शाकनाशक – प्रकार, अनुप्रयोग का उचित समय
4. तकनीकी शब्दावली
अ. सक्रिय तत्व ब. अम्लीय समतुल्य स. ध्रुवीयता प्रोलोरेटी ध्रुवीय–अध्रुवीय
द. एल.डी. 50 और ई.डी. 50 फसलों का मूल्य

GOVT. MODEL AUTONOMOUS HOLKAR SCIENCE COLLEGE, INDORE (M.P)

Syllabus 2020-2021

ACCORDING TO NEW PATTERN OF DEPT. OF HIGHER EDU. OF MP.

B.Sc. IInd Year, *HORTICULTURE*

Paper II – Farming Systems in Horticulture

Maximum Marks : 85

Unit-I

1. Importance of sustainable horticultural farming system.
2. Principle of successful farming system.
3. Studies on various system of farming :
   (i) Individual farming (ii) State farming (iii) Cooperative farming
   (iv)Collective farming (v) Capitalistic farming (vi) Contract base farming

ईकाई 1

1. टिकाऊ उद्यानिकी खेती प्रणाली का महत्व
2. सफलतम खेती प्रणाली के सिद्धांत
3. विभिन्न प्रकार के कृषि तंत्रों का अध्ययन
   अ. व्यक्तिगत खेती ब. राजकीय खेती स. सहकारी खेती
   द. सामूहिक खेती ई. पूंजीवादी खेती फ. अनुबंध आधार खेती

Unit-II

1. Study of types of farming :
   (i) Diversified farming (ii) Specialized farming (iii) Mixed farming
   (iv) Ranching (v) Irrigated farming (vi) Dryland Horticulture (vii) Experimental farms (viii) Demonstration farms (ix)Instructional farm
2. Factors determining the type of farming with emphasis on their merits and demerits
   (a) Physical factors: climate, soils and topography (b) Economic factors(c) Social factors

ईकाई 2

1. खेती के प्रकारों का अध्ययन
   अ. विविधता पूर्ण खेती ब. विशिष्ट खेती स. मिश्रित खेती
   द. रेंचिंग ई. सिंचित खेती ग. शुष्क भूमि उद्यानिकी
   ह. प्रयोगात्मक खेती ज. प्रर्दशात्मक खेती झ. सूचनात्मक खेती
2. लाभ और हानि को देखते हुए खेती के प्रकार निर्धारित करने वाले कारक –
   अ. भौतिक कारक – जलवायु, मृदा और भोगोलिक स्थिति
   ब. आर्थिक कारक स. सामाजिक कारक

Unit-III

1. Cropping system-
   (i) Definition and importance of cropping systems.
   (ii) Comparison of farming systems

2. Types of cropping systems:
   (i) Mixed cropping : types , principles, merits and demerits
   (ii) Intensive cropping - Definition, object, pre-requisites and methods

ईकाई 3

1. फसल तंत्र –
   अ. फसल तंत्र की परिभाषा और महत्व
   ब. कृषि तंत्र का तुलनात्मक अध्ययन
2. फसल तंत्र के प्रकार –
   अ. मिश्रित खेती – प्रकार, सिद्धांत, लाभ और हानि

ब. मल्चिंग खेती – परिभाषा, उद्देश्य, आवश्यकता और विधि

Unit-IV

1. Multiple cropping Requirement advantages of Multiple Cropping
   Types- (i)Relay cropping (ii) Over lapping system of cropping
2. Intercropping
   (i) Definition and comparison between intercropping and mixed cropping
   (ii) Types of intercropping - parallel cropping, companion cropping, synergistic cropping
   (iii) Principle and advantages of Intercropping
3. Cropping system interaction with,
   (i) Farm resources (ii) Technology
   (iii) Aerial environment (iv) Edaphic environment

ईकाई 4

1. बहु फसली खेती– आवश्यकता एवं लाभ।
   प्रकार– (अ) कमवार फसले उगाना (ब) लगातार फसले उगाना
2. अत सस्यन खेती –
   अ. परिभाषा और अंतवर्षीय एवं मिश्रित खेती में तुलना
   ब. अंत सस्यन फसलों के प्रकार – समान्तर फसले, सहयोगी फसले, सीनरजेटिक फसले
   स. अंत सस्यन के सिद्धान्त एवं लाभ
3. फसले तंत्र के अंतर संबध –
   अ. कृषि संसाधन ब. तकनीकी स. वायवीय पर्यावरण द. मृदीय पर्यावरण

Unit-V

1. Components of cropping system-
   (i) Environment: climate, soil and biological components
   (ii) Farms resources - land: Irrigation,
   (iii)Power: manual and mechanical
2. Crop rotation-definition principles, advantages, selection of crop rotation.

ईकाई 5

1. फसल तंत्र के घटक –
   अ. पर्यावरण, जलवायु, मृदा और जैविक घटक
   ब. कृषि संसाधन – भूमि तथा सिंचाईस. उर्जा मानवीय तथा यांत्रिक
2. फसल चकीकरण – परिभाषा, सिद्धांत, लाभ, चकीकरण हेतु फसलों का चयन

GOVT. AUTONOMOUS HOLKAR SCIENCE COLLEGE, INDORE

List of Practical Exercise 2020-2021

B.Sc. II Year, Horticulture

---

1. Preparation of herbicide

a) Preparation using different plant extract like neem, lantana etc.

b) Preparation using different chemicals.

c) Application of prepared herbicide on different herbaceous plants.

a) Kharif Vegetable Crops – Chili, Brinjal, Okra.

b) Rabi Vegetable Crops – Tomato, Cauliflower, Cabbage.

3. Study of different horticulture tools.

4. Studies based on different planting system of orchards- Calculation based on number of plant requiring /ha.

Area in different planting system.

5. To study of type of vegetables gardens.

6. study of different method of training & pruning.

7. Preparation of Nursery Beds & Sowing of Seeds.

8. Exercise based on Mixed & Intensive Cropping.

GOVT. HOLKAR SCIENCE COLLEGE, INDORE (M.P)

Scheme of Practical Examination: 2020-2021

B.Sc. II Year, HORTICULTURE

Max Marks 50 **Time: 4 Hrs.**

1. Preparation of herbicide solution.	(05 Marks)
2. Studies on different weeds of Kharif and Rabi Horticultural crops.	(05 Marks)
3. Studies on Horticulture tools.	(05 Marks)
4. Studies different orchards and vegetable farms.	(05 Marks)
5. Studies on mixed and intensive cropping.	(05 Marks)
6. Comment upon spots 1 to 5	(10 Marks)
7. Viva- Voce	(05 Marks)
8. Sessional Record	(10 Marks)
Total	**50 Marks**

Suggested Readings –

1. George Acquash 2002, Horticulture: Principle and Practices, Prantice Hall of India, Pvt. Ltd., New Delhi.
2. Kains M.G. 2008, Plant propogation, green house and nursery practice kessinger publishing, New York.
3. Adams C.R. and M.P. Early 2004, principles of horticulture putierworth-herinemar, oxford university press.
4. Jitendra singh -2006, basic horticulture, kalyani publisher, new delhi.

GOVT. MODEL AUTONOMOUS HOLKAR SCIENCE COLLEGE, INDORE (M.P)

Syllabus 2020-2021

ACCORDING TO NEW PATTERN OF DEPT. OF HIGHER EDU. OF MP.

B.Sc. IIIrd Year, *HORTICULTURE*

Paper I – Soil Productivity & Agro forestry

Maximum Marks : 85

Unit-I

1. Soil – Definition, Types, Profile, Function and Charactestics.
2. Composition and formation of Soil.
3. Physical- (a) Soil Colour (b) Soil Texture (c) Soil Structure (d) Soil Density (e) Soil Porosity
4. Chemical and biological properties of Soil.

ईकाई 1

1. मृदा– परिभाषा, प्रकार, रूपरेखा, कार्य, लक्षण
2. मृदा संगठन एवं निर्माण
3. मृदा भौतिक– 1. मृदा रंग 2. मृदा कणाकर 3. मृदा संरचना 4 मृदा घनत्व 5. मृदा सरन्ध्रता
4- मृदा के रासायनिक एवं जैविक गुण

Unit-II

1. Soil Erosion - Definition, causes of erosion, type of soil erosion.
2. Factor affecting soil erosion.
3. Classification of Soil on the basis of water holding capacity.
4. Dry-lands, wet-land, waste-land, marshy-land.

ईकाई 2

1. मृदा अपरदन– परिभाषा, अपरदन के कारण, मृदा अपरदन के प्रकार
2. मृदा अपरदन को प्रभावित करने वाले कारक
3. जल धारण क्षमता के आधार पर मृदा का वर्गीकरण
4. शुष्क भूमि, आर्द्र भूमि, परती भूमि, दलदली भूमि

Unit-III

1. Principles of soil fertility- Effect of chemical fertilizers and biofertilizers on soil quality.
2. Soil Conservation- Planning, Water Shed Management.
3. Methods of soil conservation, rain fed agriculture.
4. Types of Soil Water- Hygroscopic water, Capillary water, Gravitational water

ईकाई 3

1. मृदा उर्वरता के सिद्धान्त– रासायनिक एवं जैविक उर्वरक का मृदा गुणवत्ता पर प्रभाव
2. मृदा संरक्षण– योजना, जल संभारण प्रबंधन
3. मृदा संरक्षण की विधियां, वर्षा आधारित कृषि
4. मृदा जल के प्रकार– आर्द्रताग्राही जल, केशिका जल, गुरूत्वाकर्षण जल

Unit-IV

1. Plant nutrition- essential element for nutrient. Micro and Macro elements. Deficiency symptoms of micro and macro nutrients.
2. Method of fertilizer application.
3. Tillage- Types, objective, Implements.

ईकाई 4

1. पादप पोषण– पादप पोषण के अनिवार्य तत्व, प्राथमिक एवं द्वितीय तत्व, सूक्ष्म एवं गुरू पोषण तत्व की कमी के लक्षण
2. उर्वरक अनुप्रयोग की विधियां
3. भूपरिष्करण– प्रकार, उद्देश्य, अनुप्रयोग

Unit-V

1. Agro-forestry- Principles, objects and Agro-Forestry in India.
2. Agro-forestry system, Selection of tree for Agro-forestry.
3. International center of research in agro- forestry (ICRAF).
4. Social Agro-forestry- objects and principles.

ईकाई 5

1. कृषि वानिकी– सिद्धान्त, उद्देश्य एवं भारत में कृषि वानिकी
2. कृषि वानिकी तंत्र– वृक्षो का चयन, कृषि वानिकी का भविष्य
3. कृषि वानिकी में अन्तराष्ट्रीय शोध केन्द्र (ICRAF)
4. सामाजिक कृषि वानिकी– उद्देश्य एवं सिद्धान्त

GOVT. MODEL AUTONOMOUS HOLKAR SCIENCE COLLEGE, INDORE (M.P)

Syllabus 2020-2021

ACCORDING TO NEW PATTERN OF DEPT. OF HIGHER EDU. OF MP.

B.Sc. IIIrd Year, *HORTICULTURE*

Paper II – Processing of Horticultural Crops & Value addition

Maximum Marks : 85

Unit-I

1. Fruit preservation- definition and advantages, Importance and principles.
2. Food preservatives.
3. Limitation of fruit preservatives.
4. Uses of fruits and fruit products.

ईकाई 1

1. फल परिसंरक्षण– परिभाषा, लाभ, महत्व एवं सिद्धान्त
2. खादय परिसंरक्षक
3. खादय परिसंरक्षक की सीमाएं
4. फल एवं फल उत्पाद के उपयोग

Unit-II

1. General Principles of fruit and vegetable preservation, Methods.
2. Fruit and Vegetable Preservation Method
   (a) Canning- process and container (b) Drying (c) Dehydration
3. Post harvest changes in fruits and vegetables.

ईकाई 2

1. फल एवं सब्जी परीक्षण के सामान्य सिद्धान्त एवं विधियां
2. फल एवं सब्जी परीक्षण की विधियां
   1.कैनिंग– विधि एवं कंटेनर 2. शुष्कन 3. निर्जलीकरण
3. कटाई के पश्चात फल एवं सब्जीयो में होने वाले परिवर्तन

Unit-III

1. Preserved products and their marketing- (a) Pickles, (b) Jam (c) Jelly (d) Sauce
2. Agriculture economics- agriculture finance, co-operative.
3. Fruits and vegetables spoilage.

ईकाई 3

1. परिरक्षित उत्पाद एवं उनका विपणन– 1. आचार 2. जेम 3. जेली 4. सॉस
2. कृषि आर्थिकी– कृषि वित एवं सहकारिता
3. फल एवं सब्जी का विषाक्त होना

Unit-IV -

1. History and concept of plant tissue culture, Totipotency
2. Techniques of tissue culture- Sterilization techniques, Nutrient media
3. Callus culture, Anther culture, Meristem culture, Embryo culture.

ईकाई 4

1. पादप उतक संवर्धन की अवधारणा एवं इतिहास, टोटीपोटेन्सी
2. ऊतक संवर्धन की तकनीकी– निजर्मीकरण, पोषक माध्यम
3. कैलस संवर्धन, परागकोष संवर्धन, प्रारिभाजी ऊतक संवर्धन एवं भ्रूण संवर्धन

Unit-V

1. Somatic Hybridization and its significance.
2. Cryo preservation
3. Achievements in raising horticulture crops by using tissue culture techniques.
4. Practical application of tissue culture in horticulture.

ईकाई 5

1. कायिक संकरण एवं उसकी उपयोगिता
2. शीतलीकरण
3. ऊतक संवर्धन द्वारा उद्यानिकी फसलों के उन्नयन में उपलब्धियां
4. पादप ऊतक संवर्धन का उद्यानिकी में अनुप्रयोग

GOVT. AUTONOMOUS HOLKAR SCIENCE COLLEGE, INDORE

Department of Horticulture

List of Practical Exercise 2020-2021

B.Sc.IIIrd Year, *HORTICULTURE*

---

1. Soil:
   a) To study of different physical characteristics of given soil
   b) To study different chemical properties of given soil.
2. Culture Media:
   a) Different types of media
   b) Sterilization techniques of media for tissue culture.
3. Tissue culture techniques
   a) Preparation of nutrient media b) Methods of sterilization
   c) Transfer of explants for tissue culture
4. Fertilizers:
   a) Different types of chemical fertilizers and their combinations
   b) Different types of bio fertilizers
   i) Azobacter ii) Azospirillum iii) Rhizobiun iv) VAM
5. To study of different types of plant nutrient & their symptoms and management
6. To study of different types of Soils & their characteristics.
7. Organic fertilizer method of preparation.
   i) Vermi compost ii) Compost iii) FYM (Farmyard manure)
8. To study of water holding capacity by given soil samples.
9. Construction of ZECC.
10. Preparation of different product
    1. Jam 2. Jally 3. Squash 4. RTS 5. Pickles 6. Juice
11. Spotting –

    i) Rhizobium culture ii) Azoto bacter iii) PH meter

    iv) Black Soil v) Auto clave vi) Hot air oven

    vii) Handrefrocto meter viii) Jally meter ix) Refrigerator

Deficiancy symptoms of plant nutrient –

1. Zink 2. Calcium 3. Magnesium 4. Phosphorus 5. Nitrogen

6. Boran 7. Potassium

12. Visit to Food Park/Processing Industries & Commercial Tissue Culture Laboratory.

GOVT. HOLKAR SCIENCE COLLEGE, INDORE (M.P)

Scheme of Practical Examination: 2020-2021

B.Sc. IIIrd Semester, HORTICULTURE

Max Marks 50 **Time: 4 Hrs.**

1. Experiment based on tissue culture technique/Fruit product.	(10 Marks)
2. Determination of physical characteristic of Soil or Perform chemical tests of soil /Water holding capacity.	(05 Marks)
3. Comment upon sterilization technique/ ZECC/Manure	(05 Marks)
4. Comment upon Chemical Fertilizer of Biofertilizer	(05 Marks)
5. Comment and identification of spot 1 to 5	(10 Marks)
6. Viva- Voce/ Projects	(05 Marks)
7. Sessional Record	(10 Marks)
Total	**50 Marks**

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Microbiology

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Microbiology

Syllabus

2021-2022

(Choice Based Credit System & Multiple Entry Exit)

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Microbiology

Syllabus for B.Sc. Part – I, II, & III year (Microbiology)

&

Syllabus for M.Sc. (Microbiology) : Four Semester Course

(Duration: Two years)

Department of Higher Education, Madhya Pradesh, Bhopal

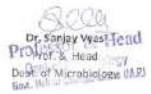
Syllabus approved by Central Board of Studies in Microbiology As per UGC Criteria

(For the Session 2021-2022)

1. **Prof. Dr. Alka Vyas**
2. **Prof. Dr. Sugandha Singh** 12/10/21
3. **Prof. Dr. Sadhana Nighojkar** 12/10/21
4. **Shri Vinod Gupta**
5. **Ms. Sadhana Solanki**
6. **Prof. Dr. Sanjay Vyas**
7. **Prof. Dr. Deepti Khare** 12/10/21
8. **Prof. Anuja Sharma** 12/10/2021

Govt. Holkar (Model, Autonomous) Science College, Indore												
Department of Microbiology												
Syllabus Session 2021-2022												
Programme : Certificate in Science											Class : B.Sc. I Semester	
S.N.	Paper	Paper Title	Paper Code	Theory Max. Marks 100				Practical Max. Marks 100				
				Credits	CCE	External assessment	Min Marks	Credits	Internal assessment	External assessment	Min. Marks	Total Credits
1	Major Paper	General Microbiology and Cell Structure	S2-14-M	4	40	60	35	2	40	60	35	6
2	Minor Paper	Microbial Tools and Techniques	S2-14-I	4	40	60	35	2	40	60	35	6

PART A: Introduction				
Program: UG/Certificate		**Class: B.Sc.**	**Semester-I**	**Session: 2021-22**
Subject: **MICROBIOLOGY**				
1.	Course Code	**S2-14-M**		
2.	Course Title	**General Microbiology and Cell Structure**		
3.	Course Type (Core Course/OpenElective/Generic Elective/Vocational	**Major**		
4.	Pre-Requisite (if any)	To study this course a student must have passed 12th .		
5.	Course Learning Outcomes (CLO)	1. **Understand** Indian traditional knowledge and historical background of Microbiology. 2. **Understand** structure and transmission of Viruses . 3. **Analyze** cell structures and cell organization of bacteria. 4. **Remember** different kinds of unicellular prokaryotic and eukaryotic microorganisms based on specific characteristics. 5. **Remember** general characteristics of important Eubacteria..		
6.	Credit Value	**4 credits**		
7.	Total Marks	Max. Marks: 40 **(CCE) + 60 (End Semester or (Theory Exam) External Evaluation Total = 100 Marks**		**Min. Passing Marks: 35**



PART B: Content of the Course		
Total No. of Lectures-Tutorials-Practicals (in hours per week): **L-T-P (4-0-0)**		
Total No. of Lecture **60 L**		
Para-graph	**Topics**	**No. of Lectures**
1	Indian traditional knowledge and global historical background of Microbiology, Significance of microbiology- (a) Branches of microbiology, Contribution of following scientists in the field of microbiology- Louis Pasteur, Robert Koch, Edward Jenner, Alexander Fleming, Joseph Lister, Serge N. Winogradsky, Wendell M. Stanley and Hans Christian Gram. **Key words:** *History of Microbiology, Renowned microbiologists.*	**12**
2	Virus — General characters of following viruses — Bacteriophage (T4 phage), Plant viruses (TMV), Prions and Viroids, Whittaker's System of Five Kingdom Classification: Monera, Protista, Fungi, Plantae and Animalia, Bacteria -Study of *Spirochete, Rickettsia, Chlamydia, Mycoplasma* and Actinomycetes, Cyanobacteria. **Key words:** *Prokaryotes, Whittaker, Bacteria, Cyanobacteria.*	**12**
3	Basic knowledge of Eukaryotic organisms and their evolutionary pattern, Fungi - Study of *Saccharomyces cerevisiae, Mucor, Aspergillus,* Protozoa- Study of *Euglena, Amoeba, Entamoeba.* **Key words:** *Eukaryotes, Fungi, Protozoa.*	**12**
4	Study of Bacteria - Size, shape and arrangement of bacterial cells, structures external to Plasma Membrane — Glycocalyx (capsule, slime layer), flagella, fimbrae, stalk, prostheca and cell wall of Gram +ve and Gram —ve bacteria. **Key words:** *Bacterial cells, Gram Positive Bacteria, Gram Negative Bacteria.*	**12**
5	Structures Internal to Cell wall — Cell membrane, cytoplasm, cytoplasmic inclusions, genome, spores and cysts, Reproduction in Bacteria—Binary fission, budding and fragmentation. **Key words:** *Bacterial cells,* budding, *Binary fission*	**12**

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings
Textbooks: At least Five 1. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R., "Microbiology". Tata McGraw-Hill, New Delhi. (2001). 2. Dubey, R.C. and Maheshwari,D.K., "A Textbook of Microbiology". S. Chand & Company Ltd., New Delhi. (2008). 3. Sharma, P.D.,"Microbiology". Rastogi Publications, Meerut. (2014). 4. Singh, R.P., "Applied Microbiology". Kalyani Publishers, New Delhi. (2007). 5. Ananthanarayana, R. and Panicker, C.K.S., "Text Book of Microbiology", 6th Edition. Oriental Longman Publications, USA. (2000). **Reference Book: At least Five** 1. Willey J.M., Sherwood L.M., and Woolverton C.J., "Prescott's Microbiology". 9th edition. McGraw Hill Higher Education. (2013). 2. Tortora G.J., Funke B.R., and Case C.L., "Microbiology: An Introduction." 9th edition Pearson Education. (2008). 3. Principles and Techniques of Biochemistry and Molecular Biology, 8th Ed.(2018) Wilson and Walker 4. Sumbali, Geeta and Mehrotra, R.S., "Principles of Microbiology". McGraw Hill Edition. (2017). 5. Shammi, Q.J., "Microbiology-I" . Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-43-4.
Suggested digital platform web links 1 https://microbiologysociety.org/members-outreach-resources/links.html 2 https://microbenotes.com/ 3 https://www.biologydiscussion.com/biologyarticles 4 https://youtu.be/Vre33LFPYxE 5 https://youtu.be/sBZIs04e-0E
Suggested equivalent online courses 1. https://www.mooc-list.com/course/small-and-mighty-introduction-microbiology-futurelearn 2. https://www.mooc-list.com/course/microbiology-saylororg 3. https://www.mooc-list.com/course/bacteria-and-chronic-infections-coursera 4. https://www.coursera.org/lecture/bacterial-infections/1-1-introduction-to-bacteria-by- bioinformatician-phd-peder-worning-HZ64m 5. https://openstax.org/books/microbiology/pages/1-3-types-of-microorganisms 6. https://openstax.org/books/microbiology/pages/4-1-prokaryote-habitats-relationships-and- microbiomes 7. https://swayam.gov.in/explorer?searchText=microbiology

Dr. Sanjay Vyas Head
Professor & Head
Dept. of Microbiology (SAP)

<table>
<tr><th colspan="5">PART D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Internal Assessment: Continuous ComprehensiveEvaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Tests. The division of marks is as follows:</td><td colspan="2">External Evaluation (Theory Exam):End Semester Exam:
60 Marks
Time: 2 hours</td></tr>
<tr><td colspan="2">A. Submission of Assignment followed by Presentation</td><td></td><td rowspan="2">Section (A): 05 MCQQuestions</td><td rowspan="2">05 x 01 = 05 Marks</td></tr>
<tr><td>B. Class Test</td><td>Best two test Marks 20 Marks</td><td rowspan="4">Best two test Marks

40 Marks</td></tr>
<tr><td>Test I (Written test)</td><td>20 Marks</td><td>Section (B): Five ShortQuestions (200 Words Each)</td><td>05 x 05= 25 Marks</td></tr>
<tr><td>Test II (Written test)</td><td>20 Marks</td><td>Section (C): Two Long Questions (500 Words Each)</td><td>02 x 15= 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td><td></td><td></td></tr>
<tr><td colspan="2">Total Internal Assessment(Theory) Marks (A+B)</td><td>40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+C)</td><td>60 Marks</td></tr>
</table>

PART A: Introduction			
Program: UG	**Class: B.Sc.**	**Year: Semester I**	**Session: 2021-22**
Subject: **: Practical (MICROBIOLOGY)**			
1.	Course Code	**S2- 14-PM**	
2.	Course Title	**Study of Microorganisms**	
3.	Course Type (Core Course/Open Elective/Generic Elective/ Vocational	**Major**	
4.	Pre-Requisite (if any)	To study this course a student must have passed 12th.	
5.	Course Learning Outcomes (CLO)	• **Understand** the isolation of various types of bacteria and yeasts. • **Comprehend** with microscopic techniques for examination of various types of bacteria, fungi and protozoa • **Understand** structure of important animal, plant and bacterial viruses using electron micrographs.	
6.	Credit Value	**2 Credits**	
7.	Total Marks	Max. Marks: **40+60**	**Min. Passing Marks**: **35**

PART B: Content of the Course	
Total No. of Lectures-Tutorials-Practical's (in hours per week): L-T-P 0+0+2=2	
Total No. of Lab hours: 30 Hrs. (2 hours per Week)	
Lab Assignments 1. Isolation of autotrophic bacteria and Cyanobacteria, Rhizobia from root nodules 2. Isolation of lactobacillus from curd. 3. Isolation of yeast from ripened fruits. 4. Preparation of temporary wet mount and microscopic examination of *Mucor, Aspergillus.* 5. Preparation of smear and microscopic examination of *Staphylococcus, Lactobacillus, & Escherichia.* 6. Preparation of temporary wet mount and microscopic examination of *Amoeba, Euglena, & Paramaecium* 7. Study of the structure of important animal viruses (influenza, hepatitis B and retroviruses) using electron micrographs . 8. Study of the structure of important plant viruses (Tobacco ring spot, cucumber mosaic and alpha-alpha mosaic viruses) using electron micrographs . 9. Study of the structure of important bacterial viruses T4 phage) using electron micrograph.	**30 (Hours)**

Dr. Sanjay Vyas Head
Professor & Head
Dept. of Microbiology (M.P)

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings
1. Dubey, R.C. and Maheswari, D.K., "Practical Microbiology", S. Chand & Co. Ltd., New Delhi. (2002). 2. Aneja, K.R., "Laboratory Manual of Microbiology and Biotechnology. 2" Edition", Meditech Scientific International. (2018). 3. Patel, Rakesh J. and Patel Kiran, R.,"Experimental Microbiology Vol. I and Vol. II",. Aditya Prakashan, Ahmedabad. (2009). 4. Varghese, Naveena and Joy, V, "Microbiology Laboratory Manual" Ed.1, Aromatic and Medicinal Plants Research Station, Odakkali, Ernakulam, Kerala. (2014). 5. Shammi, Q.J.,"Microbiology – Tools and Techniques", Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-38-0 (In Hindi also). 6. Grainger.John, Hurst. Janet and Burdass. Dariel, "Basic Practical Microbiology: A Manual",. The Society for General Microbiology. (2001).
Suggestive digital platform web links 1 https://microbenotes.com/ 2 https://www.biologydiscussion.com/biologyarticles

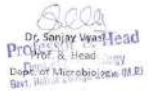
PART D: Assessment and Evaluation	
Internal Assessment (A):	**40 marks**
Lab Record/Class interaction/quiz	15 marks
Attendance in the Lab	05 marks
Assignments (Industrial Training (10 hours)/Mini Project (project demo + report))	20
End Sem External Evaluation (B) :	**60 marks**
Viva Voce on Practical	10 marks
Practical Record File	10 marks
Experiments	40 marks
Total Marks (A+B)	**100** marks
Any remarks/suggestions:	

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology (A.P.)

PART A: Introduction				
Program: UG/Certificate	**Class: B.Sc.**		**Semester-I**	**Session: 2021-22**
Subject: **MICROBIOLOGY**				
1.	Course Code	**S2-14-I**		
2.	Course Title	**Microbial Tools and Techniques**		
3.	Course Type (Core Course/OpenElective/Generic Elective/Vocational	**Minor**		
4.	Pre-Requisite (if any)	To study this course a student must have passed 12th.		
5.	Course Learning Outcomes (CLO)	1 **Remembering** the basic lab glassware to be used in the laboratory. 2 **Evaluating** different methods of sterilization and isolation of pure cultures. 3 **Understand** the working of different kinds of instruments and microscopes. 4 **Applying** serial dilution technique to isolate the bacteria. 5 **Understand** different methods to culture bacteria in the laboratory.		
6.	Credit Value	**4 credits**		
7.	Total Marks	Max. Marks: 40 **(CCE) + 60 (End Semester or (Theory Exam) External Evaluation Total = 100 Marks**		**Min. Passing Marks**: 35

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology

PART B: Content of the Course		
Total No. of Lectures-Tutorials-Practicals (in hours per week): **L-T-P (4-0-0)**		
Total No. of Lecture **60 L**		
Para-graph	**Topics**	**No. of Lectures**
1	Principles and applications of simple and compound Bright-field microscopy, Dark-field microscopy, Fluorescence microscopy, Phase-contrast microscopy, Transmission electron microscopy and Scanning electron microscopy, Wet- mount and hanging-drop techniques. Preparation for smear and fixation, Principles of staining, negative staining, simple staining, differential staining (Gram and acid-fast staining), flagella staining, capsule and endospore staining. **Key words:** *Microscopy, Light microscope, Wet mount, Hanging drop method, Bacterial staining.*	**12**
2	Electronic Balance, Autoclave, Centrifuge, Colony counter, Deep freezer, Homogenizer, Hot air Oven, Incubator, Laminar air flow, Magnetic stirrer, pH Meter, Spectrophotometer, Vortex mixture, Water bath, Water distiller, Chromatography Chambers, Anaerobic chamber and Electrophoresis apparatus . **Key words:** *Instruments in microbiology laboratory.*	**12**
3	Dry heat, Moist heat, Radiation, Filtration and Incineration, Phenol and phenolic compounds, Alcohol, Halogens and Detergents, Natural, synthetic, complex, enriched and selective. Anaerobic (Thioglycolate broth, Robertson's media, Microaerophilic), broth culture of aerobic bacteria. **Key words:** *Physical sterilization, Chemical sterilization, Microbial culture media.*	**12**
4	Pure culture techniques, Streak plate, Pour plate and Spread plate, Isolation from air, water and soil, Serial dilution and Micromanipulator methods. **Key words:** *Isolation, Streak and Pour Plate method.*	**12**
5	Cultivation on liquid and solid media, Cultivation of anaerobic bacteria and accessing non-cultivable microorganisms, Isolation of microorganisms on potato slice and bread, Maintenance and preservation for short term and long term. **Key words:** *Pure culture, Isolation of microbes, Preservation of culture.*	**12**



PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings
Textbooks: At least Five 1. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R., "Microbiology". Tata McGraw-Hill, New Delhi. (2001). 2. Dubey, R.C. and Maheshwari,D.K., "A Textbook of Microbiology". S. Chand & Company Ltd., New Delhi. (2008). 3. Sharma, P.D.,"Microbiology". Rastogi Publications, Meerut. (2014). 4. Singh, R.P., "Applied Microbiology". Kalyani Publishers, New Delhi. (2007). 5. Ananthanarayana, R. and Panicker, C.K.S., "Text Book of Microbiology", 6th Edition. Oriental Longman Publications, USA. (2000). **Reference Book: At least Five** 1. Willey J.M., Sherwood L.M., and Woolverton C.J., "Prescott's Microbiology". 9th edition. McGraw Hill Higher Education. (2013). 2. Tortora G.J., Funke B.R., and Case C.L., "Microbiology: An Introduction." 9th edition Pearson Education. (2008). 3. Principles and Techniques of Biochemistry and Molecular Biology, 8th Ed.(2018) Wilson and Walker 4. Sumbali, Geeta and Mehrotra, R.S., "Principles of Microbiology". McGraw Hill Edition. (2017). 5. Shammi, Q.J., "Microbiology-I" . Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-43-4.
Suggested digital platform web links 1 https://microbiologysociety.org/members-outreach-resources/links.html 2 https://microbenotes.com/ 3 https://www.biologydiscussion.com/biologyarticles 4 https://youtu.be/Vre33LFPYxE 5 https://youtu.be/sBZIs04e-0E
Suggested equivalent online courses 1. https://www.mooc-list.com/course/small-and-mighty-introduction-microbiology-futurelearn 2. https://www.mooc-list.com/course/microbiology-saylororg 3. https://www.mooc-list.com/course/bacteria-and-chronic-infections-coursera 4. https://www.coursera.org/lecture/bacterial-infections/1-1-introduction-to-bacteria-by- bioinformatician-phd-peder-woming-HZ64m 5. https://openstax.org/books/microbiology/pages/1-3-types-of-microorganisms 6. https://openstax.org/books/microbiology/pages/4-1-prokaryote-habitats-relationships-and- microbiomes 7. https://swayam.gov.in/explorer?searchText=microbiology

Dr. Sanjay Vyas
Professor & Head
Dept. of Microbiology

<table>
<tr><th colspan="5">PART D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Internal Assessment: Continuous ComprehensiveEvaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Tests. The division of marks is as follows:</td><td colspan="2">External Evaluation (Theory Exam):End Semester Exam:
60 Marks
Time: 2 hours</td></tr>
<tr><td colspan="2">A. Submission of Assignment followed by Presentation</td><td></td><td rowspan="2">Section (A): 05 MCQQuestions</td><td rowspan="2">05 x 01 = 05 Marks</td></tr>
<tr><td>B. ClassTest</td><td>Best two test Marks 20 Marks</td><td rowspan="4">Best two test Marks
40 Marks</td></tr>
<tr><td>Test I (Written test)</td><td>20 Marks</td><td>Section (B): Five Short Questions (200 Words Each)</td><td>05 x 05= 25 Marks</td></tr>
<tr><td>Test II (Written test)</td><td>20 Marks</td><td>Section (C): Two Long Questions (500 Words Each)</td><td>02 x 15= 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td><td></td><td></td></tr>
<tr><td colspan="2">Total Internal Assessment (Theory) Marks (A+B)</td><td>40 Marks</td><td>Total ExternalEvaluation (Theory) Marks (A+B+C)</td><td>60 Marks</td></tr>
</table>

PART A: Introduction			
Program: UG	**Class: B.Sc.**	**Year: Semester I**	**Session: 2021-22**
Subject: **: Practical (MICROBIOLOGY)**			
1.	Course Code	**S2-14-PI**	
2.	Course Title	**Microbial Tools and Techniques**	
3.	Course Type (Core Course/Open Elective/Generic Elective/ Vocational	**Core course (Minor)**	
4.	Pre-Requisite (if any)	To study this course a student must have passed 12th.	
5.	Course Learning Outcomes (CLO)	• **Remember** handling of glassware, microscopes and different kinds of instruments used in the microbiology laboratory. • **Understand** media preparation technique, autoclaving, cleaning and sterilization of glassware. • **Understand** Preparation of liquid and solid culture media.	
6.	Credit Value	**2 Credits**	
7.	Total Marks	Max. Marks: **40+60**	**Min. Passing Marks: 35**

PART B: Content of the Course	
Total No. of Lectures-Tutorials-Practical's (in hours per week): L-T-P 0+0+2=2	
Total No. of Lab hours: 30 Hrs. (2 hours per Week)	
Lab Assignments 1. Demonstration and briefing about principles and working of basic instruments. 2. Basic media preparation technique, autoclaving, and sterilization of glassware. 3. cleaning of glassware. 4. Preparation of liquid culture media - Peptone water, nutrient broth. 5. Preparation of solid culture media - Nutrient agar (agar slant! agar plate). 6. Isolation of microbes from water, soil and air by serial dilution agar plating method. 7. To perform Simple Staining to study bacterial cell. 8. To perform Negative Staining to study bacterial cell. 9. To perform Gram Staining to study bacterial cell. 10. Isolation of microorganisms by pour plate method. 11. Isolation of microorganisms by streak plate method. 12. Isolation of microorganisms by spread plate method.	**30 (Hours)**

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings
1. Dubey, R.C. and Maheswari, D.K., "Practical Microbiology", S. Chand & Co. Ltd., New Delhi. (2002). 2. Aneja, K.R., "Laboratory Manual of Microbiology and Biotechnology. 2" Edition", Meditech Scientific International. (2018). 3. Patel, Rakesh J. and Patel Kiran, R.,"Experimental Microbiology Vol. I and Vol. II",. Aditya Prakashan, Ahmedabad. (2009). 4. Varghese, Naveena and Joy, V, "Microbiology Laboratory Manual" Ed.1, Aromatic and Medicinal Plants Research Station, Odakkali, Ernakulam, Kerala. (2014). 5. Shammi, Q.J.,"Microbiology – Tools and Techniques", Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-38-0 (In Hindi also). 6. Grainger.John, Hurst. Janet and Burdass. Dariel, "Basic Practical Microbiology: A Manual",. The Society for General Microbiology. (2001).
Suggestive digital platform web links 1 https://microbenotes.com/ 2 https://www.biologydiscussion.com/biologyarticles

PART D: Assessment and Evaluation	
Internal Assessment (A):	**40 marks**
Lab Record/Class interaction/quiz	15 marks
Attendance in the Lab	05 marks
Assignments (Industrial Training (10 hours)/Mini Project (project demo + report))	20
End Sem External Evaluation (B) :	**60 marks**
Viva Voce on Practical	10 marks
Practical Record File	10 marks
Experiments	40 marks
Total Marks (A+B)	**100** marks
Any remarks/suggestions:	

Dr. Sanjay Vyas Head
Professor & Head
Dept. of Microbiology (M.P.)

Govt. Holkar (Model, Autonomous) Science College, Indore												
Department of Microbiology												
Syllabus Session 2021-2022												
Programme : Certificate in Science											Class : B.Sc. II Semester	
S.N.	Paper	Paper Title	Paper Code	Theory Max. Marks 100				Practical Max. Marks 100				
				Credits	CCE	External assessment	Min Marks	Credits	Internal assessment	External assessment	Min. Marks	Total Credits
1	Major Paper	Microbial Tools and Techniques	S2-14-I	4	40	60	35	2	40	60	35	6
2	Minor Paper	General Microbiology and Cell Structure	S2-14-M	4	40	60	35	2	40	60	35	6

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

PART A: Introduction				
Program: UG/Certificate		**Class: B.Sc.**	**Semester-II**	**Session: 2021-22**
Subject: **MICROBIOLOGY**				
1.	Course Code	**S2-14-I**		
2.	Course Title	**Microbial Tools and Techniques**		
3.	Course Type (Core Course/OpenElective/Generic Elective/Vocational	**Major**		
4.	Pre-Requisite (if any)	To study this course a student must have the Microbiology subject in B.Sc. I Semester.		
5.	Course Learning Outcomes (CLO)	1 **Remembering** the basic lab glassware to be used in the laboratory. 2 **Evaluating** different methods of sterilization and isolation of pure cultures. 3 **Understand** the working of different kinds of instruments and microscopes. 4 **Applying** serial dilution technique to isolate the bacteria. 5 **Understand** different methods to culture bacteria in the laboratory.		
6.	Credit Value	**4 credits**		
7.	Total Marks	Max. Marks: 40 **(CCE) + 60 (End Semester or (Theory Exam) External Evaluation Total = 100 Marks**	**Min. Passing Marks**: 35	

Dr. Sanjay Vyas Head
Professor & Head
Department of Microbiology (M.P.)
Govt. Holkar Science College

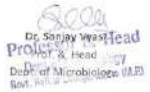
PART B: Content of the Course		
Total No. of Lectures-Tutorials-Practicals (in hours per week): **L-T-P (4-0-0)**		
Total No. of Lecture **60 L**		
Para-graph	**Topics**	**No. of Lectures**
1	Principles and applications of simple and compound Bright-field microscopy, Dark-field microscopy, Fluorescence microscopy, Phase-contrast microscopy, Transmission electron microscopy and Scanning electron microscopy, Wet- mount and hanging-drop techniques. Preparation for smear and fixation, Principles of staining, negative staining, simple staining, differential staining (Gram and acid-fast staining), flagella staining, capsule and endospore staining. **Key words:** *Microscopy, Light microscope, Wet mount, Hanging drop method, Bacterial staining.*	**12**
2	Electronic Balance, Autoclave, Centrifuge, Colony counter, Deep freezer, Homogenizer, Hot air Oven, Incubator, Laminar air flow, Magnetic stirrer, pH Meter, Spectrophotometer, Vortex mixture, Water bath, Water distiller, Chromatography Chambers, Anaerobic chamber and Electrophoresis apparatus . **Key words:** *Instruments in microbiology laboratory.*	**12**
3	Dry heat, Moist heat, Radiation, Filtration and Incineration, Phenol and phenolic compounds, Alcohol, Halogens and Detergents, Natural, synthetic, complex, enriched and selective. Anaerobic (Thioglycolate broth, Robertson's media, Microaerophilic), broth culture of aerobic bacteria. **Key words:** *Physical sterilization, Chemical sterilization, Microbial culture media.*	**12**
4	Pure culture techniques, Streak plate, Pour plate and Spread plate, Isolation from air, water and soil, Serial dilution and Micromanipulator methods. **Key words:** *Isolation, Streak and Pour Plate method.*	**12**
5	Cultivation on liquid and solid media, Cultivation of anaerobic bacteria and accessing non-cultivable microorganisms, Isolation of microorganisms on potato slice and bread, Maintenance and preservation for short term and long term. **Key words:** *Pure culture, Isolation of microbes, Preservation of culture.*	**12**

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings
Textbooks: At least Five 1. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R., "Microbiology". Tata McGraw-Hill, New Delhi. (2001). 2. Dubey, R.C. and Maheshwari,D.K., "A Textbook of Microbiology". S. Chand & Company Ltd., New Delhi. (2008). 3. Sharma, P.D.,"Microbiology". Rastogi Publications, Meerut. (2014). 4. Singh, R.P., "Applied Microbiology". Kalyani Publishers, New Delhi. (2007). 5. Ananthanarayana, R. and Panicker, C.K.S., "Text Book of Microbiology", 6th Edition. Oriental Longman Publications, USA. (2000). **Reference Book: At least Five** 1. Willey J.M., Sherwood L.M., and Woolverton C.J., "Prescott's Microbiology". 9th edition. McGraw Hill Higher Education. (2013). 2. Tortora G.J., Funke B.R., and Case C.L., "Microbiology: An Introduction." 9th edition Pearson Education. (2008). 3. Principles and Techniques of Biochemistry and Molecular Biology, 8th Ed.(2018) Wilson and Walker 4. Sumbali, Geeta and Mehrotra, R.S., "Principles of Microbiology". McGraw Hill Edition. (2017). 5. Shammi, Q.J., "Microbiology-I" . Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-43-4.
Suggested digital platform web links 1 https://microbiologysociety.org/members-outreach-resources/links.html 2 https://microbenotes.com/ 3 https://www.biologydiscussion.com/biologyarticles 4 https://youtu.be/Vre33LFPYxE 5 https://youtu.be/sBZIs04e-0E
Suggested equivalent online courses 1. https://www.mooc-list.com/course/small-and-mighty-introduction-microbiology-futurelearn 2. https://www.mooc-list.com/course/microbiology-saylororg 3. https://www.mooc-list.com/course/bacteria-and-chronic-infections-coursera 4. https://www.coursera.org/lecture/bacterial-infections/1-1-introduction-to-bacteria-by- bioinformatician-phd-peder-worning-HZ64m 5. https://openstax.org/books/microbiology/pages/1-3-types-of-microorganisms 6. https://openstax.org/books/microbiology/pages/4-1-prokaryote-habitats-relationships-and- microbiomes 7. https://swayam.gov.in/explorer?searchText=microbiology

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology (M.P.)

<table>
<tr><th colspan="5">PART D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Internal Assessment: Continuous ComprehensiveEvaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Tests. The division of marks is as follows:</td><td colspan="2">External Evaluation (Theory Exam):End Semester Exam:
60 Marks
Time: 2 hours</td></tr>
<tr><td colspan="2">A. Submission of Assignment followed by Presentation</td><td rowspan="2"></td><td rowspan="2">Section (A): 05 MCQQuestions</td><td rowspan="2">05 x 01 = 05 Marks</td></tr>
<tr><td>B. ClassTest</td><td>Best two test Marks 20 Marks</td></tr>
<tr><td>Test I (Written test)</td><td>20 Marks</td><td rowspan="3">Best two test Marks

40 Marks</td><td>Section (B): Five Short Questions (200 Words Each)</td><td>05 x 05= 25 Marks</td></tr>
<tr><td>Test II (Written test)</td><td>20 Marks</td><td>Section (C): Two Long Questions (500 Words Each)</td><td>02 x 15= 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td><td></td><td></td></tr>
<tr><td colspan="2">Total Internal Assessment (Theory) Marks (A+B)</td><td>40 Marks</td><td>Total ExternalEvaluation (Theory) Marks (A+B+C)</td><td>60 Marks</td></tr>
</table>



PART A: Introduction			
Program: UG	**Class: B.Sc.**	**Year: Semester II**	**Session: 2021-22**
Subject: **: Practical (MICROBIOLOGY)**			
1.	Course Code	**S2-14-PI**	
2.	Course Title	**Microbial Tools and Techniques**	
3.	Course Type (Core Course/Open Elective/Generic Elective/ Vocational	**Core course (Major)**	
4.	Pre-Requisite (if any)	To study this course a student must have the Microbiology subject in B.Sc. I Semester.	
5.	Course Learning Outcomes (CLO)	• **Remember** handling of glassware, microscopes and different kinds of instruments used in the microbiology laboratory. • **Understand** media preparation technique, autoclaving, cleaning and sterilization of glassware. • **Understand** Preparation of liquid and solid culture media.	
6.	Credit Value	**2 Credits**	
7.	Total Marks	Max. Marks: **40+60**	**Min. Passing Marks**: **35**

PART B: Content of the Course	
Total No. of Lectures-Tutorials-Practical's (in hours per week): L-T-P 0+0+2=2	
Total No. of Lab hours: 30 Hrs. (2 hours per Week)	
Lab Assignments 1. Demonstration and briefing about principles and working of basic instruments. 2. Basic media preparation technique, autoclaving, and sterilization of glassware. 3. cleaning of glassware. 4. Preparation of liquid culture media - Peptone water, nutrient broth. 5. Preparation of solid culture media - Nutrient agar (agar slant! agar plate). 6. Isolation of microbes from water, soil and air by serial dilution agar plating method. 7. To perform Simple Staining to study bacterial cell. 8. To perform Negative Staining to study bacterial cell. 9. To perform Gram Staining to study bacterial cell. 10. Isolation of microorganisms by pour plate method. 11. Isolation of microorganisms by streak plate method. 12. Isolation of microorganisms by spread plate method.	**30 (Hours)**

Dr. Sanjay Wasti Head
Professor & Head
Dept. of Microbiology (M.P.)

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings
1. Dubey, R.C. and Maheswari, D.K., "Practical Microbiology", S. Chand & Co. Ltd., New Delhi. (2002). 2. Aneja, K.R., "Laboratory Manual of Microbiology and Biotechnology. 2" Edition", Meditech Scientific International. (2018). 3. Patel, Rakesh J. and Patel Kiran, R.,"Experimental Microbiology Vol. I and Vol. II",. Aditya Prakashan, Ahmedabad. (2009). 4. Varghese, Naveena and Joy, V, "Microbiology Laboratory Manual" Ed.1, Aromatic and Medicinal Plants Research Station, Odakkali, Ernakulam, Kerala. (2014). 5. Shammi, Q.J.,"Microbiology – Tools and Techniques", Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-38-0 (In Hindi also). 6. Grainger.John, Hurst. Janet and Burdass. Dariel, "Basic Practical Microbiology: A Manual",. The Society for General Microbiology. (2001).
Suggestive digital platform web links 1 https://microbenotes.com/ 2 https://www.biologydiscussion.com/biologyarticles

PART D: Assessment and Evaluation	
Internal Assessment (A):	**40 marks**
Lab Record/Class interaction/quiz	15 marks
Attendance in the Lab	05 marks
Assignments (Industrial Training (10 hours)/Mini Project (project demo + report))	20
End Sem External Evaluation (B) :	**60 marks**
Viva Voce on Practical	10 marks
Practical Record File	10 marks
Experiments	40 marks
Total Marks (A+B)	**100** marks
Any remarks/suggestions:	

Dr. Sanjay Wasu Head
Professor & Head
Dept. of Microbiology (M.S)

PART A: Introduction				
Program: UG/Certificate		**Class: B.Sc.**	**Semester-II**	**Session: 2021-22**
Subject: **MICROBIOLOGY**				
1.	Course Code	**S2-14-M**		
2.	Course Title	**General Microbiology and Cell Structure**		
3.	Course Type (Core Course/OpenElective/Generic Elective/Vocational	**Minor**		
4.	Pre-Requisite (if any)	To study this course a student must have the Microbiology subject in B.Sc. I Semester.		
5.	Course Learning Outcomes (CLO)	1. **Understand** Indian traditional knowledge and historical background of Microbiology. 2. **Understand** structure and transmission of Viruses . 3. **Analyze** cell structures and cell organization of bacteria. 4. **Remember** different kinds of unicellular prokaryotic and eukaryotic microorganisms based on specific characteristics. 5. **Remember** general characteristics of important Eubacteria..		
6.	Credit Value	**4 credits**		
7.	Total Marks	Max. Marks: 40 **(CCE) + 60 (End Semester or (Theory Exam) External Evaluation** **Total = 100 Marks**		**Min. Passing Marks: 35**

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology

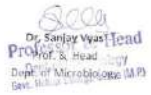
PART B: Content of the Course		
Total No. of Lectures-Tutorials-Practicals (in hours per week): **L-T-P (4-0-0)**		
Total No. of Lecture **60 L**		
Para-graph	**Topics**	**No. of Lectures**
1	Indian traditional knowledge and global historical background of Microbiology, Significance of microbiology- (a) Branches of microbiology, Contribution of following scientists in the field of microbiology- Louis Pasteur, Robert Koch, Edward Jenner, Alexander Fleming, Joseph Lister, Serge N. Winogradsky, Wendell M. Stanley and Hans Christian Gram. **Key words:** *History of Microbiology, Renowned microbiologists.*	**12**
2	Virus — General characters of following viruses — Bacteriophage (T4 phage), Plant viruses (TMV), Prions and Viroids, Whittaker's System of Five Kingdom Classification: Monera, Protista, Fungi, Plantae and Animalia, Bacteria -Study of *Spirochete, Rickettsia, Chlamydia, Mycoplasma* and Actinomycetes, Cyanobacteria. **Key words:** *Prokaryotes, Whittaker, Bacteria, Cyanobacteria.*	**12**
3	Basic knowledge of Eukaryotic organisms and their evolutionary pattern, Fungi - Study of *Saccharomyces cerevisiae, Mucor, Aspergillus,* Protozoa- Study of *Euglena, Amoeba, Entamoeba.* **Key words:** *Eukaryotes, Fungi, Protozoa.*	**12**
4	Study of Bacteria - Size, shape and arrangement of bacterial cells, structures external to Plasma Membrane — Glycocalyx (capsule, slime layer), flagella, fimbrae, stalk, prostheca and cell wall of Gram +ve and Gram —ve bacteria. **Key words:** *Bacterial cells, Gram Positive Bacteria, Gram Negative Bacteria.*	**12**
5	Structures Internal to Cell wall — Cell membrane, cytoplasm, cytoplasmic inclusions, genome, spores and cysts, Reproduction in Bacteria—Binary fission, budding and fragmentation. **Key words:** *Bacterial cells,* budding, *Binary fission*	**12**

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings
Textbooks: At least Five 1. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R., "Microbiology". Tata McGraw-Hill, New Delhi. (2001). 2. Dubey, R.C. and Maheshwari,D.K., "A Textbook of Microbiology". S. Chand & Company Ltd., New Delhi. (2008). 3. Sharma, P.D.,"Microbiology". Rastogi Publications, Meerut. (2014). 4. Singh, R.P., "Applied Microbiology". Kalyani Publishers, New Delhi. (2007). 5. Ananthanarayana, R. and Panicker, C.K.S., "Text Book of Microbiology", 6th Edition. Oriental Longman Publications, USA. (2000). **Reference Book: At least Five** 1. Willey J.M., Sherwood L.M., and Woolverton C.J., "Prescott's Microbiology". 9th edition. McGraw Hill Higher Education. (2013). 2. Tortora G.J., Funke B.R., and Case C.L., "Microbiology: An Introduction." 9th edition Pearson Education. (2008). 3. Principles and Techniques of Biochemistry and Molecular Biology, 8th Ed.(2018) Wilson and Walker 4. Sumbali, Geeta and Mehrotra, R.S., "Principles of Microbiology". McGraw Hill Edition. (2017). 5. Shammi, Q.J., "Microbiology-I" . Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-43-4.
Suggested digital platform web links 1 https://microbiologysociety.org/members-outreach-resources/links.html 2 https://microbenotes.com/ 3 https://www.biologydiscussion.com/biologyarticles 4 https://youtu.be/Vre33LFPYxE 5 https://youtu.be/sBZIs04e-0E
Suggested equivalent online courses 1. https://www.mooc-list.com/course/small-and-mighty-introduction-microbiology-futurelearn 2. https://www.mooc-list.com/course/microbiology-saylororg 3. https://www.mooc-list.com/course/bacteria-and-chronic-infections-coursera 4. https://www.coursera.org/lecture/bacterial-infections/1-1-introduction-to-bacteria-by- bioinformatician-phd-peder-worning-HZ64m 5. https://openstax.org/books/microbiology/pages/1-3-types-of-microorganisms 6. https://openstax.org/books/microbiology/pages/4-1-prokaryote-habitats-relationships-and- microbiomes 7. https://swayam.gov.in/explorer?searchText=microbiology

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology

<table>
<tr><th colspan="5">PART D: Assessment and Evaluation</th></tr>
<tr><td colspan="3">Internal Assessment: Continuous ComprehensiveEvaluation (CCE): 40 Marks
Shall be based on allotted assignments and Class Tests. The division of marks is as follows:</td><td colspan="2">External Evaluation (Theory Exam):End Semester Exam:
60 Marks
Time: 2 hours</td></tr>
<tr><td colspan="2">A. Submission of Assignment followed by Presentation</td><td></td><td rowspan="2">Section (A): 05 MCQQuestions</td><td rowspan="2">05 x 01 = 05 Marks</td></tr>
<tr><td>B. Class Test</td><td>Best two test Marks 20 Marks</td><td rowspan="4">Best two test Marks

40 Marks</td></tr>
<tr><td>Test I (Written test)</td><td>20 Marks</td><td>Section (B): Five ShortQuestions (200 Words Each)</td><td>05 x 05= 25 Marks</td></tr>
<tr><td>Test II (Written test)</td><td>20 Marks</td><td>Section (C): Two Long Questions (500 Words Each)</td><td>02 x 15= 30 Marks</td></tr>
<tr><td>Test III (Quiz/ Seminar/ Assignment)</td><td>20 Marks</td><td></td><td></td></tr>
<tr><td colspan="2">Total Internal Assessment(Theory) Marks (A+B)</td><td>40 Marks</td><td>Total External Evaluation (Theory) Marks (A+B+C)</td><td>60 Marks</td></tr>
</table>



PART A: Introduction			
Program: UG	**Class: B.Sc.**	**Year: Semester II**	**Session: 2021-22**
Subject: **: Practical (MICROBIOLOGY)**			
1.	Course Code	**S2- 14-PM**	
2.	Course Title	**Study of Microorganisms**	
3.	Course Type (Core Course/Open Elective/Generic Elective/ Vocational	**(Minor)**	
4.	Pre-Requisite (if any)	To study this course a student must have the Microbiology subject in B.Sc. I Semester.	
5.	Course Learning Outcomes (CLO)	• **Understand** the isolation of various types of bacteria and yeasts. • **Comprehend** with microscopic techniques for examination of various types of bacteria, fungi and protozoa • **Understand** structure of important animal, plant and bacterial viruses using electron micrographs.	
6.	Credit Value	**2 Credits**	
7.	Total Marks	Max. Marks: **40+60**	**Min. Passing Marks**: **35**

PART B: Content of the Course	
Total No. of Lectures-Tutorials-Practical's (in hours per week): L-T-P 0+0+2=2	
Total No. of Lab hours: 30 Hrs. (2 hours per Week)	
Lab Assignments 1. Isolation of autotrophic bacteria and Cyanobacteria, Rhizobia from root nodules 2. Isolation of lactobacillus from curd. 3. Isolation of yeast from ripened fruits. 4. Preparation of temporary wet mount and microscopic examination of *Mucor, Aspergillus.* 5. Preparation of smear and microscopic examination of *Staphylococcus, Lactobacillus, & Escherichia.* 6. Preparation of temporary wet mount and microscopic examination of *Amoeba, Euglena, & Paramaecium* 7. Study of the structure of important animal viruses (influenza, hepatitis B and retroviruses) using electron micrographs . 8. Study of the structure of important plant viruses (Tobacco ring spot, cucumber mosaic and alpha-alpha mosaic viruses) using electron micrographs . 9. Study of the structure of important bacterial viruses T4 phage) using electron micrograph.	**30 (Hours)**

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology

PART C: Learning Resources
Textbooks, Reference Books, Other Resources
Suggested Readings
1. Dubey, R.C. and Maheswari, D.K., "Practical Microbiology", S. Chand & Co. Ltd., New Delhi. (2002). 2. Aneja, K.R., "Laboratory Manual of Microbiology and Biotechnology. 2" Edition", Meditech Scientific International. (2018). 3. Patel, Rakesh J. and Patel Kiran, R.,"Experimental Microbiology Vol. I and Vol. II",. Aditya Prakashan, Ahmedabad. (2009). 4. Varghese, Naveena and Joy, V, "Microbiology Laboratory Manual" Ed.1, Aromatic and Medicinal Plants Research Station, Odakkali, Ernakulam, Kerala. (2014). 5. Shammi, Q.J.,"Microbiology – Tools and Techniques", Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-38-0 (In Hindi also). 6. Grainger.John, Hurst. Janet and Burdass. Dariel, "Basic Practical Microbiology: A Manual",. The Society for General Microbiology. (2001).
Suggestive digital platform web links 1 https://microbenotes.com/ 2 https://www.biologydiscussion.com/biologyarticles

PART D: Assessment and Evaluation	
Internal Assessment (A):	**40 marks**
Lab Record/Class interaction/quiz	15 marks
Attendance in the Lab	05 marks
Assignments (Industrial Training (10 hours)/Mini Project (project demo + report))	20
End Sem External Evaluation (B) :	**60 marks**
Viva Voce on Practical	10 marks
Practical Record File	10 marks
Experiments	40 marks
Total Marks (A+B)	**100** marks
Any remarks/suggestions:	

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology

Govt. Holkar (Model, Autonomous) Science College, Indore									
Department of Microbiology									
Syllabus Session 2021-2022									
Programme : B.Sc.								Class : B.Sc. II Year	
Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper-1	Biochemistry and Microbial Physiology	215-I	40	28	10	3	33	50	17
Paper-2	Microbial Genetics and Molecular Biology	215-II	40		10	3			

Class: B.Sc. Second Year **Marks: 40 + (CCE) 10= 50**
Subject: Microbiology **Code of the Paper:-215- I**
Paper: I

Title of the Paper: Biochemistry and Microbial Physiology

Part A : Introduction for code B.Sc. Second Year		
1	Pre-requisite (if any)	To study this course a student must have the subject Microbiology in B.Sc. First Year
2	Course Objectives	**To study microbial biochemistry and microbial physiology.**
	Course Learning outcomes	After completing this course in Microbiology, a student shall have understanding of -
		1 Students will learn properties, classification and functions of carbohydrates, lipids, proteins and amino acids.
		2 Students will study about growth of microbes and their measurement along with factors involved.
		3 Understanding the various metabolic pathways related to microorganism.
		4 Understanding the transport mechanism, microbial biosynthesis process.
		5 Understanding the principle of bioenergetics.

Part B: Content of the Course

Biochemistry and Microbial Physiology (Paper I)

Total No. of Lectures-60
Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**

Unit	Topics	No. of Lectures
1	General properties, classification and function of carbohydrates, lipids, proteins and amino acids. General properties. classification and nomenclature of enzymes. Factors affecting enzyme activity, mechanism of enzyme action, regulations of enzyme activity, applications of enzymes. Applications of Biotechnology.	12
2	Growth and measurement of growth, mathematical expression of growth, growth curve, growth yield, factors affecting growth, effect of nutrients, temperature, oxygen, pH, osmotic pressure. Cell count, direct and indirect method, dry weight and wet weight method, synchronous cultures. continuous culture, and batch cultures.	12
3	Energy production in anaerobic and aerobic process, glycolysis, Pentose phosphate pathway, Entner Duodoroff pathway, fermentation, glucose fermentation by E. coli, TCA cycle, heterotrophic carbon dioxide fixation, Glyoxylate cycle, catabolism of lipids, a and ß-oxidation, catabolism of proteins, aerobic respiration.	12
4	Diffusion, gaseous exchange, osmosis, plasmolysis, transport of nutrients in bacteria- active transport, passive diffusion, facilitated diffusion, group translocation. Utilization of Energy, Methods of studying Microbial biosynthesis, assimilation of Ammonia, Nitrogen and Sulphate Utilization of energy in non-biosynthetic and biosynthetic process	12
5	Principles of Bioenergetics, oxidation-reduction reaction. Redox-potential, oxidative phosphorylation hypothesis. Energy production by photosynthesis, photochemical reaction, cyclic and non cyclic photophosphorylation, role of ATP in metabolism, role of reducing power in metabolism, role of precursors of metabolism, component of electron transport chain and arrangement of ETC in cell membrane.	12

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1.Microbiology-Pelczar MJ, Chan ECS & Kreig NR, 5th edition (Tata McGraw-Hill, New Delhi).
2.Fundamentals of Microbiology-Frobisher M, Hinsdill RD, Crabtree KT & Goodheart CR, 9th edition (W.B. Saunders Co.).
3.Fundamental Principles of Bacteriology -Salle AJ, 7th edition (Tata McGraw-Hill, New Delhi) • Microbiology- Prescott LM, Harley JP &Klein DA, 7th edition (Wm. C. Brown Publishers, USA).
4.Elementary Microbiology-Modi, HA (Vol. I), 1st edition (Ekta Prakashan, Nadiad).
5.A Handbook of Elementary Microbiology-Modi, HA, 1st edition (Shanti Prakashan, Rohtak).
6 A Textbook of Microbiology- Dubey RC & Maheshwari DK, 2nd edition (S Chand & Co. N. Delhi.
7.General Microbiology (Vol I, II, III)- Powar CB& Daginawala HF, 2nd edition (Himalaya Publication, Bombay) Lehniger-Principles of Biochemistry- Nelson DL & Cox MM, 4th edition (CBS Publishers, New Delhi).
8.Microbial Physiology- Moat AG, Foster JW &Spector MP, 4th edition (John Wiley & Sons).
9.Fundamentals of Biochemistry-Jain JL, Jain S & Jain N, 8th edition (S.Chand & Co. New Delhi).
10.Biochemistry- Satyanarayana U, 4th edition (Elsevier, India).

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): 10
University Exam (UE): 40

Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Multiple Choice Questions	5 x 1 = 5
	Section (B): Five Long Questions (Each 300 words)	5 x 7 = 35
	Total	**40**
Any remarks/ suggestions: Nil		

Class: B.Sc. Second Year **Marks: 40 + (CCE) 10= 50**
Subject: Microbiology **Code of the Paper:-215- II**
Paper: II

Title of the Paper: Microbial Genetics and Molecular Biology

Part A : Introduction for code B.Sc. Second Year		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Microbiology in B.Sc. First Year
2	**Course Objectives**	To study and learn structure, function, replication, mutation of DNA and operon concept.
	Course Learning outcomes	After completing this course in Microbiology, a student shall have understanding of -
		1 Students will study and learn about structure and function of DNA and RNA.
		2 Understand the mechanism of DNA replication in living cell.
		3 Understand the process of transcription and translation in prokaryotes and eukaryotes and basics of operon concept.
		4 Importance of transformation techniques in genetic engineering.
		5 Understand the mechanism of DNA mutation and repair systems.

Part B: Content of the Course

Microbial Genetics and Molecular Biology (Paper II)

Total No. of Lectures-60
Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**

Unit	Topics	No. of Lectures
1	Structure and genetic material of microbes, Nucleic acid as genetic material, Physical and chemical structure and different forms of DNA. Melting curve of DNA and Tm value determination, Buoyant density of DNA and its relationship with mole (G+C) content in DNA, types of RNA, mRNA, rRNA, tRNA. Gene structure and functions.	**12**
2	Types of DNA replication, Replication of DNA in prokaryotes and eukaryotes, Conservative, Semi-conservative and Dispersive mode of replication, mechanism of replication, Messelson and Stahl experiment, DNA topology, Supercoiling of DNA and linking number, Enzymes involved in replication of DNA. Molecular Mechanism of chromosomal replication, Models of chromosomal replication, Cairns model, Rolling Circle model.	**12**
3	Translation and transcription in prokaryotes and eukaryotes, Basic features of genetic code, Biological significance of degeneracy, Wobble hypothesis, Poly cistronic RNA, overlapping genes, deciphering of genetic code, gene translocation, Ribosomes, and role in protein synthesis, tRNAs, initiation, elongation and termination of protein synthesis in prokaryotes, post translational modification of polypeptides, regulation of protein synthesis, Lac operon, Repressible operon.	**12**
4	Genetic recombination in bacteria, transformation, conjugation, F factor, Hfr strains, transduction in microbes, plasmids and binary vectors, transposons, transformation techniques, use of bacteria and viruses in genetic engineering.	**12**
5	DNA mutation and repair, types of mutation, evidence of spontaneous nature of mutation, fluctuation test, new comb's experiment and replica testing, mode of action of physical, chemical and biological mutagens-UV rays, nitrous acid, 5-bromouracil, 2-aminopurin, EMS, Reversion in mutation, true reversion, suppression and types of suppressor mutation, DNA repair mechanism, Photo reactivation, excision, mismatch, SOS repair and dealkylation repair.	**12**

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1.Genetics- Russel JP, 2nd edition (Scott, Foresman & Company, USA).
2.Principles of Genetics- Gardner JE, Simmons JM & Snustad PD, 8th edition (John Wiley & Sons. Canada)..
3.Concepts of Genetics- Klug W.S & Cummings MR, 10th edition (Benjamin Cummings, USA).
4.Microbial Genetics- Freifelder D, 2nd edition (Jones & Bartlett, Boston).
5.Molecular Biology & Genetic Engineering- Singh BD, 1st edition (Kalyani Publishers).
6.Essentials of Practical Microbiology- Patel B & Phanse N, I st edition (Print Care, Indore). Experiments in Biotechnology- Nighojkar S& Nighojkar A, I st edition (Satprachar Press, Indore).
7.Recombinant DNA Technology- Sardul Singh Sandhu (2008). 1K International publisher, New Delhi.
8. A Textbook of Microbiology- Dubey RC & Maheshwari DK, 2nd edition (S Chand & Co. N. Delhi.)

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **50**
Continuous Comprehensive Evaluation (CCE): **10**
University Exam (UE): **40**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Multiple Choice Questions	5 x 1 = 5
	Section (B): Five Long Questions (Each 300 words)	5 x 7 = 35
	Total	**40**
Any remarks/ suggestions: Nil		

Part A - Introduction				
Programme : B.Sc.		**Class: B.Sc.**	**Year: Second Year**	**Session: 2021-22**
Subject: Microbiology (Practical)				
1	**Course Code-**	**C215- P**		
2	**Course Title**	Biochemistry and Microbial Physiology & Microbial Genetics and Molecular Biology (Paper I & II)		
3	**Course Type**	**Core Course**		
4	**Pre-requisite**	To study this course a student must have had the subject Microbiology in B.Sc. First Year		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to understand:** • Students will learn biochemical identification of carbohydrates, lipids, proteins and amino acids. • Study about bacterial growth curve. • Isolation of genomic DNA. • Isolation of antibiotic resistant mutants.		
6	**Total Marks**	Maximum Marks: **50**	Min. Passing Marks: **17**	

Part B - Content of Practical Course		
Total No. of Lectures-30 Tutorials-Practical (in hours per week): **L-T-P: 0-0-2**		
S.No.	**Name of Exercises**	**No., of Lab Hours**
1	To determine the pH of a given solution.	1
2	To prepare a buffer solution.	1
3	Identification of biological compound, Carbohydrates — Molisch's test, Protein - Biuret test, Lipid - Saponification test	1
4	Qualitative analysis for amino acid- Color reaction for amino acid, Biuret test, Ninhydrine test.	1
5	Quantitative analysis of fat- Test for oil, Solubility test, Emulsion test, Absorption test.	1
6	Estimation of glucose by Cole's method.	1
7	Estimation of protein by Folin Lowry method.	2
8	Study of enzyme activity and effect of different factors on enzyme activity.	1
9	Demonstration on isolation of DNA.	3
10	Quantitative estimation of DNA by DPA method.	2
11	Quantitative estimation of RNA by Orcinol method.	2
12	To study conjugation in bacteria.	2
13	To Transfer bacterial colonies by replica plating method.	2
14	Effect of UV light on growth of bacteria.	2
15	Effect of mutagen on the growth of bacteria-	2
16	To study antibiotic resistance in bacteria.	2
17	Primary screening of amylase/ protease producers.	2
18	Designing of at least two innovative experiments based on the available facility in the college/ University related to subject.	2
Key words: DPA, Isolation of DNA, Replica plate, Biuret test, Ninhydrine test.		

Part C : Learning Resources

Text Books, Reference Books

Suggested Reading:

1. Cappuccino, J. and Sherman, N., "Microbiology: A Laboratory Manual", 9th edition. Pearson Education Limited. (2010).
2. Dubey, R.C. and Maheswari, D.K., "Practical Microbiology", S. Chand & Co. Ltd., New Delhi. (2002).
3. M. Gopal Reddy,M., Reddy, M.N., Saigopal, D.V.R. and Mallaiah K.V., "Laboratory Experiments in Microbiology",. Himalaya Publishing House, Mumbai. (2007).
4. Aneja, K.R., "Laboratory Manual of Microbiology and Biotechnology. 2" Edition", Meditech Scientific International. (2018).
5. Patel, Rakesh J. and Patel Kiran, R.,"Experimental Microbiology Vol. I and Vol. II",. Aditya Prakashan, Ahmedabad. (2009).
6. Varghese, Naveena and Joy, V, "Microbiology Laboratory Manual" Ed.1, Aromatic and Medicinal Plants Research Station, Odakkali, Ernakulam, Kerala. (2014).
7. Shammi, Q.J.,"Microbiology - Tools and Techniques", Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-38-0 (In Hindi also).
8. Grainger.John, Hurst. Janet and Burdass. Dariel, "Basic Practical Microbiology: A Manual",. The Society for General Microbiology. (2001).

Part D : Assessment and Evaluation

External Assessment	Marks
Viva voce on Practical	05
Practical Record File	05
Table work/ Experiments	30
Spotting	10
Total	**50**

Govt. Holkar (Model, Autonomous) Science College, Indore									
Department of Microbiology									
Syllabus Session 2021-2022									
Programme : B.Sc.								Class : B.Sc. III Year	
Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper-1	Applied and Environmental Microbiology	315-I	40	28	10	3	33	50	17
Paper-2	Immunology and Medical Microbiology	315-II	40		10	3			
Internship			Report	Viva	Max	Minimum			
			50	50	100	33			

Class: B.Sc. Third Year **Marks: 40 + (CCE) 10= 50**
Subject: Microbiology **Code of the Paper:-315- I**
Paper: I

Title of the Paper: Applied and Environmental Microbiology

Part A : Introduction for code B.Sc. Third Year		
1	Pre-requisite (if any)	To study this course a student must have the subject Microbiology in B.Sc. Second Year
2	Course Objectives	To study basic design of fermentor, food spoilage, concept of environment in relation to microbes and use of microbes in bioleaching and bioremediation..
	Course Learning outcomes	After completing this course in Microbiology, a student shall have understanding of -
		1.Students will study and learn the basic design and types of fermentor. Comprehend with techniques of strain improvement and immobilization.
		2.Learning about food spoilage, basic and advanced methods of food preservation.
		3.Understand the role of microbes as biofertilizer to increase fertility of soil and production of SCP.
		4.Learning about physiological adaptation in microbes and microbial interaction.
		5.Understand the basic concept of bioleaching and bioremediation. Role of microbes sewage treatment plant.

Part B: Content of the Course

Total No. of Lectures-60 Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**		
Unit	**Topics**	**No. of Lectures**
1	Design and types of Fermentor, factors affecting fermentation process, Industrial production of alcohol, organic acid economically important enzymes, amino acids, antibiotics, vitamins, Method of immobilization and applications. Strategy for improvement of industrially important microbial strain.	**12**
2	Physical and microbial spoilage of food and food products, spoilage of stored products, fruits and vegetables, spoilage of milk, milk products and meat. Food borne diseases. Food preservation methods, asepsis, pasteurization, canning, desiccation, low temperature, anaerobiosis, filtration, chemical preservation of food- salt and sugar, organic acids, use of sulphur dioxide, ethylene and propylene oxides, wood smoke. Applications and production of SCP.	**12**
3	Physical and chemical characteristics of soil, soil microflora, soil fertility and management of agricultural soil, rhizosphere and phyllosphere. Microbial diseases of crop plants with special reference to wheat, rice. VAM and its importance. Nitrogen fixation by symbiotic and non- symbiotic microbes. Use of microbes as biofertilizers, mass cultivation of Rhizobium and Azotobacter, use of blue green algae as biofertilizer.	**12**
4	Concept of environment in relation to microbes, physiological adaptation in microbes, nature of microbial population in soil, water and air. Microbial interactions - neutralism, commensalism, synergism.	**12**
5	Bioremediation, biomagnification, bioleaching, biopesticides, Microbial 1b production. Impact or genetically modified organisms. Biodegradation of plastics. Liquid waste disposal, characteristics of solid and liquid waste, sewage treatment - primary, secondary and tertiary treatment.	**12**

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1.Introduction to soil microbiology-Alexander M, 2nd edition (John Wiley and Sons New York).
2.Soil Microbiology- Subba Rao NS, 4th edition (Oxford and IBH, Publishing Co. New Delhi).
3.Fundamental Principles of Bacteriology -Salle AJ, 7th edition (Tata McGrawhill, New Delhi).
4.Microbiology-Pelczar MJ, Chan ECS & Kreig NR, 5th edition (Tata McGraw-Hill, New Delhi).
5.A Textbook of Microbiology- Dubey RC & Maheshwari DK, 2nd edition (S Chand & Co. New Delhi.
6.Food Microbiology- Frazier CW and Westhoff CD, 4th edition (Tata McGrawhill, New Delhi).
7.Food Microbiology- Adams RM and Moss 0M, 3rd edition (RSC publisher).
8.Introductory Food Microbiology-Modi HA, 1st edition, (Aavishkar Publishers, Jaipur).
9.Modern Food Microbiology- Jay JM, 5th edition (Aspen Publishers, Maryland).
10.Introduction to Environmental Microbiology-Michael R, 1st edition (Prentice Hall).
11.Bioremediation-Baker KH and Herson DS (Mc Graw Hill, New York).
12.Textbook of Industrial Microbiology -Patel AH, 1st edition (Macmillan India Ltd, Madras).
13.Industrial Microbiology-Cassida LE, 4th edition (Wiley Eastern Ltd, New Delhi).
14.Principles of Fermentation Technology-Stanbary FP, Whitaker A and Hall JS, 2nd edition, •(Elsevier, Delhi).
15.Fermentation Technology- Modi HA, 1st edition (Pointer Publisher, Jaipur).
16.Biotechnology -Industrial Microbiology- Crueger W & Crueger A, 2nd edition (Panima Publisher, Delhi).
17.Industrial Microbiology- Prescott SC & Dunn CG, 4th edition (Agrobios India, Jodhpur).
18.Industrial Microbiology: Fundamentals and Applications- Agarwal AK & Parihar P, I[st] edition (Agrobios India, Jodhpur).

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **50** **Continuous Comprehensive Evaluation (CCE):** **10** **University Exam (UE):** **40**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Multiple Choice Questions	5 x 1 = 5
	Section (B): Five Long Questions (Each 300 words)	5 x 7 = 35
	Total	**40**

Class: B.Sc. Third Year **Marks: 40 + (CCE) 10= 50**
Subject: Microbiology **Code of the Paper:-315- II**
Paper: II

Title of the Paper: Immunology and Medical Microbiology

	Part A : Introduction for code B.Sc. Third Year	
1	**Pre-requisite (if any)**	To study this course a student must have the subject Microbiology in B.Sc. Second Year
2	**Course Objectives**	To study structure of immune cell, antigen, antibody, immunoassay, drug delivery system and diseases caused by bacteria, virus and fungi.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Studying and learing about cells and organs in immune system, innate and acquired immunity.
		2.Understand the basic concept of antigen antibody interaction and immunoassays.
		3.Understand the basic concept of origin and development of tumor cells and the role of nanoparticles in drug delivery system.
		4.Learning about immunization schedule and medical importance of blood group.
		5.Comprehend with laboratory techniques used in diagnoses of microbial infections.

Part B: Content of the Course

Total No. of Lectures-60 Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**		
Unit	**Topics**	**No. of Lectures**
1	Structure. composition and types of cells and organs involved in immune system. Innate and acquired immunity. Types, structure and functions of MHC molecules, antigen processing and presentation. Humoral and cell mediated immune responses.	**12**
2	Antigens — structure, properties and types. Haptens and adjuvants. Immunoglobulins- structure, heterogeneity, types and subtypes, physico-chemical and biological properties. Theories of antibody production. generation of antibody diversity. Antigen-Antibody interactions agglutination, precipitation, immunofluorescence, ELISA, Radioimmunoassays. Hybridoma technology - Production and applications of monoclonal antibodies.	**12**
3	Tumor immunology —Cancer, origin, oncogenes, tumor antigens, immune response to tumors, tumor evasion of the immune system, immune diagnosis of tumors. Bio nanotechnology in Drug delivery systems.	**12**
4	Immunization - Modern methods of vaccine production, autoimmunity, hypersesitivity. Immunohematology, antigens of ABO and Rh blood group systems. Medical importance of blood groups- ABO and Rh incompatibility.	**12**
5	Host microbe interaction, mechanism of pathogenicity. Laboratory strategies in diagnosis of infective syndrome. Bacterial and viral diseases of human - Syphilis, pox, Hepatitis. Fungal diseases or human- Cryptococcus, Candidiasis, Dermatomycosis, sexually transmitted diseases (STDs).	**12**

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1.Kuby Immunology- Kindt T, Goldsby RA, Osborne BA, 6th edition (WH Freeman & Co. NewYork).
2.Textbook of Microbiology -Ananthnarayan R and Panikar CKJ, 8th edition, (Univ Press Pvt Ltd. Hyderabad).
3.Text book of Microbiology-Chakraborty P, 1st edition (New Central book agency Pvt Ltd).
4.Fundamental Immunology- Paul WE, 7th edition (Lippincott Williams & Wilkins, USA).
5.Fundamentals of Immunology-Coleman RM, Lombord MF and Sicard RE, 2nd edition (WMC Brown, USA).
6.Immunology-Weir DM and Steward J, 8th edition (Topley & Wilson, UK).
7.Immunology-Rao CV, 2nd edition (Narosa Publishing House, New Delhi).
8.Essentials of Immunology- Roitt IM, 11th edition, (Blackwell Pub, USA).
9.Immunology- Elgert KD- 2nd edition (Wiley Blackwell)-

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **50** **Continuous Comprehensive Evaluation (CCE):** **10** **University Exam (UE):** **40**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Multiple Choice Questions	5 x 1 = 5
	Section (B): Five Long Questions (Each 300 words)	5 x 7 = 35
	Total	**40**

Part A - Introduction				
Programme : B.Sc.		**Class: B.Sc.**	**Year: Third Year**	**Session: 2021-22**
Subject: Microbiology (Practical)				
1	**Course Code-**	**315- P**		
2	**Course Title**	Applied and Environmental Microbiology & Immunology and Medical Microbiology (Paper I & II)		
3	**Course Type**	**Core Course**		
4	**Pre-requisite**	To study this course a student must have had the subject Microbiology in B.Sc. First Year		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to understand:** • Isolation of microbes from air, water & soil. • Measurement and confirmation of coliforms in water samples. • Determination of blood groups and haemoglobin content of blood. • Various methods of diagnosis of diseases.		
6	**Total Marks**	Maximum Marks: **50**		Min. Passing Marks: **17**

Part B - Content of Practical Course		
Total No. of Lectures-30 Tutorials-Practical (in hours per week): **L-T-P: 0-0-2**		
S.No.	**Name of Exercises**	**No., of Lab Hours**
1	Isolation and enumeration of microorganisms from air.	**2**
2	Isolation and enumeration of microorganisms from water.	**2**
3	Isolation and enumeration of microorganisms from soil.	**2**
4	Total count of bacteria from water.	**2**
5	Measurement and confirmation of E. coli in water sample.	**3**
6	Isolation and identification of bacteria from spoiled food.	**2**
7	Heavy metal sensitivity in microbes.	**1**
8	Study of Rhizobium bacteria from root nodules.	**2**
9	Study of symbiotic and non-symbiotic blue green algae.	**1**
10	Determination of milk quality by resazurin test through MBRT.	**1**
11	Determination of Blood Groups.	**1**
12	Estimation of haemoglobin by Sahil's method.	**1**
13	Total count of W.B.C.	**1**
14	Total count of R.B.C.	**1**
15	Differential W.B.C. count.	**1**
16	Flocculation reaction- VDRL	**1**
17	Agglutination reaction- Widal test.	**1**
18	Examination of urine- chemical, physical, microscopic and bacteriological.	**1**
19	Demonstration of ELISA test.	**2**
20	Designing of at least two innovative experiments based on the available facility in the college/ University related to subject.	**2**

Part C: Learning Resources

Text Books, Reference Books and Other Resources

Suggested Reading:

1. Cappuccino, J. and Sherman, N., "Microbiology: A Laboratory Manual", 9th edition. Pearson Education Limited. (2010).
2. Dubey, R.C. and Maheswari, D.K., "Practical Microbiology", S. Chand & Co. Ltd., New Delhi. (2002).
3. M. Gopal Reddy,M., Reddy, M.N., Saigopal, D.V.R. and Mallaiah K.V., "Laboratory Experiments in Microbiology",. Himalaya Publishing House, Mumbai. (2007).
4. Aneja, K.R., "Laboratory Manual of Microbiology and Biotechnology. 2" Edition", Meditech Scientific International. (2018).
5. Patel, Rakesh J. and Patel Kiran, R.,"Experimental Microbiology Vol. I and Vol. II",. Aditya Prakashan, Ahmedabad. (2009).
6. Varghese, Naveena and Joy, V, "Microbiology Laboratory Manual" Ed.1, Aromatic and Medicinal Plants Research Station, Odakkali, Ernakulam, Kerala. (2014).
7. Shammi, Q.J.,"Microbiology – Tools and Techniques", Kailash Pustak Sadan, Bhopal. ISBN: 978-81-89900-38-0 (In Hindi also).
8. Grainger.John, Hurst. Janet and Burdass. Dariel, "Basic Practical Microbiology: A Manual",. The Society for General Microbiology. (2001).
9. Mukesh kumar, Practical Manuel for microbiology, Jain brothers, 2018

Part D : Assessment and Evaluation

External Assessment	Marks
Viva voce on Practical	05
Practical Record File	05
Table work/ Experiments	30
Spotting	10
Total	**50**

Important Note: Internship is compulsory during IIIrd Year.

(Visit to any Industry/Research Industry/Research laboratory related to Microbial product during IIIrd year)

Dr. Sanjay Vyas Head Professor & Head Dept. of Microbiology (M.P.) Govt. Holkar College, Indore

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Microbiology

Syllabus Session 2021-2022

Programme : M.Sc. Microbiology **Class : M.Sc. I Sem.**

S.N.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External assessment Max.	External assessment Min.	Total Max	Total Mini.
1	Core 1	Bacteriology	MB-11	4	25	9	75	26	100	35
2	Core 2	Virology, Mycology and Phycology	MB-12	4	25	9	75	26	100	35
3	Core 3	Immunology	MB-13	4	25	9	75	26	100	35
4	Core 4	Microbial Biochemistry	MB-14	4	25	9	75	26	100	35
5	Practical 1	Lab. Course-I	PRMB-11	3	---	---	75	---	75	26
6	Practical 2	Lab. Course-II	PRMB-12	3	---	---	75	---	75	26
7	Seminar I	---	---	1	---	---	25	---	25	9
8	Seminar II/ Field Trip/Industrial Visit etc.	---	---	1	---	---	25	---	25	9
			Total	**24**	**100**		**500**		**600**	

Dr. Sanjay Vyas Head Professor & Head Dept. of Microbiology (M.P.) Govt. Holkar College, Indore

Class: M.Sc. First Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit: 4**
Paper: Core 1 **Code of the Paper: -MB-11**

Bacteriology (Paper 1)

Part A : Introduction for code M.Sc. Ist Semester		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Microbiology/Botany/Biotechnology/Biochemistry/ in B.Sc.
2	**Course Objectives**	To study and identify the basic structure of bacteria and methods of cultivation, staining and control of bacteria.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Students will study and learn to identify the basic structure of bacteria.
		2.Students will study and learn about the growth phases of bacteria
		3.Students will study and learn the methods of cultivation of bacteria.
		4.Chemical and physical control methods for bacteria.
		5.Various staining techniques for bacterial structure.

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Part B: Content of the Course

Unit	Topics
1	Classification of microorganisms – Haeckel's three kingdom concept, Whittaker's five kingdom concept, Three domain concept of Carl Woese, Basis of microbial classification, Classification and salient features of bacteria according to the Bergey's manual of determinative bacteriology.
2	Morphology and ultra structure of bacteria – morphological types – cell walls of archaebacteria and eubacteria (Gram negative and Gram positive), L- forms. Cell wall synthesis, antigenic properties. Capsule – types, composition and function. Cell membrane – structure, composition and properties.
3	Structure and function of flagella, pili, gas vesicles, chromosomes, carboxysomes, magnetosomes, phycobolisomes and nucleoid. Spores and Cysts. Reserve food materials – Polyhydroxybutyrate, polyphosphate granules, oil droplets, cyanophycin granules and sulphur inclusions.
4	Cultivation of bacteria – Aerobic and anaerobic cultivation, Shake flask and still cultivation. Nutritional types of bacteria. Bacterial growth- Culture media, Growth curve, Batch, continuous and synchronous cultures. Measurement of bacterial growth- Growth kinetics, Generation time and growth rate. Factors affecting microbial growth.
5	Control of bacteria – Microbial death curve under adverse conditions. Concepts of bioburden, thermal death constant and decimal reduction time. Control of microbes by physical and chemical agents and mechanisms of their microbicidal activity.

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Part C : Learning Resources

Text Books, Reference Books **Suggested Readings:**	
1. Fundamental Principles of Bacteriology	Salle
2. Biology of Microorganisms	Brock, Madigan
3. Microbiology Pelczar,	Chan & Kreig
4. Text Book on Principles of Bacteriology, Virology & Immunology	Topley and Wilson
5. General Microbiology	Stainer, Ingharam, Wheelis
6. Illustrated Genera of Imperfect Fungi	Barnett and Hunter
7. Bergey's Manual of Determinative Bacteriology (VIII Edition)	Breed and Buchanan
8. Bergey's Manual of Determinative Bacteriology (IX Edition)	Breed and Buchanan
9. Bergey's Manual of Systematic Bacteriology (II Edition)	Breed and Buchanan
10. The genetics of Bacteria and their Viruses	William Hayes
11. General Microbiology	Robert Boyd
12. An Introduction to Microbiology	Tauro, Kapoor, and Yadav
13. Microbiology-A Practical Approach	Patel & Phanse

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100** **Continuous Comprehensive Evaluation (CCE):** **25** **University Exam (UE):** **75**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Type tex

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Class: M.Sc. First Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit : 4**
Paper: Core 2 **Code of the Paper:-MB-12**

Virology, Mycology and Phycology (Paper 2)

Part A : Introduction for code M.Sc. Ist Semester		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Microbiology/Botany/Biotechnology/Biochemistry/ in B.Sc.
2	**Course Objectives**	To understand the basic idea of structure of viruses, life cycle of bacteriophage, classification of fungi and cultivation of Algae.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Students will understand the basic idea of structure of viruses.
		2.Students will study the life cycle of bacteriophage.
		3.Understand the concept of cultivation of virus and quantification.
		4.Students will learn general characters of fungi with classification.
		5.Understand the basic characters of Algae and cultivation.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Part B: Content of the Course

Unit	Topics
1	Discovery, nomenclature and general characters of viruses. Classification of virus – Baltimore, ICTV. Morphology and ultra structure, capsids and their arrangements, types of envelopes and their composition. Viral genome, their types and structures. Virus related agents- Viroids and prions.
2	Bacteriophages: Organization and life cycle. One step growth curve; Phage DNA transcription and phage DNA replication, eclipse phase; Phage production; Burst size, Lysogenic cycle, Bacteriophage typing. Application in bacterial genetics. Brief details on T phages and Lambda phages.
3	Cultivation of viruses in embryonated eggs, experimental animals and cell cultures. Assay of viruses: Physical and chemical methods- Protein, nucleic acid, radioactivity tracers, electron microscopy. Infectivity assay- Plaque method and end point method.
4	Mycology: Classification and general features of fungi, Structure of fungal cells and growth – Hyphae and non- motile unicells, motile cells, effect of environment on growth, prevention of fungal growth. Life cycle of *Penicillium, Saccharomyces* and *Fusarium*.
5	Phycology: Distribution of algae, Classification of algae, Algal nutrition, reproduction, green algae, diatoms, euglenoids, brown Rhodophyta, Microalgae. Cultivation of algae.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Introduction to Mycology (III Edition)	Alexopoulous and Mims
2. Introduction to Modern Virology (IV Edition)	Dimmock and Primrose
3. An Introduction to Mycology	Mehrotra and Aneja
4. Fundamentals of Mycology	Burnett
5. The Fungi	Charlile and Walkinson
6. Fundamentals of Mycology	Burnett
7. Fundamentals of the fungi	Moore and Landeekeerl
8. Virology (III Edition)	Conrat, Kimball
9. Phycology (Fourth Edition)	Robert Edward Lee
10.Textbook of Algae	O P Sharma

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:		
Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Class: M.Sc. First Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit : 4**
Paper: Core 3 **Code of the Paper:-MB-13**

Immunology (Paper 3)

Part A : Introduction for code M.Sc. Ist Semester		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Microbiology/Botany/Biotechnology/Biochemistry/ in B.Sc.
2	**Course Objectives**	To study the various method of vaccine production and immunological techniques.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Students will study and learn the various methods of vaccine productions.
		2.Students will study the mechanism of antibody generation and role of immunoglobulins in immunity.
		3.Understanding of various immunological techniques.
		4.Understanding of the mechanism, diagnosis and treatment of Cancer.
		5. Understanding of the mechanism of development of hypersensitivity reactions.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Part B: Content of the Course

Unit	Topics
1	Structure, composition and types of cells and organs involved in immune system. Innate and acquired immunity. Humoral and cell mediated immune responses. Immunization – Modern methods of vaccine production.
2	Antigens – Structure, properties and types. Haptens and adjuvants. Immunoglobulins- structure, heterogeneity, types and subtypes. Physico-chemical and biological properties of immunoglobulins. Theories of antibody production. Generation of antibody diversity. Complement – Structure, components, properties and functions of complement components, Complement pathways and biological consequences of complement activation.
3	Antigen-Antibody interactions – *In vitro* methods – Agglutination, Precipitation, Complement fixation. Immunofluorescence, ELISA, Radioimmunoassay, Immuno blotting. *In vivo* methods: Skin tests and immune complex tissue demonstrations and their applications in diagnosis of microbial diseases. Hybridoma technology – Production and applications of monoclonal antibodies.
4	Structure and functions of MHC and the HL-A systems. HL-A and tissue transplantation – Tissue typing methods for organ and tissue transplantations in humans, Graft versus host reaction and rejection. Tumor immunology – tumor specific antigens, immune response to tumors, immunodiagnosis of tumors – detection of tumor markers – alpha foetal proteins.
5	Type I IgE – Mediated Hypersensitivity, Type II Antibody – Mediated Cytotoxic Hypersensitivity. Type III Immune Complex – Mediated Hypersensitivity. Type IV Delayed – Type Hypersensitivity. Autoimmunity – mechanism and diseases.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Type text here

Part C : Learning Resources

Text Books, Reference Books **Suggested Readings:**	
1. Essentials of Immunology	Roitt
2. Immunology (II Edition)	Kuby
3. Immunology	Klaus
4. Text Book on Principles of Bacteriology, Virology and Immunology, IX Edition (5 volumes)	Topley and Wilson's
5. The Experimental Foundations of Modern Immunology	Clark, John Willey
6. Fundamental Immunology	Paul
7. Fundamentals of Immunology	Coleman, Lombord and Sicard
8. Immunology	Weir and Steward

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100** **Continuous Comprehensive Evaluation (CCE):** **25** **University Exam (UE):** **75**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College (M.P.)

Class: M.Sc. First Semester
Subject: Microbiology
Paper: Core 4

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-MB-14

Microbial Biochemistry (Paper 4)

Part A : Introduction for code M.Sc. Ist Semester		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Microbiology/Botany/Biotechnology/Biochemistry in B.Sc.
2	**Course Objectives**	To study and learn structure and function of carbohydrate, protein, lipids, enzymes and vitamins.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Students will study and learn about structure, classification, identification and Properties of carbohydrates.
		2.Study and learning about structure, classification, identification and Properties of lipids.
		3.Study and learning about structure, classification, identification and Properties of Amino acids and proteins.
		4.Importance of enzymes as biocatalyst and its kinetic. 5.Role of vitamins and their chemistry in living organism.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College (M.P.)

Type text here

Part B: Content of the Course

Unit	Topics
1	Monosaccharides and their relationship, structure of sugars, stereoisomerism and optical isomers of sugars. Reactions of aldehyde and ketone groups, Ring structures and tautomeric forms, Mutarotation, Reaction of sugars to -OH groups. Important derivatives of monosaccharides, disaccharides and trisaccharides. Structure, identification and importance of mono and oligosaccharides. Structure, occurrence and biological importance of structural polysaccharides *e.g.* Blood group lipopolysaccharides.
2	Definition and classification of lipids. Building blocks of lipids, fatty acids, glycerol, sphingosine. Fatty acids distribution in nature, classification, physico-chemical properties, separation, characterization and chemical properties. Saponification and iodine number. Properties and function of phospholipids. Lipoproteins - classification, composition and their importance. Role of lipids in cellular architecture and functions.
3	Amino Acids- structure, classification and properties. Handerson and Hasselbach equation for ionization of amino acids. Chemical reactions of amino acids, Lab synthesis of poly peptide. Primary, secondary, tertiary and quaternary structure of Haemoglobin and Myoglobin. Ramchandran plot. Determination of amino acid sequence in proteins / polypeptides.
4	Enzymes as biocatalysts- Enzyme classification. Mechanism of enzyme action - specificity, active site, activity unit and isozymes. Factors affecting enzyme efficiency, enzyme activators, coenzymes and cofactors. Enzyme kinetics - Michaelis - Menton equation for simple enzymes, determination of kinetic parameters, multi-step reactions and rate limiting steps. Enzyme inhibition- reversible, irreversible, competitive and noncompetitive. Allostersim- kinetic analysis of allosteric enzymes, Principles of allosteric regulation.
5	Vitamins - Discovery, role and chemistry of fat soluble vitamins A, D, E and K. Water soluble vitamins – Pantothenic acid, niacin, pyridoxine, biotin, riboflavin, cyanocobalamine, folic acid and ascorbic acid.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Principles of Biochemistry- IV Edition	Lehniger
2. Biochemistry - V Edition	Stryer
3. Harper's Biochemistry	Murrey
4. Principles of Biochemistry	Zubey, Parson and Vance
5. Modern Microbiology	Brige and Brown
6. Introduction to protein structure	Branden and Tooze
7. Experiments in Biotechnology	Nighojkar and Nighojkar

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Part A - Introduction				
Programme : M.Sc.		**Class: M.Sc.**	**I SEMESTER**	**Session: 2021-22**
Subject: Microbiology (Practical)				
1	**Course Code-**	**PRMB-11**		
2	**Course Title**	Lab. Course - I		
3	**Course Type**	**Core Course**		
4	**Pre-requisite**	To study this course a student must have the subject Microbiology/Botany/Biotechnology/Biochemistry/ in B.Sc.		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to understand:** • Students will study and learn to identify the basic structure of bacteria. • Students will study and learn about the growth phases of bacteria. • Students will learn general characters of fungi with classification. • Understand the basic characters of Algae and cultivation.		
6	**Total Marks**	**Maximum Marks: 75**		**Min. Passing Marks: 26**

	Part B - Content of Practical Course
S.No.	**Name of Exercises**
1	To perform studies on growth curve of given bacterial culture.
2	To study thermal death point of given culture.
3	To study thermal death temperature of given culture.
4	To isolate and identify different bacteria from soil sample.
5	To study control of microbes by physical agent.
6	To study control of microbes by chemical agent.
7	To isolate the fungi from soil sample.
8	To perform lactophenol cotton blue staining techniques.
9	To identify the given algae sample.
10	To identify the given fungal sample.
11	To isolate the bacteriophage from sewage sample.
12	To identify the characters of filamentous algae.
13	Any other experiment may be designed on the basis of theoretical aspects.

Type text here

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part D : Assessment and Evaluation

External Assessment	**Marks**
Viva voce on Practical	10
Practical Record File	10
Major Exercise	21
Minor Exercise (A)	12
Minor Exercise (B)	12
Spotting	10
Total	**75**
Credits	**03**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part A - Introduction				
Programme : M.Sc.		**Class: M.Sc.**	**I SEMESTER**	**Session: 2021-22**
Subject: Microbiology (Practical)				
1	**Course Code-**	**PRMB-12**		
2	**Course Title**	Lab. Course - II		
3	**Course Type**	**Core Course**		
4	**Pre-requisite**	To study this course a student must have the subject Microbiology/Botany/Biotechnology/Biochemistry/ in B.Sc.		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to understand:** • Understanding of various immunological techniques. • Comprehend with various diagnostic methods. • Student learn the biochemical method of identification of biomolecules and quantitative analysis of carbohydrates and proteins.		
6	**Total Marks**	Maximum Marks: 75		Min. Passing Marks: 26

	Part B - Content of Practical Course
S.No.	**Name of Exercises**
1	To perform radial immunodiffusion (RID) techniques.
2	To perform Ochterolony double diffusion (ODD) technique.
3	To detect typhoid by widal test.
4	To detect syphilis by VDRL test.
5	To determine blood group of an individual.
6	To determine haemoglobin content of given blood sample by sahli's method.
7	To determine antibiotic sensitivity of given bacterial culture by Kirby-bauer method.
8	To perform immunoelectrophoretic techniques
9	To study the preparation of different standard solution.
10	To perform detection of carbohydrates in given sample.
11	To perform the detection of protein in given sample.
12	To perform the detection of lipid in given sample.
13	To perform quantitative estimation of protein by biuret method.
14	To perform quantitative estimation of carbohydrate by cole's method.
15	Any other experiment may be designed on the basis of theoretical aspects.

Type text here

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part D : Assessment and Evaluation

External Assessment	**Marks**
Viva voce on Practical	10
Practical Record File	10
Major Exercise	21
Minor Exercise (A)	12
Minor Exercise (B)	12
Spotting	10
Total	**75**
Credits	**03**

Seminar: Assessment and Evaluation

External Assessment	**Marks**			
Seminar I	**PPT Slides**	**Presentation**	**Group Discussion**	**Total**
	10	**10**	**05**	**25**
Credits				**01**
	Marks			**Total**
Seminar II	**PPT Slides**	**Presentation**	**Group Discussion**	
	10	**10**	**05**	**25**
Credits				**01**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Microbiology

Syllabus Session 2021-2022

Programme : M.Sc. Microbiology **Class : M.Sc. II Sem.**

S.N.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External assessment Max.	External assessment Min.	Total Max	Total Mini.
1	Core 5	Microbial Genetics	MB-21	4	25	9	75	26	100	35
2	Core 6	Microbial Physiology	MB-22	4	25	9	75	26	100	35
3	Core 7	Instrumentation	MB-23	4	25	9	75	26	100	35
4	Core 8	Fermentation Technology	MB-24	4	25	9	75	26	100	35
5	Practical 3	Lab. Course-III	PRMB-21	3	----	----	75	---	75	26
6	Practical 4	Lab. Course-IV	PRMB-22	3	----	----	75	---	75	26
7	Seminar 3	----	----	1	----	----	25	---	25	9
8	Seminar 4	----	----	1	----	----	25	---	25	9
			Total	24	100		500		600	

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Class: M.Sc. Second Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit : 4**
Paper: Core 5 **Code of the Paper:-MB-21**

Microbial Genetics (Paper 5)

Part A : Introduction for code M.Sc. IInd Semester		
1	Pre-requisite (if any)	To study this course a student must have to pass M.Sc. Ist Semester in Microbiology.
2	Course Objectives	**To study the mechanism of DNA replication, DNA repair pathway, Operon concept and Gene transfer.**
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Students will study and learn the mechanism of DNA replication in prokaryotes and eukaryotes.
		2.Understanding of different types of Mutation and DNA repair pathways.
		3.Studying the process of protein synthesis in prokaryotes and eukaryotes. .
		4.Learning about Operon concept.
		5.Knowledge about various mechanism of Gene transfer such as transduction, transformation and conjugation.

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Part B: Content of the Course

Unit	Topics
1	Fine structure of prokaryotic and eukaryotic genome. DNA structure and types DNA replication- general principles, various modes of replication, Proof-reading, Continuous and discontinuous synthesis, Synthesis of leading and lagging strands. Superhelicity in DNA. Mechanism of action of topoisomerases. Inhibitors of DNA replication..
2	Gene as a unit of mutation, molecular nature of mutation. Mutagens, spontaneous mutation, DNA damage (Deamination, oxidative damage, alkylation, pyrimidine dimers) Repair pathways- methyl directed mis-match, repair, very short patch repair, nucleotide excision repair, base excision repair, recombination repair and SOS repair.
3	Gene Expression, Structural features of RNA (rRNA, tRNA and mRNA) Transcription- General Principles, basic apparatus and types of RNA polymerases. Initiation, elongation and termination steps Inhibitors of RNA synthesis. Polycistronic and monocistronic RNAs. Control of transcription by interaction between RNA polymerases and promoter regions. Use of alternate sigma factors, controlled termination, attenuation and anti-termination RNA. Maturation and processing of RNA: Methylation, cutting and trimming of rRNA; capping, polyadenylation and splicing of mRNA; cutting and modification of tRNA degradation system.
4	Basic features of the genetic code. Protein synthesis: steps, details of initiation, elongation and termination, role of various factors in these steps, inhibitors of protein synthesis. Regulation of gene expression: Operon concept, catabolite repression, positive and negative regulation, inducers and co-repressors Negative regulation in *E. coli*- lac operon; positive regulation – *E.coli* ara operon; regulation by attenuation of *his* and *trp* operons.
5	Gene transfer mechanisms- Transformation, conjugation, transduction, transfection: mechanisms and their applications Bacteriophages- lytic phages and lysogenic phages.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology

Type text here

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Microbial Genetics	Maloy
2. Molecular genetics of bacteria	Dale
3. Modern microbial genetics	Streips and Yasbin
4. Genome	Brown
6. Gene IX	Lewin
7. Molecular Biology	Glick
8. Molecular and Cellular Methods in Biology and Medicine	Kaufman, Kim and Seke
9. Molecular Cell Biology	Lodish, Berk, Zippursky

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology

Type tex

Class: M.Sc. Second Semester
Subject: Microbiology
Paper: Core 6

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-MB-22

Microbial Physiology (Paper 6)

Part A : Introduction for code M.Sc. IInd Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. Ist Semester in Microbiology.
2	**Course Objectives**	**To study the bacterial photosynthesis, pathways of bacterial metabolism and application of extremophiles.**
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Studying and learning about the mechanism of bacterial photosynthesis.
		2.Students will learn various metabolic pathways.
		3.Understanding of the lipid metabolism pathways.
		4.Importance of polysaccharides and biopolymers as cell components.
		5.Application of extremophiles and molecular methods for the study of microbial diversity.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part B: Content of the Course

Unit	Topics
1	Photosynthesis: Bacterial photosynthesis: scope, electron carriers. Photosynthetic reaction center, cyclic flow of electrons. Bacterial photophosphorylation in various groups of phototrophic bacteria. Electron donors other than water in anoxygenic photosynthetic bacteria.
2	Respiratory metabolism: Embden -Mayerhoff pathway- Entner –Duodroff pathway- Glyoxalate pathway- Kreb's cycle- oxidative and substrate level phosphorylation- reverse TCA cycle- gluconeogenesis- Pasteur effect, anaerobic respiration. Biochemistry of methanogens
3	Lipid Metabolism: Lipids as energy reserves, Fatty acid oxidation- alpha, beta and omega oxidations. Energy yields from fatty acid oxidation. Oxidation of unsaturated fatty acids and fatty acids with odd numbered carbon atoms, Ketogenesis Biosynthesis of fatty acid and triacylglycerols.
4	Biosynthesis of amino acids. Catabolism of amino acids. Synthesis of polysaccharides, peptidoglycan and biopolymers as cell components.
5	Unculturable and culturable bacteria : Conventional and molecular methods for the study of microbial diversity. Extremophiles– Mechanism and adoption of acidophilic, alkalophilic, thermophilic, psychrophilic, barophilic and osmophilic microbes. Halophiles – membrane variation electron transport. Applications of extremophiles.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part C : Learning Resources

Text Books, Reference Books Suggested Readings:	
1. Microbial Physiology and metabolism	Caldwell.
2. Microbial Physiology	Moat and Foster
3. General Microbiology	Stainer, Ingharam, Wheelis.
4. Prokaryotic Development	Brun and Shimkets.
5. Extremophiles	Joluri.
6. Microbial Diversity	Colwd.
7. Biology of microorganisms	Brock and Madigan.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100** **Continuous Comprehensive Evaluation (CCE):** **25** **University Exam (UE):** **75**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Class: M.Sc. Second Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit : 4**
Paper: Core 7 **Code of the Paper:-MB-23**

Instrumentation (Paper 7)

Part A : Introduction for code M.Sc. Ist Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. Ist Semester in Microbiology.
2	**Course Objectives**	**To study and learn various techniques such as electrophoresis, chromatography and microscopy.**
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		1.Studying about working, principle and applications of various types of microscopy.
		2.Learn basic working, principle and applications of various types of instrumentation of centrifugation.
		3.Understanding of the working, principle and applications of various types of chromatography techniques.
		4.Comprehend basic theory and instrumentation of electrophoresis and spectroscopy.
		5.Learning of the various radioisotopes techniques.

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part B: Content of the Course

Unit	Topics
1	Microscopy – Theoretical considerations and instrumentation of Light, Phase-contrast, Interference, Polarization and Fluorescence microscopes. Transmission and Scanning electron microscopy.
2	Centrifugation: Differential and density gradient centrifugation, Zonal and isopycnic separation, Preparative and analytical centrifugation.
3	Chromatography: Paper and Thin layer chromatography, Adsorption column chromatography, Ion –exchange chromatography, Gel exclusion chromatography, High performance liquid chromatography. Affinity chromatography and Gas chromatography.
4	Electrophoresis: Horizontal and vertical gel electrophoresis. Spectrophotometry: Colorimetry, Spectrophotometry. Spectroscopy: Absorption and emission spectroscopy. Theory, instrumentation and applications of visible, ultraviolet and infra red spectroscopy.
5	Radioisotope techniques – Detection and measurement of radioactivity, Geiger-Muller counter, Scintillation counter and Autoradiography Radioimmunoassay and application of isotopes in biological studies.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Principles and Techniques of Biochemistry and Molecular Biology, 6th Ed.	Wilson and Walker
2. Biophysical Chemistry -Principles and Techniques	Upadhyay, Upadhyay and Nath
2. Biochemistry of nucleic acids. 1992	Adams
3. Crystallography made crystal clear. 1993	Rhodes
4. Principles of physical biochemistry. 1998	Van Holde

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:		
Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section: 75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Class: M.Sc. Second Semester | **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology | **Credit : 4**
Paper: Core 8 | **Code of the Paper:-MB-24**

Fermentation Technology (Paper 8)

Part A : Introduction for code M.Sc. Ist Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. Ist Semester in Microbiology.
2	**Course Objectives**	**To study and learn the screening methods of industrially important microorganisms and their role in various fermentation technology.**
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		1.Learning about various methods of screening of microorganisms, strain improvement, inoculum development and media for industrially important microbes.
		2.Comprehend the procedure of harvesting and recovery of commercially product.
		3.Know about basic design of fermentor and factors affecting growth and production.
		4.Microbial production of commercially importance products such as solvents, organic enzymes.
		5.Microbial productions of commercially importance such as antibiotics, vitamins amino acids.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Rolkal College

Part B: Content of the Course

Unit	Topics
1	Screening of industrially important microorganisms.Strategies for strain improvement. Maintenance and preservation of industrially important microorganisms. Inoculum development for industrial fermentation. Industrial sterilization process for media, air and equipment. Media for industrial fermentations
2	Scale up of fermentation process. Harvest and product recovery –Removal of insoluble- Filtration, centrifugation, cell disruption methods. Product isolation- Extraction and adsorption methods. Product purification- Chromatographic methods, Precipitation, crystallization and drying devices.
3	Concept of submerged, surface and solid state fermentations. Batch and continuous fermentation processes. Basic design of fermentation equipment. Monitoring and controls of fermentation parameters. Fermentor types and their applications– Plug flow reactor, Air lift fermentor, Packed bed reactor, Fluidized bed reactor and Tray reactor.
4	Microbial production of commercially important products – I Solvent – Ethanol Organic acids - Citric acid, Acetic acid, Lactic acid. Enzymes – Amylase and Protease. Steroid bioconversions.
5	Microbial production of commercially important products – II Antibiotics – Penicillin and Streptomycin. Vitamins – Cyanocobalamine and Riboflavin. Amino Acids – Lysine and Glutamic acid. Microbial assay of growth promoters and growth inhibitors, MIC.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Rolkal College

Part C : Learning Resources

Text Books, Reference Books **Suggested Readings:**	
1. Biotechnology	Crueger and Crueger.
2. Industrial Microbiology	Cassida
3. Principles of Fermentation Technology	Standbary, Whitaker
4. Industrial Microbiology	Reed
5. Biology of Industrial Microorganisms.	Demain.
6. Textbook of Industrial Microbiology	Patel.
7. Fundamentals of Biotechnology	Prave, Faust, Sittig.
8. Bioprocess Engineering	Shuler and Kargi.
9. Molecular cloning Vol. 1-III	Sambrook and Russel.
10. Biotechnological innovations in chemical synthesis.	Bioptol. Publisher: Butterworth Heinemann.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100** **Continuous Comprehensive Evaluation (CCE):** **25** **University Exam (UE):** **75**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas Head
Professor & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Part A - Introduction				
Programme : M.Sc.		**Class: M.Sc.**	**II SEMESTER**	**Session: 2021-22**
Subject: Microbiology (Practical)				
1	**Course Code-**	**PRMB-21**		
2	**Course Title**	**Lab Course - III**		
3	**Course Type**	**Core Course**		
4	**Pre-requisite**	To study this course a student must have to pass M.Sc. Ist Semester in Microbiology.		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to understand:** • Students will study and learn to isolate mutant strains. • Students will study and learn transformation in bacteria. • Students will learn general biochemical test to identify bacterial strains. • Understand the basic concept of thermal death point and thermal death temperature in bacteria.		
6	**Total Marks**	**Maximum Marks: 75**	**Min. Passing Marks: 26**	

Dr. Sanjay Vyas Head
Professor & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

	Part B - Content of Practical Course
S.No.	**Name of Exercises**
1	To determine concentration of DNA in given sample by DPA method
2	To determine concentration of RNA in given sample by orcinol method
3	To isolate antibiotic resistant strains using Gradient plate method
4	To perform isolation of mutants by *UV* as a mutagen
5	To study technique of transformation.
6	To study technique of conjugation.
7	Isolation of genomic DNA from bacteria.
8	Isolation of plasmid DNA from bacteria.
9	To perform TSI test for given bacterial sample
10	To perform catalase test for given bacterial sample
11	To perform IMVIC test for given bacterial sample
12	To study thermal death temp. for the given bacterial sample.
13	To study thermal death point for the given bacterial sample.
14	Any other experiment may be designed on the basis of theoretical aspects.

Part D : Assessment and Evaluation

External Assessment	**Marks**
Viva voce on Practical	10
Practical Record File	10
Major Exercise	21
Minor Exercise (A)	12
Minor Exercise (B)	12
Spotting	10
Total	**75**
Credits	**03**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part A - Introduction				
Programme : M.Sc.		**Class: M.Sc.**	**II SEMESTER**	**Session: 2021-22**
Subject: Microbiology (Practical)				
1	**Course Code-**	**PRMB-22**		
2	**Course Title**	**Lab Course -IV**		
3	**Course Type**	**Core Course**		
4	**Pre-requisite**	To study this course a student must have to pass M.Sc. Ist Semester in Microbiology.		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to understand:** • Understanding of various microscopic techniques and chromatographic techniques. • Comprehend with spectrophotometric methods. • Students study and learn basic design and application of fermentor. • Student learn about primary screening of industrially important strains.		
6	**Total Marks**	Maximum Marks: **75**		Min. Passing Marks: 26

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

	Part B - Content of Practical Course
S.No.	**Name of Exercises**
1	To identify components of Chlorophyll pigment by paper chromatography
2	To perform Agarose gel electrophoresis
3	To perform thin layer chromatography
4	To perform column chromatography
5	To perform vertical gel electrophoresis.
6	To perform maintenance & preservation of given bacterial culture
7	To perform isolation of antibiotic producing organism from soil
8	To study the effect of agitation on bacterial growth
9	To perform primary screening of amylase producing organism.
10	To perform primary screening of protease producing organism.
11	Any other experiment may be designed on the basis of theoretical aspects.

Part D : Assessment and Evaluation

External Assessment	**Marks**
Viva voce on Practical	10
Practical Record File	10
Major Exercise	21
Minor Exercise (A)	12
Minor Exercise (B)	12
Spotting	10
Total	**75**
Credits	**03**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Seminar: Assessment and Evaluation

External Assessment	**Marks**			
Seminar III	**PPT Slides**	**Presentation**	**Group Discussion**	**Total**
	10	**10**	**05**	**25**
Credits				**01**
	Marks			**Total**
Seminar IV	**PPT Slides**	**Presentation**	**Group Discussion**	
	10	**10**	**05**	**25**
Credits				**01**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Microbiology

Syllabus Session 2021-2022

Programme : M.Sc. Microbiology **Class : M.Sc. III**

Sem.

S.N.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External assessment Max.	External assessment Min.	Total Max	Total Mini.
1	Core 9	Molecular Biology and Genetic Engineering	MB-31	4	25	9	75	26	100	35
2	Core 10	Medical Microbiology	MB-32	4	25	9	75	26	100	35
3	Elective 1/1	Biostatistics and Computer applications	MB-33 A	4	25	9	75	26	100	35
	Elective 1/2	Microbial Ecology	MB-33 B							
4	Elective 2/1	Bioinformatics, Proteomics and Genomics	MB-34 A	4	25	9	75	26	100	35
	Elective 2/2	Agriculture Microbiology	MB-34 B							
5	Open Elective (Inter Disciplinary)	Basics of Microbiology	OE-BM	4	25	9	75	26	100	35
6	Practical -5	----	PRMB-3	3	---	---	75	---	75	26
7	Practical -6	----	PRMB-4	3	---	---	75	---	75	26
			TOTAL	26	125	---	525	---	650	---

Dr. Sanjay Vyas
Professor & Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Class: M.Sc. Third Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit : 4**
Paper: Core 9 **Code of the Paper:-MB-31**

Molecular Biology and Genetic Engineering (Paper 9)

Part A : Introduction for code M.Sc. IIIrd Semester		
1	Pre-requisite (if any)	To study this course a student must have to pass M.Sc. IInd Semester in Microbiology.
2	Course Objectives	To study and understand the molecular techniques, Gene mapping, DNA isolation, DNA sequences and Gene cloning.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Knowing the terms and terminology related to molecular biology and understanding the structure and functions of genes in living organism at the molecular level.
		2.Understanding the cloning strategies for construction of gene library.
		3.Studying about gene amplification – PCR and its applications.
		4.Importance of Hybridization techniques.
		5.Learning the concept of recombination, linkage mapping and elucidate the gene transfer mechanism in prokaryotes and eukaryotes.

Dr. Sanjay Vyas
Professor & Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Part B: Content of the Course

Unit	Topics
1	Core techniques and essential enzymes used in r-DNA technology. Restriction digestion, ligation and transformation. Cloning vectors – Plasmids, phages and cosmids. Cloning strategies – Cloning and selection of individual genes, gene libraries – cDNA and genomic libraries.
2	Specialized cloning strategies – Expression vectors, promoter probe vectors, vectors for library construction - artificial chromosomes, Rationale for the design of vectors for the over-expression of recombination protein, selection of suitable promoter sequences, ribosome binding sites, transcription terminator, fusion protein tags, purification tags, protease cleavage sites and enzymes, plasmid copy number and inducible expression system.
3	DNA sequencing methods – Dideoxy and chemical method, sequence assembly. Automated sequencing and physical mapping of genomes. Gene amplification - PCR and its applications. Ribozymes and RNAi.
4	Expression of cloned DNA – Expression in heterologous system. Identification of cloned gene – Study of the transcript of a cloned gene. Hybridization techniques. Modification of cloned DNA – Site directed mutagenesis, Efficient expression of cloned genes.
5	Applications of r-DNA technology- Requirement and production of recombinant molecules in pharmaceutical, health, agricultural and industrial sectors and research laboratories. Transgenic animals, Agrobacterium mediated transformation, Bt cotton, Gene Therapy. Safety of recombinant DNA technology, IPR and patenting.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Current protocols in molecular biology.	Ausbel
2. Molecular cloning Vol. 1-III.	Sambrook and Russel
3. Principles of gene manipulation	Old and Primrose.
4. Genome analysis Four volumes	CSH Press.
5. Principles and techniques of biochemistry and molecular biology, 6th Ed.	Wilson Walker.
6. Gene Cloning	Brown

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:		
Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Class: M.Sc. Third Semester
Subject: Microbiology
Paper: Core 10

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-MB-32

Medical Microbiology (Paper 10)

Part A : Introduction for code M.Sc. IIIrd Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IInd Semester in Microbiology.
2	**Course Objectives**	This course provides learning opportunities in the basics principles of medical microbiology and infectious diseases.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Learning the basic concept of pathogenic microorganism and the mechanism by which they cause disease in human body.
		2.Understanding the importance of bacteria in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract.
		3.Understanding the concept of pathogenicity & toxigenicity.
		4.Development of diagnostic skills an interpretation of laboratory test in the diagnosis of diseases.
		5.Studying about various fungal & Viral infections.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part B: Content of the Course

Unit	Topics
1	Early discovery of pathogenic microorganisms, Development of bacteriology as a scientific discipline. Contributions made by eminent scientists. Classification of medically important microorganisms; Normal microbial flora of human body; role of the resident flora; normal flora and the human host.
2	Epidemiological studies of diseases - Sources of infection for humans- vehicles, reservoirs of infection. Exogenous infection: Patients, carriers, infected animals and soil endogenous infection. Mode of spread of infection: Respiratory, skin, wound and burn infection, venereal infections, alimentary tract infection, arthropod borne blood infections, laboratory infections and nosocomial infections. Preventive and curative measures for diseases.
3	Microbial pathogenicity: Opportunistic and true pathogens, establishment and spreading of infections, antiphagocytic factors, mechanism of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts. Toxigenicity: invasiveness, role of aggressins, hyaluronidase, coagulase, fibrinolysins or kinase; depolymerizing enzymes mucinase, lipases, proteases, nucleases, collagenase, neuraminidase, depolymerising enzymes, variation and virulence.
4	Gram positive cocci - *Staphylococcus, Streptococcus.* Gram negative bacilli - *E.coli, Salmonella, and Shigella.* Gram positive bacilli - *Clostridium.* Acid Fast Bacteria – *Mycobacterium tuberculosis, Mycobacterium leprae.* Spirochaete – *Treponema pallidum.*
5	Fungal infections – Description and classification of pathogenic fungi, dermatophytes. Viral infections – Mumps, Measles, Rabies, Polio, Hepatitis and AIDS. Diseases caused by *Anctiomycetes; Rickettsia and Chlamdiae.*

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part C: Learning Resources

Text Books, Reference Books **Suggested Readings:**	
1. Text of book of Microbiology	Ananthanarayanan
2. Medical Microbiology Vol. 1- Microbial Infection Vol. 2- Practical Medical Microbiology	Mackie and McCartney
3. Microbiology in Clinical Practice	Shanson, Wright
4. Bailey and Scott's Diagnostic Microbiology	Baron, Peterson.
5. Biochemistry of Antimicrobial Action	Franklin, Snow
6. Epidemiology and Infections	Gordon Smith
7. Lecture Notes in Immunology Vol. 1: Microbial infections, Vol. 2: Practical Medical Microbiology	Todd
8. Cellular Microbiology	Henderson

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100** **Continuous Comprehensive Evaluation (CCE):** **25** **University Exam (UE):** **75**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas
Professor & Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar

Class: M.Sc. Third Semester
Subject: Microbiology
Paper: Elective Paper-1/1

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -MB-33 A

Biostatistics and Computer applications

Part A: Introduction for code M.Sc. IIIrd Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IInd Semester in Microbiology.
2	**Course Objectives**	To study and understand the concept of data representation, probability and applications of computer.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Understanding different types of data and its representation
		2.Calculation and understanding the measure of central tendency and variability.
		3.Studying and learning about different test of significance and probability theories.
		4.Learn about basics of computer and its organization.
		5.Understanding networking fundamentals and MS office.

Dr. Sanjay Vyas
Professor & Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar

Part B: Content of the Course

Unit	Topics
1	Basic definitions and applications of biostatistics. Sampling: Representative sample, sample size, sampling bias and sampling techniques. Data collection and presentation: Types of data, methods of collection of primary and secondary data, methods of data presentation, graphical representation by histogram, polygon and pie diagram.
2	Measures of central tendency: Mean, Median, Mode. Measures of variability: Standard deviation, standard error, range, mean deviation and coefficient of variation. Correlation and Regression: Positive and negative correlation and calculation of Karl-Pearson's co-efficient of correlation. Linear regression and regression equation and multiple linear regression, ANOVA, One- and two-way classification. Calculation of unknown variable using regression equation.
3	Tests of significance: small sample tests (Chi-square t test, F test), large sample test (Z test) and standard error. Introduction to probability theory and distributions, (concept without deviation). Normal, binomial, poison distributions (only definitions and problems). Computer oriented statistical techniques.
4	Introduction to computers: Computer application, basics, organization. Computer classification and generations. Concept of file, folders and directories, commonly used DOS & Windows commands. Concept of hardware, software, memory and their types.
5	Introduction to MS Office software concerning MS Word processing. Excel spreadsheets and Power point presentation software. Networking fundamentals, client, server, LAN, WAN, ftp, Telenet, INTERNET, NICNET, WWW, html and e- mail.

Part C: Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Statistics in biology, Vol. 1	Bliss
2. Practical Statistics for experimental biologist	Wardlaw
3. How Computers work - 2000.	White
4. How the Internet Work 2000	Preston Gralla
5. Statistical Methods in Biology - 2000	Bailey
6. Biostatistics - 7th Edition	Daniel
7. Fundamental of Biostatistics	Khan
8. Biostatistical Methods	Lachin
9. Statistics for Biologist	Campbell
10. Internet CDC publication, India.	Brown
11. Biostatistics	P N Arora

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Class: M.Sc. Third Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit: 4**
Paper: Elective Paper-1/2 **Code of the Paper: -MB-33 B**

Microbial Ecology

Part A: Introduction for code M.Sc. IIIrd Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IInd Semester in Microbiology.
2	**Course Objectives**	To study and learn types of ecosystems, microbial interaction and utility of microbes in sustainable development.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Studying various types of Ecosystems.
		2.Calculate diversity index and their practical application in ecological studies.
		3.Learning about hardy-Weinberg law of equilibrant of ecology and factors affecting it.
		4.Study about microbial interaction with human and plants.
		5.Role of microbiology in sustainable development.

Part B: Content of the Course

Unit	Topics
1	Population, guilds, communities, homeostatis, Environment and microenvironment. Biofilms. Terrestrial environment, deep surface microbiology. Fresh water environment, lake and river microbiology. Marine Microbiology and Hydrothermal vents.
2	Diversity indices, dominance indices, information statistics indices, Shannon index, Brillouin Index, Rank abundance diagrams, community similarity analysis, Jaccard Coefficient, Sorensen coefficient, cluster analysis. Community stability, stability hypothesis, Intermediate-disturbance hypothesis. Meaning of succession: Tolerance and inhibition patterns of succession, theories of succession.
3	Genetic structure of population: - Genotype frequency, allele frequencies. Hardy-Weinberg Law: - Assumptions, predictions, derivation, extension and natural selection. Measuring genetic variation at protein level, measuring genetic variation at DNA level. Factors effecting gene frequencies: -Mutation, Random genetic drift, migration, Hardy-Weinberg natural selection, Assortative mating, Inbreeding.
4	Microbial Interactions: Competition and coexistence, Gauss hypothesis, syntropy, commensalism and Mutualism, predation, parasitism, and antagonism, Interaction with plants and animals.
5	Microbial technology and sustainable development. Management and improvement of waste land/barren land. Oil spills, damage and management petroleum and oil shore management

Part C: Learning Resources

Text Books, Reference Books **Suggested Readings:**
1.Microbial Ecology: Larryl Barton, Diana E.Northup
2.Environmental Microbiology: Fundamentals & Application: Bertrand
3.Concept of Ecology: N Arumugam, Saras Publication.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:**		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time: 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Class: M.Sc. Third Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit: 4**
Paper: Elective Paper- 2/1 **Code of the Paper: -MB-34 A**

Bioinformatics, Proteomics and Genomics

Part A: Introduction for code M.Sc. IIIrd Semester		
1	**Pre-requisite (If any)**	To study this course a student must have to pass M.Sc. IInd Semester in Microbiology.
2	**Course Objectives**	To study and understand about biological databases, sequence, searching tool and sequence alignment.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Studying and learning about various biological databases.
		2.Understanding different algorithms and searching tools for nucleotide and protein sequence.
		3.Importance and construction of phylogenetic trees.
		4.Learning of gene expression analysis by DNA microscopy.
		5.Various techniques on proteome analysis.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Part B: Content of the Course

Unit	Topics
1	Introduction to bioinformatics-History, aim and scope of bioinformatics. Database concept, DBMS. Biological databases and their function, Classification of biological databases. Nucleotide and Protein sequence databases (GenBank, EMBL, DDBJ, PIR, SWISSPROT). Structure and Structure classification databases (PDB, SCOP, CATH). Specialized databases (ESTs, EXPASY, Prosite, Pfam) Genome databases and composite database (NCBI).
2	Sequence comparison, sequence identity, similarity and homology. Scoring/substitution matrices (PAM, BLOSUM). Pair wise Local and Global alignment algorithms (Needleman and Wunsch, Smith and Waterman), Multiple Sequence alignment, Sequence database searching tool (BLAST and FASTA), Basic knowledge of their variants and statistical significance.
3	Studying Open reading frames (ORFs), Motifs, Domains, Patterns, Profiles and their importance. Importance of phylogenetics, nomenclature of trees and construction of phylogenetic trees using distance-based method (UPGMA).
4	DNA Microarray- Printing of oligonucleotides and PCR products on glass slides and nitrocellulose paper. Whole genome analysis for Global patterns of gene expression using fluorescent-labelled cDNA or end labelled RNA probes. Analyses of single nucleotide polymorphism using DNA chips.
5	Proteome analysis- Two-dimensional separation of total cellular proteins. Isolation and analysis of individual protein spots by Mass Spectroscopy.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Part C: Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Bioinformatics. 1998 Baxevanis
2. Bioinformatics 2000 Higgins and Taylor.
3. Nucleic acid Research 2001. Jan. Genome database issue.
4. The Internet and the new Biology: Tools for Genomics and Molecular Research Peruski and Peruske (ASM)
5. Functional Genomics. A Practical Approach Stephen and Rick Liveey.
6. DNA microarrays: A practical approach Mark Schena
7. Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins 2nd Edition Baxevanis
8. Bioinformatics: Sequence, structure and Data Bank: A Practical Approach Higgis.
9. Bioinformatics - from Genomes to drug. Lenganer.
10. Bioinformatics Methods and Protocols Misener.
11. Bioinformatics: Sequence and Genome analysis.
12. Introduction to Bioinformatics Altwood.
13. Protein Biotechnology. Felix Franks.
14. Protein Engineering: Principles and Practice Cleland.
15. Computer analysis of sequence data Colte.
16. Protein Engineering: Principles and Practice Cleland.
17. Computer analysis of sequence data Colte.
18. Essential Bioinformatic Jin Xiong

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100** **Continuous Comprehensive Evaluation (CCE):** **25** **University Exam (UE):** **75**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Type text here

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Class: M.Sc. Third Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit: 4**
Paper: Elective Paper- 2/2 **Code of the Paper: -MB-34 B**

Agriculture Microbiology

Part A: Introduction for code M.Sc. IIIrd Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IInd Semester in Microbiology.
2	**Course Objectives**	To study the methods of production of biofertilizer, development of resistant varieties and relationship between plant and pathogen.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1. Learning methods of production of biofertilizer by using bacteria, fungi and cyanobacteria.
		2.Studying the concept and relation between plant and pathogen in development of disease.
		3.Understanding the process of development of transgenic resistance varieties.
		4.Studying about different types of plant diseases caused by fungi, bacteria & virus.
		5.Comprehending the various control method of plant diseases and importance of microorganism in organic farming.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part B: Content of the Course

Unit	Topics
1	Introduction to biofertilizers - Structure and characteristic features of the following biofertilizer organisms: Bacteria: *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia*. Cyanobacteria: *Anabaena, Nostoc, Hapalosiphon*. Fungi: *Glomus, Gigaspora, Sclerocystis, Amanita, Laccaria*.
2	Principles of plant pathology: entry and establishment of pathogens in plants, host and parasite interaction, role of toxins and enzymes in pathogenesis. Disease resistance in plants – protection and defence, mechanisms of resistance (performed and induced defence, local signals, programmed cell death, induced structural barriers, phytoalexins.
3	Transgenic Resistance: Gene-to-gene resistance (horizontal and vertical), functions of plant resistance genes, features and classification of cloned resistance genes. Transformation for disease resistance: Resistance to viruses, fungi, bacteria and insects, the Bt genes and the resistance to insects.
4	Plant diseases – Epidemiology and plant disease forecasting- Principles, symptoms and control measures of the following diseases: Plant diseases caused by fungi – late blight of potato, downy mildew of grapes, Loose smut of wheat, smut of bajra, covered smut of barley, blast disease of rice, red rot of sugarcane. Plant diseases caused by bacteria – bacterial blight of paddy, angular leaf spot of cotton, common scab of potato. Plant diseases caused by viruses – tobacco mosaic, leaf curl of tomato, yellow vein mosaic of bhindi.
5	Plant disease control – Cultural methods, Agronomic practices (crop rotation, field and crop sanitation), Chemical control (fungicides, fumigants, morganic copper/ sulphur compounds, Di thiocarbamates) - Organic agriculture and disease control. Biological control – Principle, concepts and environmental safety– bio-pesticides (bacterial, fungal and viral). Plant disease assessment methods – visual method in the field, scales for estimating disease intensity, yield losses, multiple point model and remote sensing techniques.

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt.

Part C: Learning Resources

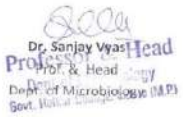
Text Books, Reference Books
Suggested Readings:

1. Agrio, G.N. Plant pathology
2. Alexander, M Soil Microbiology
3. Benjamin Cummings, Merio pank. California 1987 Microbial ecology, fundamentals an application.
4. Bilgrami, K.S. and H.C. Dube Modern Plant pathology
5. N.S. Subba Rao: Biofertilizers
6. Lynch J.M.: Soil Biotechnology
7. Lynch Poole Microbial ecology: A conceptual approach
8. Mehrotra, R.S.: Plant Pathology
9. Microbial ecology: Principles, methods & applications & Biological nitrogen fixation.
10. R.S. Singh: An introduction to principles of plant pathology
11. Rangaswami, G. and A. Mahadevan: Diseases of crop plants
12. Rangaswamy, G and. Bhagyaraj D. J.: Agricultural Microbiology
13. Richard, B.N.: An introduction to soil ecosystem
14. Singh, R.S.: Plant diseases R
15. Stolop H.: Microbial ecology: Organisms, habitats, Activities
16. Subba Rao N. S: Advances in Agriculture Microbiology
17. Subba Rao, N.S.: Soil microorganisms and plant growth
18. Tarr, S.A.J.: Principles of plant pathology
19. Vander Plank: Plant disease resistance
20. Vidyasekaran: Molecular plant pathology.
21. K R Aneja: Fundamental of Agriculture Microbiology

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100** **Continuous Comprehensive Evaluation (CCE):** **25** **University Exam (UE):** **75**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

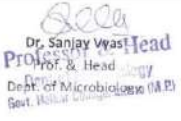


Class: M.Sc. Third Semester
Subject: Microbiology
Paper: Elective Paper- 2/1

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -MB-21

Bioinformatics, Proteomics and Genomics

Part A: Introduction for code M.Sc. IIIrd Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IInd Semester in Microbiology.
2	**Course Objectives**	To study and understand about biological databases, sequence, searching tool and sequence alignment.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Studying and learning about various biological databases.
		2.Understanding different algorithms and searching tools for nucleotide and protein sequence.
		3.Importance and construction of phylogenetic trees.
		4.Learning of gene expression analysis by DNA microscopy.
		5.Various techniques on proteome analysis.



Part B: Content of the Course

Unit	Topics
1	Introduction to bioinformatics-History, aim and scope of bioinformatics. Database concept, DBMS. Biological databases and their function, Classification of biological databases. Nucleotide and Protein sequence databases (GenBank, EMBL, DDBJ, PIR, SWISSPROT). Structure and Structure classification databases (PDB, SCOP, CATH). Specialized databases (ESTs, EXPASY, Prosite, Pfam)\Genome databases and composite database (NCBI).
2	Sequence comparison, sequence identity, similarity and homology. Scoring/substitution matrices (PAM, BLOSUM). Pair wise Local and Global alignment algorithms (Needleman and Wunsch, Smith and Waterman), Multiple Sequence alignment, Sequence database searching tool (BLAST and FASTA), Basic knowledge of their variants and statistical significance.
3	Studying Open reading frames (ORFs), Motifs, Domains, Patterns, Profiles and their importance. Importance of phylogenetics, nomenclature of trees and construction of phylogenetic trees using distance-based method (UPGMA).
4	DNA Microarray- Printing of oligonucleotides and PCR products on glass slides and nitrocellulose paper. Whole genome analysis for Global patterns of gene expression using fluorescent-labelled cDNA or end labelled RNA probes. Analyses of single nucleotide polymorphism using DNA chips.
5	Proteome analysis- Two-dimensional separation of total cellular proteins. Isolation and analysis of individual protein spots by Mass Spectroscopy.

Part C: Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Bioinformatics. 1998	Baxevanis
2. Bioinformatics 2000	Higgins and Taylor.
3. Nucleic acid Research 2001.	Jan. Genome database issue.
4. The Internet and the new Biology: Tools for Genomics and Molecular Research	Peruski and Peruske (ASM)
5. Functional Genomics. A Practical Approach	Stephen and Rick Liveey.
6. DNA microarrays: A practical approach	Mark Schena
7. Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins 2nd Edition	Baxevanis
8. Bioinformatics: Sequence, structure and Data Bank: A Practical Approach	Higgis.
9. Bioinformatics - from Genomes to drug.	Lenganer.
10. Bioinformatics Methods and Protocols	Misener.
11. Bioinformatics: Sequence and Genome analysis.	
12. Introduction to Bioinformatics	Altwood.
13. Protein Biotechnology.	Felix Franks.
14. Protein Engineering: Principles and Practice	Cleland.
15. Computer analysis of sequence data	Colte.
16. Protein Engineering: Principles and Practice	Cleland.
17. Computer analysis of sequence data	Colte.
18. Essential Bioinformatic	Jin Xiong

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100** **Continuous Comprehensive Evaluation (CCE):** **25** **University Exam (UE):** **75**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Class: M.Sc. Third Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit : 4**
Paper: Open Elective **Code of the Paper:-OE-BM**

Basics of Microbiology

Open Elective

Part A: Introduction for code M.Sc. IIIrd Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IInd Semester in Interdisciplinary Subjects.
2	**Course Objectives**	To learn about the basics of microbiology including the scope, instruments used, culture and preservation, characteristic of microbes and their control.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Study of major contributions in the history, branches of microbiology and effects of microbes.
		2.Knowledge regarding instruments used in microbiology lab.
		3.Learning various techniques of microbial culture and preservation.
		4.To study the general characteristics of Bacteria, Algae, Virus and Fungi.
		5. Learning the concept of control of microorganism and various methods.

Part B: Content of the Course

Unit	Topics
1	Contribution of major microbiologists. Branches of microbiology. Place of microbes in living world. Beneficial and harmful effects of microorganisms.
2	Microscope, Incubator, pH meter, LAF, Centrifuge, Hot air oven, Autoclave, Spectrophotometer.
3	Culture media and its type. Pure culture and cultural characteristics. Culture collection centers. Maintenance and Preservation.
4	Bacteria, Algae, Virus and Fungi.
5	Sterilization, Disinfection, Antisepsis and sanitation. Physical methods of control. Chemical methods of control.

Part C: Learning Resources

Text Books, Reference Books
Suggested Readings:

1.Microbiology – An Introduction – Gerard J. Tortora
2.Prescott's Microbiology - Willey & Sherwood
3.Microbiology: Principles & Explorations – Black & Black
4.Microbiology- Pelczar, Chan, Krieg.
5.Text book of Microbiology – D. K.Maheshwari & R.C. Dubey, S. Chand Publication.

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:		
Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Part A - Introduction				
Programme: M.Sc.		**Class: M.Sc.**	**III SEMESTER**	**Session: 2021-22**
Subject: Microbiology (Practical)				
1	**Course Code-**	**PRMB-31**		
2	**Course Title**	**Lab. Course - 5**		
3	**Course Type**	**Core Course**		
4	**Pre-requisite**	To study this course a student must have to pass M.Sc. IInd Semester in Microbiology.		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to understand:** • Students will study and learn basics and advancement of subject. • Comprehend with techniques used in microbiology • Enhancement of practical skills.		
6	**Total Marks**	**Maximum Marks: 75**		**Min. Passing Marks: 26**

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar

	Part B - Content of Practical Course
S.No.	**Name of Exercises**
1	To determine concentration of DNA in given sample by DPA method
2	To determine concentration of RNA in given sample by orcinol method
3	Isolation of genomic DNA from bacteria.
4	Isolation of plasmid DNA from bacteria.
5	To perform agarose gel electrophoresis.
6	To study the effect of some common herbal paste
7	To study the antimicrobial activity of spices
8	Isolation of normal flora from different parts.
9	Isolation and identification of gram-positive bacteria from given sample.
10	Isolation and identification of gram-negative bacteria from given sample.
11	Any other experiment may be designed on the basis of theoretical aspects.

Part D: Assessment and Evaluation

External Assessment	**Marks**
Viva voce on Practical	10
Practical Record File	10
Major Exercise	21
Minor Exercise (A)	12
Minor Exercise (B)	12
Spotting	10
Total	**75**
Credits	**03**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Part A - Introduction				
Programme : M.Sc.		**Class: M.Sc.**	**III SEMESTER**	**Session: 2021-22**
Subject: Microbiology (Practical)				
1	**Course Code-**	**PRMB-32**		
2	**Course Title**	**Lab. Course - 6**		
3	**Course Type**	**Based on Elective Papers**		
4	**Pre-requisite**	To study this course a student must have to pass M.Sc. IInd Semester in Microbiology.		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to understand:** Students will study and learn basics and advancement of subject. Comprehend with techniques used in microbiology Enhancement of practical skills.		
6	**Total Marks**	Maximum Marks: **75**	Min. Passing Marks: **26**	

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

S.No.	Part B - Content of Practical Course Name of Exercises
1	To calculate Mean, Mode, Median from given data.
2	To calculate standard deviation from given data.
3	To prepare histograms and pie charts from given data.
4	Collection of primary and secondary data.
5	To prepare presentation by using MS-PowerPoint.
6	Give any two steps for retrieval of nucleotide sequence from NCBI and run its BLAST
7	Explain steps to retrieve structure from PDB give details of the structure observed
8	Determination of D.O. of Pond & Tap water.
9	Write comment on Lichen.
10	To study pond water ecosystem.
11	Isolation of oil degrading bacteria.
12	To study mutualism between rhizobium bacteria and leguminous plants.
13	To isolate the pathogenic fungi from diseased plant
14	To isolate *Xanthomonas citrii* from citrus fruit
15	To identify given Cyanobacterial culture
16	To isolate azotobacter from given sample
17	To isolate rhizobium from root nodules of leguminous plants.
18	Any other experiment may be designed on the basis of theoretical aspects.

Part D : Assessment and Evaluation

External Assessment	Marks
Viva voce on Practical	10
Practical Record File	10
Major Exercise	21
Minor Exercise (A)	12
Minor Exercise (B)	12
Spotting	10
Total	**75**
Credits	**03**

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Microbiology

Syllabus Session 2021-2022

Programme : M.Sc. Microbiology **Class: M.Sc. IV Sem.**

S.N.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External assessment Max.	External assessment Min.	Total Max	Total Mini.
1	Core 11	Food and Dairy Microbiology	MB-41	4	25	9	75	26	100	35
2	Core 12	Environmental Microbiology	MB-42	4	25	9	75	26	100	35
3	Elective 3/1	Pharmaceutical Microbiology	MB-43 A	4	25	9	75	26	100	35
	Elective 3/2	Biosafety and IPR Issues	MB-43 B							
4	Elective 4/1	Bio-Nanotechnology	MB-44 A	4	25	9	75	26	100	35
	Elective 4/2	Cell Biology	MB-44 B							
5	Practical -7	Lab. Course-7	PRMB-41	3	-------	-------	75	-------	75	26
6	Practical -8	Lab. Course-8	PRMB-42	3	-------	-------	75	-------	75	26
7	Internship	Pathology Laboratories, Pharmaceutical industry, Hospitals, Sanchi dugdh Sahkari Maryadit Sangh, Indore, National research center for soyabean (NRCS), Schools & Coaching Institutes, Biofertilizer Industry	-------	4	25	09	75	26	100	35
			Total	26	125		525	-------	650	------

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Class: M.Sc. Fourth Semester
Subject: Microbiology
Paper: Core 11

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-MB-41

Food and Dairy Microbiology (Paper 11)

Part A : Introduction for code M.Sc. IVth Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IIIrd Semester in Microbiology.
2	**Course Objectives**	To study the advance concepts of food microbiology including preservation, production, quality control, microbial examinations and spoilage control.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Various food fermentation procedure for bread, vinegar, bear, wine. Study of mushroom cultivation, single cell protein, probiotics and GOMs.
		2.Studying food infection and food intoxications, and understand microbiological quality standard of food.
		3.Understanding the principle techniques of food preservation, and control of food spoilage.
		4.Comprehending various techniques using for microbiological analysis of milk and quality control.
		5.Understanding the applications of microbial enzymes in dairy industry and probiotics.

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology (M.P.)
Govt.

Part B: Content of the Course

Unit	Topics
1	Food fermentations – Bread and Vinegar. Fermented beverages- Beer and Wine. Microbial cells as food (single Cell Proteins), Probiotics and Prebiotics. Mushroom cultivation, genetically modified foods.
2	Food infections – Gastroenteritis, Salmonellosis, Shigellosis. Bacterial food intoxications –Botulism and Staphylococcal intoxication. Mycotoxins – Aflatoxins. Microbiological examination of food. Quality assurance: Microbiological quality standards of food. Government regulatory practices and policies. FDA, EPA, HACCP and ISI.
3	General principles of food preservation. Preservation by using high and low temperature. Chemical preservatives and food additives. Use of irradiation for preservation. Spoilage of food – fresh food, canned food, milk products.
4	Composition of milk. Normal flora of milk, changes produced by microorganisms in milk. Pasteurization – basis of pasteurization, methods of pasteurization Milk borne diseases. Microbiological analysis of milk- Standard plate count, direct count, reduction tests, phosphatase test Grades of milk
5	Milk starter cultures, Microbiology of cheese – types of cheese, cheese manufacture, Fermented milk products-yoghurt, cultured buttermilk, acidophilus milk, kefir, kumiss Applications of microbial enzymes in dairy industry [proteases and lipases]. Utilization and disposal of dairy by-product – Whey

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology (M.P.)
Govt.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Food Microbiology 2nd Ed	Adams
2. Basic Food Microbiology	Banwart George
3. Food Microbiology: Fundamentals and Frontiers	Dolle
4. Food Microbiology	Frazier and Westhoff
5. Fundamentals of Dairy Microbiology	Prajapati
6. Essentials of Food Microbiology	Garbult
7. Microbiology of Fermented Foods.Volume I and II.	Wood
8. Microbiology of Foods	Orwin
9. Dairy Microbiology. Volume I and II.	Robinson
10. Food Microbiology: Fundamentals and Frontiers. 2nd Ed	Doyle Beuchat

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:		
Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continnons Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Class: M.Sc. Fourth Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit : 4**
Paper: Core 12 **Code of the Paper:-MB-42**

Environmental Microbiology (Paper 12)

Part A : Introduction for code M.Sc. IVth Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IIIrd Semester in Microbiology.
2	**Course Objectives**	To study the occurrence and distribution of microbial diversity in air, water and soil. Understand the concept of biopolymers, bioplastics, biosensors and biogeotechnology.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		1.Learning the occurrence, abundance and distribution in air, and transmission of bacterial fungal and viral diseases through air.
		2.Understanding various biogeochemical cycles, carbon, nitrogen, phosphorus cycle, and plant microbes interaction specially rhizosphere and phyllosphere.
		3.Learning the various aspect of environmental microbiology including purification of water, waste water treatment and microbial analysis of water.
		4.Understanding the importance and application Immobilized enzymes.
		5.Role of microorganisms in Bioremediation, Biodeterioration. Bioleaching of metals, Microbial enhancement of oil recovery.

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar Science College (M.P.)

Part B: Content of the Course

Unit	Topics
1	Aerobiology: Droplet nuclei, aerosol. Assessment of air quality. Bacterial, fungal and viral diseases transmitted through air and their preventive measures.
2	Soil Microbiology: Physical and chemical characteristics of soil. Micro flora of various soil types, rhizosphere and phyllosphere. Positive and negative microbial interactions. Biogeochemical cycles: carbon, nitrogen, phosphorus cycle. Symbiotic and non-symbiotic nitrogen fixation, Mycorrhiza, Phosphate Solubilizing Bacteria.
3	Aquatic Microbiology: Potability of water: microbial assessment of water quality. Purification of water. Major water borne diseases and their control measures. Waste Water treatment: Types and characterization of waste water. Physical, chemical and biological waste treatments, Solid waste treatment.
4	Immobilized enzymes and cells: Methods of immobilization. Applications of immobilized enzymes. Concept and production of: Microbial insecticides, Biofertilizers, Biopolymers, Bioplastics and Biosensors.
5	Bioremediation – Oil spills, Metals, Lignin and Hazardous wastes. Application of GMO in bioremediation. Biodeterioration. Biogeotechnology – Bioleaching of metals, Microbial enhancement of oil recovery.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Microbial ecology.	Alexander
2. Introduction to Soil Microbiology.	Alexander
3. Bioremediation	Baker and Herson.
4. Advances in microbial ecology Vol-8	Marshall.
5. Experimental Microbial Ecology	Burns and Slater
6. Essays in agricultural and food Microbiology	Norms and Pettipher
7. Soil Biology	Burges and Raw
8. Introduction to Environmental Microbiology	Michel

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Class: M.Sc. Fourth Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit: 4**
Paper: Elective Paper-3/1 **Code of the Paper: -MB-43 A**

Pharmaceutical Microbiology

Part A : Introduction for code M.Sc. IVth Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IIIrd Semester in Microbiology.
2	**Course Objectives**	To gain job opportunity in pharma industry and study various techniques of production of pharmaceutical products, spoilage and quality control.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		1.Exploring the role of microbiologist and job opportunities in pharma industry.
		2.Training and learning about different tests performed by microbiologist in pharma industry.
		3.Knowledge about antimicrobial agents and drugs.
		4.Learning of drug delivery systems, drug targeting and mode of antimicrobial agents.
		5.Knowledge about drug development in pharma industry and new vaccine technologies.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Part B: Content of the Course

Unit	Topics
1	Introduction to pharmaceutical industry: Role of a microbiologist in a pharma industry (Active Pharmaceutical Ingredient Production units, Formulation units, Research and Development, Quality Assurance and Regulatory Aspects). Pharmacopoeias with special reference to Indian, British, United States. Government regulatory practices and policies, FDA perspective. Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry. Design and layout of sterile product manufacturing unit. (Designing of microbiology laboratory) Safety in microbiology laboratory.
2	Quality assurance and quality management in pharmaceuticals: ISO, WHO and US certification. Microbiological analysis for pharmaceutical industries: Standard operating procedures for microbiological assay of antibiotics, vitamins and amino acids, Water analysis, Microbial limit test, Sterility test, Pyrogen test (BET), Area monitoring, Growth promotion test, Calibration and validation of equipments. Microbial contamination and spoilage of pharmaceutical products (sterile injectibles, non injectibles, ophthalmic preparations and implants) and their sterilization. Chemical disinfectants, antiseptics and preservatives.
3	Antibiotics and synthetic antimicrobial agents – Structure, types and modes of action. Beta lactams and non beta lactams. Aminoglycosides, Tetracyclines, Chloramphenicol, Macrolides, Fluroquinilones. Chemosynthetic drugs-Sulphonamides, Trimethoprim, Nitrofurans and Isoniazid. Antifungal and antiviral drugs.
4	Bacterial resistance to antibiotics- Origin, mechanism, transfer, and clinical implications. Molecular principles of drug targeting, Drug delivery system in gene therapy, Microencapsulation. Nanoparticles, Liposomes, Antibodies for drug delivery. Penetrating defenses – How the antimicrobial agents reach the targets (cellular permeability barrier, cellular transport system and drug diffusion).
5	Drug development in pharmaceutical process: Production of biopharmaceuticals by genetically engineered cells: Hormones (Humulin, Humatrope), Interferons (Intron A, Referon-A), t- Plasminogen activator (Activase), Monoclonal antibodies and hybridoma technology (Monoclate, Orthoclone OKT3). Other pharmaceuticals produced by microbial fermentations (Streptokinase, Streptodornase). New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials. Application of microbial enzymes in pharmaceutical industry.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Part C : Learning Resources

Text Books, Reference Books **Suggested Readings:**	
1. Pharmaceutical Microbiology	Hugo & Russell
2. Analytical Microbiology Volume I & II.	Kavanagh
3. Quinolinone antimicrobial agents	Hooper, Wolfson
4. Quality control in the Pharmaceutical Industry Vol.2	Cooper
5. Biotechnology Vol 4	Rehm & Reed,
6. Pharmaceutical Biotechnology	Vyas & Dixit.
7. Good Manufacturing Practices for Pharmaceuticals Second Edition	Sydney, Murray, William
8. Advances in Applied Biotechnology Series Vol 10, Biopharmaceuticals in transition. Industrial Biotechnology Association	Webber.
9. Drug Carriers in biology and Medicine	Gregoriadis

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:**		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Class: M.Sc. Fourth Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit: 4**
Paper: Elective Paper-3/2 **Code of the Paper: -MB-43 B**

Biosafety and IPR Issues

Part A : Introduction for code M.Sc. IVth Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IIIrd Semester in Microbiology.
2	**Course Objectives**	To make the students aware about the various types of intellectual properties and standard biosafety levels.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		1.Awareness about patents, Trademarks, Copyright & Related Rights etc.
		2.Learning the concept of patent databases, analysis and report formation.
		3.Knowledge about basics of patents, filing of applications and role of country patent office.
		4.Guideline regarding patent filing and infringement.
		5.Knowledge regarding different biosafety levels, biosafety guideline and environmental release of GOMs.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College, Indore (M.P.)

Part B: Content of the Course

Unit	Topics
1	Introduction to Intellectual Property: Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, Protection of New GMOs; International framework for the protection of IP IP as a factor in R&D; IPs of relevance to Biotechnology and few Case Studies
2	Introduction to History of GATT, WTO, WIPO and TRIPS. Concept of prior art: Invention in context of "prior art"; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, India etc.); Analysis and report formation.
3	Basics of Patents: Types of patents; Indian Patent Act 1970; Recent Amendments; Filing of a patent application; Precautions before patenting-disclosure/non-disclosure; WIPO Treaties; Budapest Treaty; PCT and Implications; Role of a Country Patent Office; Procedure for filing a PCT application.
4	Patent filing and infringement: Patent application- forms and guidelines, fee structure, time frames; Types of patent applications: provisional and complete specifications; PCT and convention patent applications; International patenting-requirement, procedures and costs; financial assistance for patenting-introduction to existing schemes; Publication of patents-gazette of India, status in Europe and US. Patenting by research students, lecturers and scientists-University/organizational rules in India and abroad, credit sharing by workers, financial incentives. Patent infringement meaning, scope, litigation, case studies and examples.
5	Biosafety : Historical Background; Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines - Government of India; Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs;

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1.P Ganguly, Intellectual Property Rights, Tata McGraw Hill, 2007.
2.IPR Biosafety & Bioethics – Deepa Goel
3. Biotechnology – B.D. Singh

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section: 75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Fourth Semester | **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology | **Credit: 4**
Paper: Elective Paper-4/1 | **Code of the Paper: -MB-44 A**

Bio-Nanotechnology

Part A : Introduction for code M.Sc. IVth Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IIIrd Semester in Microbiology.
2	**Course Objectives**	To make the students learn about the latest development in the field of bio nanotechnology with regards to its applications and instrumentation.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		1.To understand the basic concepts of Nanotechnology in regards to health environment and society.
		2.Knowledge about different spectroscopic techniques involved in Nano technology.
		3.Knowledge about different spectroscopic techniques involved in microscopic techniques.
		4.Learning about Nanoparticles and their synthesis.
		5.Exploring different applications of Nanobiology.

Part B: Content of the Course

Unit	Topics
1	Introduction and history of Nanotechnology, Applications of Nanotechnology in Biology, Criteria for suitability of nanostructures for biological applications. Health, environmental and social impact of Nanotechnology, plants and microbes as nanofactotries.
2	Methods in Nanotechnology I – Spectroscopic techniques – UV – Visible Spectroscopy, Raman Spectroscopy, X - ray diffraction, Fourier Transform Infra Red spectroscopy (FTIR), Terahertz spectrometry, Surface Enhanced Raman Spectroscopy (SERS).
3	Methods in Nanotechnology II – Microscopic techniques – Confocal microscopy, Electron microscopy, Scanning probe microscopy: Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy (AFM), optical microscopic methods in nanoscience. Fluorescent in *situ* hybridization (FISH), Fluorescent Biological Lables, Colourimetric assay.
4	Nanoparticles and their synthesis, Nanomaterials: Fullerens, Carbon Nanotubes (CNT), gold monolayer, quantum dots, core shell nanopracticles. Silver nanoparticles, Magnetic nanoparticles, Nanoshells. Diamondoid, Biodegradable polymers and their uses, Colloids in Nanotechnology.
5	Nanobiology, Nanosensers, Nanomedicine, Drug delivery system, Nanomachine, Nanobiosensors, Nano DNA Technology, Optical biosensors, Concept of Nanorobots and Nubots.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1. Pharmaceutical Microbiology	Hugo & Russell
2. Analytical Microbiology Volume I & II.	Kavanagh
3. Quinolinone antimicrobial agents	Hooper, Wolfson
4. Quality control in the Pharmaceutical Industry Vol.2	Cooper
5. Biotechnology Vol 4	Rehm & Reed.
6. Pharmaceutical Biotechnology	Vyas & Dixit.
7. Good Manufacturing Practices for Pharmaceuticals Second Edition	Sydney, Murray, William
8. Advances in Applied Biotechnology Series Vol 10, Biopharmaceuticals in transition. Industrial Biotechnology Association	Webber.
9. Drug Carriers in biology and Medicine	Gregoriadis

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas Professor & Head Prof. & Head Dept. of Microbiology Govt. Holkar College Indore (M.P.)

Class: M.Sc. Fourth Semester **Marks: 75 + (CCE) 25 = 100**
Subject: Microbiology **Credit: 4**
Paper: Elective Paper-4/2 **Code of the Paper: -MB- 44 B**

Cell Biology (Paper 16)

Part A : Introduction for code M.Sc. IVth Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. IIIrd Semester in Microbiology.
2	**Course Objectives**	To make the students aware about the various types of intellectual properties and standard biosafety levels.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		1.To study prokaryotic and eukaryotic cell structure along with cell wall, cell membrane composition.
		2.To study transport of metabolites access cell membrane.
		3.Structure of functions of mitochondria and chloroplast.
		4.Phases of cell cycle and cell division.
		5.To understand various cell signaling pathways.

Dr. Sanjay Vyas Professor & Head Prof. & Head Dept. of Microbiology Govt. Holkar College Indore (M.P.)

Part B: Content of the Course

Unit	Topics
1	Structure of Prokaryotic cell, Structure of plant and animal cell, Plant cell wall and its composition, Plasmodesmata, Models of the biomembrane, structure, constituents and fluidity of plasma membrane, Cytoskeleton.
2	Transport of metabolites across the Plasma membrane, non-mediated and mediated, Endocytosis and Exocytosis, passive and active transport. Primary and secondary active transport.
3	Structure of mitochondria, different enzymes and their location, electron transport complexes, ATP synthase, mitochondrial DNA. Structure of chloroplast, protein complexes and photosynthetic electron transport chain, DNA of the chloroplast.
4	Structure and functions of the ribosomes and endoplasmic reticulum, protein sorting and signal hypothesis. Structure and function of Golgi body and lysosomes, Mechanism of secretary processes, structure of nucleus: nuclear membrane and chromatin.
5	Cell signaling General features of Signal transduction. 1) G-Protein-coupled receptors and second messangers. 2) Receptor Tyrosine Kinase 3) Receptor Guanydyl cycles, cGMP and Protein kinase G 4) Signaling in Microorganisms.- 2 Component System.

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1.Essential Cell Biology by Bruce Alberts
2.Molecular Cell Biology by Lodish
3.Cell & Molecular Biology : Concepts & Experiments - Gerald Karp
4.The Cell : Geoffrey M - cooper
5.Essential Cell biology – Dennis Bray
6.Cytology by – Arun kumar Sharma & Archana Sharma

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section: 75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part A - Introduction				
Programme : M.Sc.		Class: M.Sc.	IV SEMESTER	Session: 2021-22
Subject: Microbiology (Practical)				
1	Course Code-	PRMB-41		
2	Course Title	Lab. Course - 7		
3	Course Type	Core Course		
4	Pre-requisite	To study this course a student must have to pass M.Sc. IIIrd Semester in Microbiology.		
5	Course Learning Outcomes (CLO)	**On completion of this course, learners will be able to understand:** • Students will study and learn to identify microflora from contaminated food. • Students will study and learn about basic test to assure the quality of food and milk. • Students will learn to identify microorganism from air, water, soil. • Understand the association between microorganism plants and anilmals.		
6	Total Marks	Maximum Marks: 75		Min. Passing Marks: 26

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

	Part B - Content of Practical Course
S.No.	Name of Exercises
1	To study R:S ratio for given soil sample.
2	To study area monitoring of selected indoor environment.
3	To perform MPN for given water sample.
4	To study heavy meatal toxicity for given microbial culture.
5	To study droplet nuclei formation by plate count method.
6	To study E.coli as an ideal coliform.
7	To study the effectiveness of preservation method.
8	To perform microbial examination of food by SPC.
9	To perform microbial analysis of milk by MBRT.
10	To isolate the probiotic organisms.
11	To study the spoilage of dairy products.
12	To identify surface contamination on fruits.
13	To perform microbiological examination of milk sample by SPC method.
14	Any other experiment may be designed on the basis of theoretical aspects.

Part D : Assessment and Evaluation

External Assessment	Marks
Viva voce on Practical	10
Practical Record File	10
Major Exercise	21
Minor Exercise (A)	12
Minor Exercise (B)	12
Spotting	10
Total	**75**
Credits	**03**

Dr. Sanjay Vyas
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part A - Introduction				
Programme : M.Sc.		**Class: M.Sc.**	**IV SEMESTER**	**Session: 2021-22**
Subject: Microbiology (Practical)				
1	**Course Code-**	**PRMB-42**		
2	**Course Title**	**Lab. Course - 8**		
3	**Course Type**	**Based on Elective Papers**		
4	**Pre-requisite**	To study this course a student must have to pass M.Sc. IIIrd Semester in Microbiology.		
5	**Course Learning Outcomes (CLO)**	**On completion of this course, learners will be able to understand:** • Students will study and learn basics and advancement of subject. • Comprehend with techniques used in microbiology • Enhancement of practical skills.		
6	**Total Marks**	Maximum Marks: **75**		Min. Passing Marks: **26**

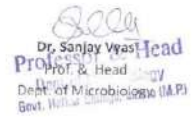
Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

	Part B - Content of Practical Course
S.No.	**Name of Exercises**
1	To perform Sterility test of sterile products.
2	To perform MLT (microbial limit test) for pharma products.
3	To perform bioassay of antibiotics.
4	To determine (MIC) Minimum inhibitory concentrations of given antibiotic.
5	To perform area monitoring by passive sampling method.
6	To perform analysis physical, chemical & biological parameters of water.
7	To study antimicrobial activity of various drugs.
8	To prepare a temporary mount of a leaf peel to show stomata.
9	To prepare a stained temporary mount of onion peel.
10	To identify the blood cell types in human blood smear.
11	To prepare permanent slide using the given sectors like stem, root & leaf.
12	To identify the different types cells, present in leaf cross sectors.
13	To prepare stained temporary mount of human cheek cells.
14	To identify the blood cell types in human blood smear, Leishman staining method.
15	To determine the phenomenon of plasmolysis & deplasmolysis.
16	To understand the process & different stages of mitosis & visualize different phases.
17	To study Indian patent act and recent amendments.
18	To study the process of filling of a patent application.
19	To study patent databases and searching international databases.
20	To explore publication of patent online and their status in Europe and US
21	Demonstration of biosafety levels.
22	To study the synthesis of nanoparticles by using plant extract.
23	To study the presence of magnetic nano particle in audio cassettes ribbon.
24	Any other experiment may be designed on the basis of theoretical aspects.

Dr. Sanjay Vyas Head
Prof. & Head
Dept. of Microbiology
Govt. Holkar College Indore (M.P.)

Part D : Assessment and Evaluation

External Assessment	Marks
Viva voce on Practical	10
Practical Record File	10
Major Exercise	21
Minor Exercise (A)	12
Minor Exercise (B)	12
Spotting	10
Total	**75**
Credits	**03**



Internship/Project: Assessment and Evaluation

External Assessment	Internal Assessment	Total
75	25	100

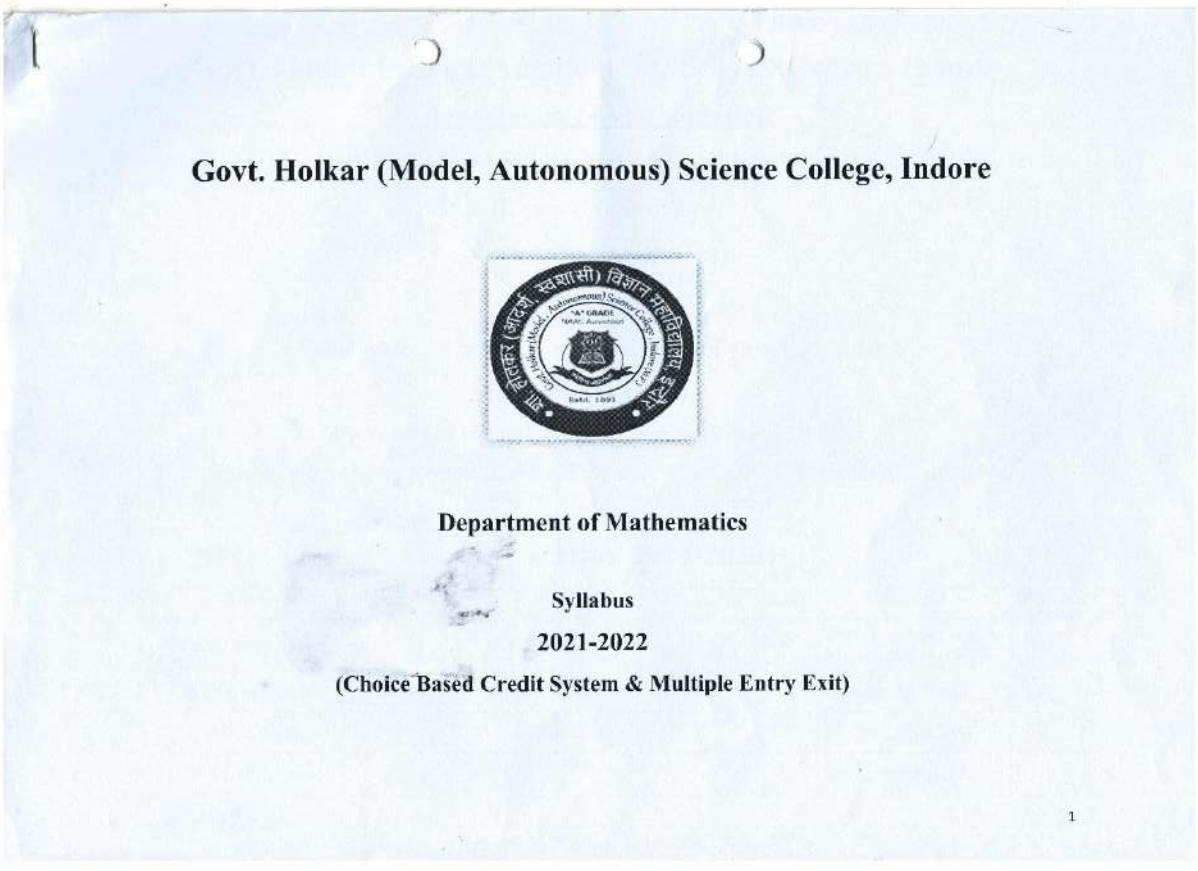
Important Note: Internship is compulsory during M.Sc. Fourth Semester.

(Visit to any Pharma Industry/Research Industry/Research laboratory related to Microbial product during M.Sc. IV Semester)

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Mathematics

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development



Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Mathematics

Syllabus

2021-2022

(Choice Based Credit System & Multiple Entry Exit)

1

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Mathematics

Syllabus for B.Sc. Part – I and II Sem,

II & III year (Mathematics)

B.C.A

&

Syllabus for M.Sc. (Mathematics): Four Semester Course

(Duration: Two years)

Department of Higher Education, Madhya Pradesh, Bhopal

Syllabus approved by Central Board of Studies in Mathematics As per UGC Criteria

(For the Session 2021-2022)

S.No.	Name	Sign.	S.No.	Name	Sign.	S.No.	Name	Sign.
1	Dr. Ravindra Garg		5	Dr. C. Sharma		9	Prof. Pratibha Mujumdar	
2	Dr. Vivek Raich		6	Prof. B.N. Namdeo		10	Dr.Sangita Jamod	
3	Dr. M.K.Mishra		7	Prof. S.K.Sharma		11	Dr. Hema Yadav	
4	Dr. Rajnish Jain		8	Prof. Chitra Ranadive		12	Dr.Naresh Patel	

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Mathematics

Syllabus Session 2021-2022

Programme : Certificate in Science **Class : B.Sc. I & II Semester**

Semester	Paper	Paper Title	PaperCode	Theory Max. Marks 100							
				Credits	CCE	External assessment	Min Marks				
I	Paper-ICore Course (Major)	Algebra, Vector Analysis and Geometry (Paper-1)	S1- MATH 1T	6	40	60	21				
II	Paper-II Core Course (Major)	Calculus and Differential Equations (Paper-2)	S1- MATH 2T	6	40	60	21				
I	Minor	Calculus and Differential Equations (Paper-2)	S1- MATH 2T	6	40	60	21				
II	Minor	Algebra, Vector Analysis and Geometry (Paper-1)	S1- MATH 1T	6	40	60	21				
I	Open Elective	Mathematical Logic and sets	S1- MATH 1G	4	40	60	21				
II	Open Elective	Matrices, Geometry and Vector Algebra	S1- MATH 2G	4	40	60	21				

Prof B.N.Namdeo

Class: B.Sc. I Sem
Subject: Mathematics
Paper: 1 (Major)

Marks: 60 + (CCE) 40 = 100
Credit: 6
Code of the Paper:-S1-MATH1T

Title of Paper: Algebra, Vector Analysis and Geometry

Part A: Introduction for Program B.Sc. I [illegible] Sem		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in class 12th.
2	**Course Objectives**	The aim of this course is to develop the capacity to solve mathematical problems related to Algebra, Vector Analysis and Trigonometry.
	Course Learning outcomes	The course will enable the students to: 1. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix using the rank of matrix. 2. To find the Eigen values and corresponding Eigen vectors for a square matrix. 3. Using the knowledge of vector calculus in geometry. 4. Enhance the knowledge of three dimensional geometrical figures (e.g. cone and cylinder).

Part B: Content of the Course

Total No. of Lectures (in hours per week): Total Lectures: 90 hours 3 hours per week

Unit	Topics	No. of Lectures
1	1. I Historical background: 1.1.1 Development of Indian Mathematics: Later Classical Period (500 -1250). 1.1.2 A brief biography of Varahamihira and Aryabhata. 1.2 Rank of a Matrix. 1.3 Echelon and Normal form of a matrix. 1.4 Characteristic equations of a matrix. 1.4.1 Eigen-values. 1.4.2 Eigen-vectors.	15
2	2.1 Cayley Hamilton theorem. 2.2 Application of Cayley Hamilton theorem to find the inverse of a matrix. 2.3 Application of matrix to solve a system of linear equations. 2.4 Theorems on consistency and inconsistency of a system of linear equations. 2.5 Solving linear equations up to three unknowns.	18
3	3.1 Scalar and Vector products of three and four vectors. 3.2 Reciprocal vectors. 3.3 Vector differentiation. 3.3.1 Rules of differentiation. 3.3.2 Derivatives of Triple Products. 3.4 Gradient, Divergence and Curl. 3.5 Directional derivatives. 3.6 Vector identities. 3.7 Vector Equations.	18
4	4. I Vector Integration 4.2 Gauss theorem (without proof) and problems based on it. 4.3 Green theorem (without proof) and problems based on it. 4.4 Stoke theorem (without proof) and problems based on it.	15

5	5.1 General equation of second degree. 5.2 Tracing of conics. 5.3 System of conics. 5.4 Cone 5.4.1 Equation of a cone with given base. 5.4.2 Generators of cone. 5.4.3 Condition for three mutually perpendicular generators. 5.4.4 Right circular cone. 5.5 Cylinder. 5.5.1 Equation of cylinder and its properties. 5.5.2 Right Circular Cylinder. 5.5.3 Enveloping Cylinder.	24
	Keywords: Indian Mathematics. Rank of a Matrix, Scalar and vector Products. vector differentiation. vector identities, vector integration. General equation of second degree, Tracing of conics. System of conics, Equation of cone, Equation of cylinder.	

Part C : Learning Resources

Text Books, Reference Books and Other ResourcesSuggested Readings:

Text Books:

1. K. B. Datta: Matrix and Linear Algebra. Prentice Hall of India Pvt. Ltd. New Delhi 2000.
2. Shanti Narayan: A Text Book of Vector Calculus, S. Chand & Co., New Delhi, 1987.
3. S. L. Loney: The Elements of Coordinate Geometry part-1, New Age International (P) Ltd., Publishers, New Delhi. 2016.
4. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Three Dimensions, Willey Eastern Ltd, 1999.
5. Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agencies VOL. 3 2005
6. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. Chandrika Prasad: A Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd. Allahabad. 2017.
2. N. Jacobson: Basic Algebra Vol. I and II, W. H. Freeman.2009.
3. I. S. Luther and I. B. S. Passi: Algebra Vol. I and II, Narosa Publishing House. 1997.
4. N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd. Allahabad. 1990.
5. Murray R. Spiegel: Vector Analysis. Schaum Publishing Company. New York,2017.
6. Gorakh Prasad and H. C. Gupta: Text Book on **Coordinate Geometry, Pothishala Pvt.** Ltd. Allahabad. 2000.
7. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Two Dimensions' Macmillan Indian Ltd... 1994.
8. S. L. Loney: The Elements of Coordinate Geometry Part-2, Macmillan, 1923.
9. N. Saran and D. N. Gupta: Three Dimensional Coordinate Geometry, Pothishala Pvt. Ltd. Allahabad. 1994.
10. R. J. T. Bell: Elementary Treatise on Coordinate Geometry of Three Dimensions. Macmillan India Ltd. 1994.
11. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics. Asia Publishing House. 1962.

Suggested Digital Platforms Web links:

https://epgp. inflibnet.ac. in hnps://freevideolectures.com/university/iit-roorkee https://www.h ighereducation.mp.gov. in/?page=xhzlQmpZwkylQo2b%2Fy5G7w%k3D%3D

https://www.bhojvirtualuniversity.com

Suggested Equivalent online courses:

https://nptel.ac. in/courses/ I | | 105|22l

https://nptel.ac.in/courses/ | | | 107 | 12l

https://nptel.ac.in/courses/ | | | / | 0 1 / | 1 | | 0 | 080

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** 100 **Continuous Comprehensive Evaluation (CCE):** 40 **University Exam (UE):** 60	
Internal Assessment Continuous ComprehensiveEvaluation (CCE)	**Total Marks : 40**
External Assessment University Exam	**Total Marks : 60**
Any remarks/ suggestions: Nil	

Prof Rajnish Jain

Class: B.Sc. I Sem
Subject: Mathematics
Paper: 2 (Minor)

Marks: 60 + (CCE) 40 = 100
Credit: 6
Code of the Paper: - S1-MATH 2T

Title of Paper: Calculus and Differential Equations
(Paper –II)

Part A: Introduction for program B.Sc. I Sem		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in class 12th
2	**Course Objectives**	The main aim of this course is to introduced the expansion of function by successive differentiation, curve tracing, integration of various standard forms and elementary differential equations.
	Course Learning outcomes	After completing this course in Mathematics, a student shall have understanding of -
		1. Sketch curves in a plane using its Mathematical properties in the different coordinate systems of reference.
		2. Using the derivatives in Optimization, Social sciences, Physics and Life sciences etc.
		3. Formulate the Differential equations for various Mathematical models.
		4. Using techniques to solve and analyze various Mathematical models.

Part B : Content of the Course

Total No. of Lectures-60
Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**

Unit	Topics	No. of Lectures
1	1.1 Historical background: 1.1.1 Development of Indian Mathematics: Ancient and Early Classical Period (till 500 CE) 1.1.2 A brief biography of Bhaskaracharya (with special reference to Lilavati) and Madhava 1.2 Successive differentiation 1.2.1 Leibnitz theorem 1.2.2 Maclaurin's series expansion 1.2.3 Taylor's series expansion 1.3 Partial Differentiation 1.3.1 Partial derivatives of higher order 1.3.2 Euler's theorem on homogeneous functions 1.4 Asymptotes 1.4.1 Asymptotes of algebraic curves 1.4.2 Condition for Existence of Asymptotes 1.4.3 Parallel Asymptotes 1.4.4 Asymptotes of polar curves	18
2	2.1 Curvature 2.1.1 Formula for radius of Curvature 2.1.2 Curvature at origin 2.1.3 Centre of Curvature 2.2 Concavity and Convexity 2.2.1 Concavity and Convexity of curves 2.2.2 Point of Inflexion' 2.2.3 Singular point 2.2.4 Multiple points 2.3 Tracing of curves 2.3.1 Curves represented by Cartesian equation 2.3.2 Curves represented by Polar equation	18

3	3.1 Integration of transcendental functio 3.2 Introduction to Double and Triple Integral 3.3 Reduction formulae 3.4 Quadrature 3.4.1 For Cartesian coordinates 3.4.2 For Polar coordinates 3.5 Rectification 3.5.1 For Cartesian coordinates 3.5.2 For Polar coordinates	18
4	4.1 Linear differential equations 4.1.1 Linear equation 4.1.2 Equations reducible to the linear form 4.1.3 Change of variables 4.2 Exact differential equations 4.3 First otder and higher degree differential equations 4.3.1 Equations solvable for x, y and p 4.3.2 Equations homogenous in x and y 4.3.3 Clairaut's equation 4.3.4 Singular solutions 4.3.5 Geometrical meaning of differential equations 4.3.6 Orthogonal trajectories	18
5	5.1 Linear differential equation with constant coefficients 5.2 Homogeneous linear ordinary differential equations 5.3 Linear differential equations of second order 5.4 Transformation of equations by changing the dependent/ independent variable 5.5 Method of variation of parameters	18
	Keywords/Tags: Indian Mathematics, Successive differentiation, Partial Differentiation, Asymptotes Curvature, Tracing of curves. Quadrature. Rectification, Linear differential equations, Method of variation or parameters.	

Part C : Learning Resources

Text Books, Reference Books and Other Resources
Suggested Readings:

Text Books:

1. Gorakh Prasad: DifTerential Calculus, Pothishala Private Ltd., Allahabad, 2016.
2. Gorakh Prasad: integral Calculus, Pothishala Private Ltd., Allahabad, 2015.
3. M. D. Raisinghania: Ordinary and Partial DifTerential Equations. S Chand A Co Ltd. 2017.
4. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
5. मध्यप्रदेश हिंदी ग्रंथ अकादमी

Reference Books:

1. N. Piskunov: Differential and Integral Calculus, CBS Publishers, 1996.
2. G. F. Simmons: Differential Equations, Tata McGraw Hill. 1972.
3. E. A. Codington: An Introduction to ordinary differential Equation, Prentice Hall of India, 1961.
4. D. A. Murray: Intrdductory Course in DifTerential Equations, Orient Longman (India) 1967.
5. H. T. H Piaggio: Elementary Treatise on Differential Equations and their Application, C.B.S. Publisher & Distributors, Delhi. 1985.
6. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.

Suggested Digital Platforms
Web.links: https://epgp.inflibnet.ac.in
https://freevideolectures.com/university/iit-roorkee
https://www.highereducation.mp.gov.in/?page=xhzfQmpZwkyIQo2b%2Fy5G7w%3D%3D https://www.bhojvirtualuniversity.com

Suggested Equivaleat oaliae courses: hxps://npteLac.in/courses/I 11106100/
https://nptel.ac.in/courses/I /101/111101080/

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks: 100** **Continuous Comprehensive Evaluation (CCE): 40** **University Exam (UE): 60**	
Internal Assessment Continuous ComprehensiveEvaluation (CCE)	**Total Marks : 40**
External Assessment University Exam	**Total Marks : 60**
Any remarks/ suggestions: Nil	

Prof. S. Jamod

Part A – Introduction for program B.Sc. I Sem				
Programme: Certificate Course		**Class: B.Sc.**	**Year: I Sem**	**Session: 2021-22**
Subject: Mathematics				
1	**Course Code-**	**S1-MATH 1G**		
2	**Course Title**	**Mathematical Logic and Sets**		
3	**Course Type**	**Elective**		
4	**Pre-requisite**	Open for all		
5	**Course Learning Outcomes (CLO)**	At the end of this course. The students will be able to: 1. Using the principles of logic to distinguish between sound and unsound resoning in discourse of everybody. 2. Construct truth tables for logical expressions: test statements for logical equivalence and represent mathematical statements in the language of predicate language. 3. Using the appropriate set theoretical concepts, thinking process, tools and techniques in the solution to various conceptual or real-world problems.		
6	**Credit Value**	**Theory: 4**		
7	**Total Marks**	Maximum Marks : **40+60**	Min. Passing Marks: **21**	

Part B - Content of Course		
Total No. of Lectures (in hours per week:) 2 Hours per week **Total Lectures:** 60 Hours		
Unit	**Topics**	**No. of Lectures**
1	**Mathematical Logic-I:** 1.1 Propositions and Truth table 1.2 Negation, Conjunction and Disjunction 1.3 Implications and Double implication 1.4 Bi-conditional propositions 1.5 Contrapositive Implication and converse 1.6 Contrapositive and inverse proposition	**15**
2	**Mathematical Logic-II:** 2.1 Precedence of logical operators 2.2 Tautology and Contradiction 2.3 Propositional equivalence Logical equivalences 2.4 Predicates and quantifiers 2.4.1 Introduction 2.4.2 Quantifiers 2.4.3 Binding variables and Negations	**15**
3	**Set Theory:** 3.1 Introduction to sets 3.2 Finite and infinite sets 3.3 Counting principle 3.4 Standard set operations 3.4.1 Classes of sets 3.4.2 Power set of a set 3.4.3 Difference Symmetric difference of two sets 3.4.4 Set Identities 3.4.5 Generalized union and intersection 3.4.6 Principle of Inclusion and Exclusion 3.5 Cardinality 3.6 Fuzzy Sets and it's basic operations	**15**

4	**Relations:** 1.1 Cartesian product of sets 1.2 Composition of relation 1.3 Types of relations 1.4 Partitions 1.5 Equivalence relations 1.6 Partial ordering relations 1.7 Congruence modulo relation	**15**
	Keywords: Mathematical Logic, Set Theory, Fuzzy Sets, Relation on sets.	

Part C : Learning Resources

Text Books, Reference Books and Other ResourcesSuggested Reading:

Text Books:

1. R.M Somasundaram: Discrete Mathematical Structures, PHL Learning Pvt. Ltd. 2003.
2. Samar Ballav Bhoi: A Text Book of logic and sets Educreation Publishing 2018.
3. Ganesh: Introduction to Fuzzy Sets and Fuzzy Logic. Prentice Hall India Learning Private Limited 2006.
4. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. Ajit Kumar S. Kumaresan. Bhaba Kumar Sharma A Foundation Course in Mathematics Alpha Science International Ltd. 2018.
2. R.P Grimaldi Discrete Mathematics and Combinatorial Mathematics, Person Education 1998.
3. Jean-Paul Tremblay, R Manohar Discrete Mathematical Structures with Applications to Computer Science. McGrew Hill Education 1st Edition 2017.
4. G.J Klir and B. Yuan: Fuzzy sets and Fuzzy logic Pearson 2015.

Suggested Digital Platform Web links:

https://wwwhighereduction.mp.gov.in/?pagexhz1Qm pZwky1Q02b%2Fy5G7w%3D%3D

https://epathshala.ncert.org.in/

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** 100 **Continuous Comprehensive Evaluation (CCE):** 40 **University Exam (UE):** 60	
Internal Assessment Continuous Comprehensive Evaluation (CCE)	**Total Marks : 40**
External Assessment University Exam	**Total Marks : 60**
Any remarks/ suggestions: Nil	

Class: B.Sc. II Sem
Subject: Mathematics
Paper: 2 (Major)

Dr Rajnish Jain
Marks: 60 + (CCE) 40 = 100
Credit: 6
Code of the Paper: - S1-MATH 2T

Title of Paper: Calculus and Differential Equations
(Paper –II)

Part A: Introduction for program. B.Sc. II Sem		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in class 12th
2	**Course Objectives**	The main aim of this course is to introduced the expansion of function by successive differentiation, curve tracing, integration of various standard forms and elementary differential equations.
	Course Learning outcomes	After completing this course in Mathematics, a student shall have understanding of -
		1. Sketch curves in a plane using its Mathematical properties in the different coordinate systems of reference.
		2. Using the derivatives in Optimization. Social sciences, Physics and Life sciences etc.
		3. Formulate the Differential equations for various Mathematical models.
		4. Using techniques to solve and analyze various Mathematical models.

Part B : Content of the Course

Total No. of Lectures-60
Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**

Unit	Topics	No. of Lectures
1	1.1 Historical background: 1.1 .1 Development of Indian Mathematics: Ancient and Early Classical Period (till 500 CE) 1.1 .2 A brief biography of Bhaskaracharya (with special reference to Lilavati) and Madhava 1.5 Successive differentiation 1.5.1 Leibnitz theorem 1.5.2 Maclaurin's series expansion 1.5.3 Taylor's series expansion 1.6 Partial Differentiation 1.6.1 Partial derivatives of higher order 1.6.2 Euler's theorem on homogeneous functions 1.7 Asymptotes 1.7.1 Asymptotes of algebraic curves 1.7.2 Condition for Existence of Asymptotes 1.7.3 Parallel Asymptotes 1.4.4 Asymptotes of polar curves	18
2	2.1 Curvature 2.1.1 Formula for radius of Curvature 2.1.4 Curvature at origin 2.1.5 Centre of Curvature 2.4 Concavity and Convexity 2.4.1 Concavity and Convexity of curves 2.4.2 Point of Inflexion 2.4.3 Singular point 2.4.4 Multiple points 2.5 Tracing of curves 2.5.1 Curves represented by Cartesian equation 2.5.2 Curves represented by Polar equation	18

3	3.1 Integration of transcendental functions 3.2 Introduction to Double and Triple Integral 3.3 Reduction formulae 3.4 Quadrature 3.4.1 For Cartesian coordinates 3.4.2 For Polar coordinates 3.5 Rectification 3.5.1 For Cartesian coordinates 3.5.2 For Polar coordinates	18
4	4.1 Linear differential equations 4.1.1 Linear equation 4.1.4 Equations reducible to the linear form 4.1.5 Change of variables 4.4 Excel differential equations 4.5 First order and higher degree differential equations 4.5.1 Equations solvable for x, y and p 4.5.2 Equations homogenous in x and y 4.5.3 Clairaut's equation 4.5.4 Singular solutions 4.5.5 Geometrical meaning of differential equations 4.5.6 Orthogonal trajectories	18
5	6.1 Linear differential equation with constant coefficients 6.2 Homogeneous linear ordinary differential equations 6.3 Linear differential equations of second order 6.4 Transformation of equations by changing the dependent/ independent variable S.5 Method of variation of parameters	18
	Keywords/Tags: Indian Mathematics, Successive differentiation, Partial Differentiation, Asymptotes Curvature, Tracing of curves. Quadrature. Rectification, Linear differential equations, Method of variation or parameters.	

Part C : Learning Resources

Text Books, Reference Books and Other Resources
Suggested Readings:

Text Books:

2. Gorakh Prasad: DilTerential Calculus, Pothishala Private Ltd., Allahabad. 2016.
2. Gorakh Prasad: integral Calculus, Pothishala Private Ltd,. Allahabad, 2015.
3. M. D. Raisinghania: Ordinary and Partial DilTerential Equations. S Chand A Co Ltd, 2017.
4. Gerard G. Emch, R. Sridharan and M. D. Srinivas: Contributions to the History of Indian Mathematics. Hindustan Book Agency, Vol. 3, 2005.
5. मध्यप्रदेश हिंदी ग्रंथ अकादमी

Reference Books:

1. N. Piskunov: Differential and Integral Calculus, CBS Publishers, 1996.
2. G. F. Simmons: Differential Equations, Tata McGraw Hill. 1972.
3. E. A. Codington: An Introduction to ordinary differential Equation, Prentice Hall of India, 1961.
4. D. A. Murray: Intrdductory Course in Differential Equations, Orient Longman (India) 1967.
5. H. T. H Piaggio: Elementary Treatise on Differential Equations and their Application. C.B.S. Publisher & Distributors, Delhi. 1985.
6. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House, 1962.

Suggested Digital Platforms
Web.links: https://epgp.inflibnet.ac.in
https://freevideolectures.com/university/iit-roorkes
https://www.highereducation.mp.gov.in/?page=xhzfQmpZwkyIQo2b%2Fy5G7w%3D?«3D https://www.bhojvirtualuniversity.com

Suggested Equivaleat oaliae courses: hxps://nptel.ac.in/courses/I 11106100/
https://nptel.ac.in/courses/I /101/I 1110I080/

Part D : Assessment and Evaluatio

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100** **Continuous Comprehensive Evaluation (CCE):** **40** **University Exam (UE):** **60**	
Internal Assessment Continuous ComprehensiveEvaluation (CCE)	**Total Marks : 40**
External Assessment University Exam	**Total Marks : 60**
Any remarks/ suggestions: Nil	

Part D : Assessment and Evaluatio

Suggested Continuous Evaluation Methods: **Maximum Marks:** 100 **Continuous Comprehensive Evaluation (CCE):** 40 **University Exam (UE):** 60		
Internal Assessment Continuous ComprehensiveEvaluation (CCE)		**Total Marks : 40**
External Assessment University Exam		**Total Marks : 60**
Any remarks/ suggestions: Nil		

Prof B.N. Mandeo

Class: B.Sc. II Sem
Subject: Mathematics
Paper: I (Minor)

Marks: 60 + (CCE) 40 = 100
Credit: 6
Code of the Paper:-S1-MATH1T

Title of Paper: Algebra, Vector Analysis and Geometry

Part A: Introduction for Program B.Sc. II Sem		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in class 12th.
2	**Course Objectives**	The aim of this course is to develop the capacity to solve mathematical problems related to Algebra, Vector Analysis and Trigonometry.
	Course Learning outcomes	The course will enable the students to: 1. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix using the rank of matrix. 2. To find the Eigen values and corresponding Eigen vectors for a square matrix. 3. Using the knowledge of vector calculus in geometry. 4. Enhance the knowledge of three dimensional geometrical figures (e.g. cone and cylinder).

Part B: Content of the Course

Total No. of Lectures (in hours per week): Total Lectures: 90 hours 3 hours per week		
Unit	**Topics**	**No. of Lectures**
1	1. I Historical background: 1.1.1 Development of Indian Mathematics: Later Classical Period (500 -1250). 1.1.2 A brief biography of Varahamihira and Aryabhata. 1.2 Rank of a Matrix. 1.3 Echelon and Normal form of a matrix. 1.4 Characteristic equations of a matrix. 1.4.1 Eigen-values. 1.4.2 Eigen-vectors.	**15**
2	2.1 Cayley Hamilton theorem. 2.2 Application of Cayley Hamilton theorem to find the inverse of a matrix. 2.3 Application of matrix to solve a system of linear equations. 2.4 Theorems on consistency and inconsistency of a system of linear equations. 2.5 Solving linear equations up to three unknowns.	**18**
3	3.1 Scalar and Vector products of three and four vectors. 3.2 Reciprocal vectors. 3.3 Vector differentiation. 3.3.1 Rules of differentiation. 3.3.2 Derivatives of Triple Products. 3.4 Gradient, Divergence and Curl. 3.5 Directional derivatives. 3.6 Vector identities. 3.7 Vector Equations.	**18**
4	4. I Vector Integration 4.2 Gauss theorem (without proof) and problems based on it. 4.3 Green theorem (without proof) and problems based on it. 4.4 Stoke theorem (without proof) and problems based on it.	**15**

5	5.1 General equation of second degree. 5.2 Tracing of conics. 5.3 System of conics. 5.4 Cone 5.4. I Equation of a cone with given base. 5.4.2 Generators of cone. 5.4.3 Condition for three mutually perpendicular generators. 5.4.4 Right circular cone. 5.5 Cylinder. 5.5. I Equation of cylinder and its properties. 5.5.2 Right Circular Cylinder. 5.5.3 Enveloping Cylinder.	**24**
	Keywords: Indian Mathematics. Rank of a Matrix, Scalar and vector Products. vector differentiation. vector identities, vector integration. General equation of second degree, 'Tracing of conics. System of conics, Equation of cone, Equation of cylinder.	

Part C : Learning Resources

Text Books, Reference Books and Other ResourcesSuggested Readings:

Text Books:

1. K. B. Datta: Matrix and Linear Algebra. Prentice Hall of India Pvt. Ltd. New Delhi 2000.
2. Shanti Narayan: A Text Book of Vector Calculus, S. Chand & Co., New Delhi, 1987.
3. S. L. Loney: The Elements of Coordinate Geometry part-1, New Age International (P) Ltd., Publishers, New Delhi. 2016.
4. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Three Dimensions, Willey Eastern Ltd, 1999.
5. Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agencies VOL. 3 2005
6. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

I. Chandrika Prasad: A Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd. Allahabad. 2017.
2. N. Jacobson: Basic Algebra Vol. I and II, W. H. Freeman.2009.
3. I. S. Luther and I. B. S. Passi: Algebra Vol. I and II, Narosa Publishing House. 1997.
4. N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd. Allahabad. 1990.
5. Murray R. Spiegel: Vector Analysis. Schaum Publishing Company. New York,2017.
6. Gorakh Prasad and H. C. Gupta: Text Book on **Coordinate Geometry, Pothishala Pvt.** Ltd. Allahabad. 2000.
7. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Two Dimensions' Macmillan Indian Ltd... 1994.
8. S. L. Loney: The Elements of Coordinate Geometry Part-2, Macmillan, 1923.
9. N. Saran and D. N. Gupta: Three Dimensional Coordinate Geometry, Pothishala Pvt. Ltd. Allahabad. 1994.
10. R. J. T. Bell: Elementary Treatise on Coordinate Geometry of Three Dimensions. Macmillan India Ltd. 1994.
11. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics. Asia Publishing House. 1962.

Suggested Digital Platforms Web links:

https://epgp. inflibnet.ac. in hnps://freevideolectures.com/university/iit-roorkee https://www.h ighereducation.mp.gov. in/?page=xhzlQmpZwkylQo2b%2Fy5G7w%k3D%3D

https://www.bhojvirtualuniversity.com

Suggested Equivalent online courses:

https://nptel.ac. in/courses/ I | | l05l221

https://nptel.ac.in/courses/ | | | 107 | 121

https://nptel.ac.in/courses/ | | | / | 0 I / | I | | 0 | 080

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks: 100** **Continuous Comprehensive Evaluation (CCE): 40** **University Exam (UE): 60**	
Internal Assessment Continuous ComprehensiveEvaluation (CCE)	**Total Marks : 40**
External Assessment University Exam	**Total Marks : 60**
Any remarks/ suggestions: Nil	

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks: 100** **Continuous Comprehensive Evaluation (CCE): 40** **University Exam (UE): 60**	
Internal Assessment Continuous ComprehensiveEvaluation (CCE)	**Total Marks : 40**
External Assessment University Exam	**Total Marks : 60**
Any remarks/ suggestions: Nil	

Prof S. Jamal.

Part A – Introduction for program B.Sc. II Sem				
Programme : Certificate Course		**Class: B.Sc.**	**Year: II Sem**	**Session: 2021-22**
Subject: Mathematics				
1	**Course Code-**	**S1 MATH 2G**		
2	**CourseTitle**	**Matrices, Geometry and Vector Algebra**		
3	**Course Type**	**Elective**		
4	**Pre-requisite**	This course can be opted as an elective by the student of all subjects who do not have Mathematical Background at 12th level.		
5	**Course Learning Outcomes (CLO)**	On completion of this course, learners will be able to use the Matrices, Determinants, Geometry and Vector approach in different areas of business and science like budgeting, sales projection, cost estimation analyzing the result of an experiment etc.		
6	**Credit Value**	**Theory: 4**		
7	**Total Marks**	Maximum Marks: **40+60**	Min. Passing Marks: **21**	

Part B - Content of Course		
Total No. of Lectures (in hours per week:) 2 Hours per week **Total Lectures:** 60 Hours		
Unit	**Topics**	**No. of Lectures**
1	1.1 Determinants 1.2 Basic Properties of Determinants 1.3 Minor Determinants 1.4 Co- factor 1.5 Applications of Determinants in finding the area of a triangle.	15
2	2.1 Matrices 2.1.1 Concept of Matrices 2.1.2 Notation, order and equality of Matrices 2.1.3 Types of Matrices 2.1.4 Transpose of Matrix 2.2 Operation on Matrices 2.2.1 Addition and multiplication 2.2.2 Multiplication with a scalar 2.2.3 Simple properties of addition, multiplication and scaler multiplication 2.3 Adjoint and inverse of a square Matrix.	15
3	3.1 Two dimensional Coordinate geometry 3.1.1 Shifting of origin 3.1.2 Slope of a line 3.1.3 Angle between two lines. 3.2 Various form of equation of a line in two dimension 3.2.1 Parallel to axes 3.2.2 Point slope form 3.2.3 Slope intercept form 3.2.4 Two-point form 3.2.5 Intercept form and normal form 3.2.6 General equation of a line. 3.3 Distance of a point from a line in two dimension 3.4 Three dimensional coordinate geometry	15

	3.4.1 Coordinate axes and coordinate planes 3.4.2 Coordinate of point 3.4.2 Distance between two points and section formula.	
4	4.1 Vectors and scalars 4.2 Magnitude and direction of a vector 4.3 Direction cosines and direction ratios of a vector 4.4 Types of vectors and position vector of a point 4.5 Negative of a vector and components of a vector 4.6 Operation on Vectors 4.6.1 Addition of vectors 4.6.2 Multiplication of a vector by a scaler 4.7 Properties vector of a point dividing a line segment in given ratio. 4.8 Properties and application of 4.8.1 Scalar (dot) product of vectors 4.8.2 Vector (cross) product of vectors.	
Keywords: Determinants, Matrices. Two and three dimensional coordinate geometry, Vector analysis.		

Part C : Learning Resources

Text Books, Reference Books and Other Resources
Suggested Reading:

Text Books:

1. PK Mittal and Shanti Narayan Vector Algebra. S. Chand Publishing 2005.
2. Nita H. Shah Foram A. Thakkar Matrix and Determinant Fundamental and Applications, CRC Press 2020.
3. G. Prasad: Coordinate Geometry of Two and Three Dimension. Axis Publications 2010.
4. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

2. Hari Kishan: A Textbook of Matrices, Atlantic Publishers & Dist. 2008
3. Hari Kishan: Vector Algebra and Calculus Atlantic Publishers & Dist. 2007
4. K.C Mathew S. Veeraraghavan: A Text book of Coordinate Geometry of Two and Three Dimensions Chand Publication 1972.
5. Shanti Narayan and P.K Mittal: A Textbook of Matrices. S. Chand Publishing 1953.

Suggested Digital Platform Web links:
https://freedeolecture.com/university/iit-roorkee/
https://www.highereduction.mpgov.in?pagexhzlQmp/wkylQo2b%2Fy5G7w%3D%3D
https://epathshala.ncert.or.in

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks: 100** **Continuous Comprehensive Evaluation (CCE): 40** **University Exam (UE): 60**	
Internal Assessment Continuous ComprehensiveEvaluation (CCE)	**Total Marks : 40**
External Assessment University Exam	**Total Marks : 60**
Any remarks/ suggestions: Nil	

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Mathematics

Syllabus Session 2021-2022

Programme : B.Sc. **Class : B.Sc. II Year**

Paper	Title of the paper	Paper Code	Theory					
			Paper-wise Maximum Marks	Total Theory Marks	Minimum Passing Marks in Theory	Internal Assessment Maximum Marks	Minimum Passing Marks in Internal Assessment	Total Marks
Paper-1	Abstract Algebra	214-I	40	120	40	10	10	150
Paper-2	Advanced Calculus	214-II	40			10		
Paper–3	Differential Equations	214-III	40			10		

Class: B.Sc. Second Year
Subject: Mathematics
Paper: I

Marks: 40 + (CCE) 10= 50
Code of the Paper:- 114 - I

Title of the Paper: Abstract Algebra

Part A: Introduction for Program B.Sc. Second Year		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in B.Sc. First Year
2	**Course Objectives**	Group Theory is one of the building blocks of Modern Algebra. Main objective of this course is to introduce students to basic concepts of Group, Ring theory and their properties.
	Course Learning outcomes	After completing this course in Mathematics, a student would be able to.
		C01: To recognize the mathematical objects called groups. This part provides a foundation in the basic concepts in the groups, subgroups and cyclic groups including properties
		C02: To explain the significance of the notions of cosets, Lagrange's theorem and its consequences, normal subgroup and factor group.
		C03: To learn about structure preserving maps between groups namely homomorphism, isomorphism and its consequences, Permutation groups.
		C04: To utilize the class equation and Cauchy, sylow's theorems to solve related problems.
		C05: To provide information on rings, ideal and quotient ring, integral domain and Euclidean ring.

Part B: Content of the Course

Abstract Algebra (Paper I)

Total No. of Lectures-60
Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**

Unit	Topics	No. of Lectures
1	Definition and basic properties of groups, subgroups, subgroups generated by a subset, Cyclic groups and simple properties.	12
2	Coset decomposition, Lagrange's theorem and its corollaries including Fermat's theorem Normal subgroups, Quotient groups.	12
3	Homomorphism and Isomorphism of groups, Fundamental Theorem of homomorphism, Transformation and Permutation group, S_n (various subgroups of S_n, n<5 to be studied) Cayley's theorems.	12
4	Group Automorphism, Inner Automorphism, group of Automorphisms. Conjugacy relation and Centraliser, Normaliser, Counting Principle and class equation of a finite group, Cauchy's theorem for finite abelian groups and non-abelian groups.	12
5	Definition and basic properties of rings, Ring homomorphism, subrings, Ideals and Quotient rings, Polynomial rings & its properties, Integral domain, Principal ideal domains, Euclidean domains and unique factorization domains, Filed and quotient field.	12

Part C : Learning Resources

Text Books, Reference Books Suggested Readings:

Text Books:

1. I.N Herstein-Topics in Algebra, Wiley Eastern Ltd. New Delhi. 1977
2. PB Bhattacharya, S.K Jain and S.R Nagpaul-Basic Abstract Algebra, Wiley Eastern, New Delhi 1977
3. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1. Shantinarayan- A text Book of Modern Abstract Algebra, S. Chand and Company, New Delhi.
2. Surjeet Singh- A Text Book of Modern Algebra.
3. N. Jacobson- Basic Algebra, Vol. I & II, W.H. Freeman.
4. I.S Luther and I.B.S Passi-Algebra, Vol. I and II, Narosa Publishing House.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** 50 **Continuous Comprehensive Evaluation (CCE):** 10 **University Exam (UE):** 40		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Five Objective Choice Questions	5 x 1 = 5
	Section (B): Five Short Answer Type Questions	5 x 2 = 10
	Section (C) : Five Long Answer Type Questions	5 x 5 = 25
	Total	**40**
Any remarks/ suggestions: Nil		

Prof P mujumdar

Class: B. Sc. Second Year **Marks: 40 + (CCE) 10= 50**
Subject: Mathematics **Code of the Paper:-214- II**
Paper: II

Title of the Paper: Advanced Calculus

Part A: Introduction for Program B.Sc. Second Year		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in B.Sc. First Year
2	**Course Objectives**	The course enables the students to understand the sequences and series of real numbers and their convergence. To acquire the knowledge of continuity and differentiability of functions of single variable, limit of functions of two variables, Partial differentiation. Also to get the knowledge of maxima and minima of functions, double and triple integrals. To enable the students of revolution and to evaluate volumes and surfaces of solid to know the change of order of double integral.
	Course Learning outcomes	After completion the course Students will be able to
		CO1 : Understand the convergence of sequences and series of real numbers which is useful in a number of mathematical disciplines for studying functions, spaces and other mathematical structures.
		CO2 : Understand the concept of continuity and differentiability of functions of a single variable and several important results.
		CO3 : Get knowledge of limit and continuity of functions of two variables, partial differentiation, Taylor's theorem and Jacobians.
		CO4 : Evaluate maxima and minima of functions of two variables, envelopes and evaluates, and get the knowledge of two very important functions namely beta and gamma functions.
		CO5 : Double and triple integrals and to evaluate them To evaluate the volumes and surfaces of solid revolution and also the change of the order of integrals.

Part B: Content of the Course
Advanced Calculus

Total No. of Lectures-60 Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**		
Unit	**Topics**	**No. of Lectures**
1	Definition of a Sequence, Theorems on limits of sequences, indeterminate forms Bounded and Monotonic sequences. Cauchy's convergence criterion series of non-negative terms, comparison test, Cauchy's Intergral test, Cauchy's root test, ration test, Raabe's tests, logarithmic tests. Alternating series. Leibnitz's test, Absolute and Conditional Convergence, absolute and conditional converegence of series of real and complex terms, rearrangement of series.	12
2	Continuity of functions of single variable, sequential continuity. Properties of continuous functions. Uniform continuity, chain rule of differentiability, Mean value theorems and their geometrical interpretations. Darboux's intermediate value theorem for derivatives.	12
3	Limit and continuity of functions of function of two variables, Partial differentiation, Change of variables, Euler's theorem on homogeneous functions, Taylors theorem for functions of two variables, Jacobians.	12
4	Envelops, Evolutes Maxima and Minima of functions of two variables Lagrange's multiplier method, Beta and Gamma Functions.	12
5	Double and triple integrals , volumes and surfaces of solids of revolution, Dirichlet's integrals change of order of integration in double integrals.	12

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text books:

1. R.R Goldbeg-Real Analysis, Oxford & I.B.H Publishing co. New Delhi
2. Gorakh Prasad- Diffrential Calculus, Pothishala Pvt. Ltd. Allahabad
3. Gorakh Prasad- Integral Calculus Pothishala Pvt. Ltd. Allahabad
4. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Books:

1.Gabriel Klaumber- Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975
2.T.M Apostol- Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
3.D. Soma Sundaram and B. Choudhary- A first course in mathematical Analysis Narosa Publishing House, New Delhi, 1997
4.Murray R. Spiegel- Theory and problems of advance Calculus, Schauma Publishing CO. New York
5. O.E Stanatitis- An Introduction to Sequences, Series and improper Integrales

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:		
Maximum Marks:	**50**	
Continuous Comprehensive Evaluation (CCE):	**10**	
University Exam (UE):	**40**	
Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Objective Type Questions	5 x 1 = 5
	Section (B): Five Short Answer Type Questions	5 x 2 = 10
	Section (C): Five Long Answer Type Question	5 x 5 = 25
	Total	**40**
Any remarks/ suggestions: Nil		

Prof. M. Patel

Class: B. Sc. Second Year
Subject: Mathematics
Paper: III

Marks: 40 + (CCE) 10= 50
Code of the Paper:-214- III

Title of the Paper: Differential Equations

Part A : Introduction for program B.Sc. Second Year		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in B.Sc. First Year
2	**Course Objectives**	To introduce the students with the fundamentals of Ordinary Differential Equations, Partial Differential Equations and Laplace Transform.
	Course Learning outcomes	After completion the course Students will be able to
		CO1: Learn second order differential equations in particular Bessel's and Legendre's equations using the Power series method.
		CO2: Learn to find the Laplace transform of functions, their differential and integrals.
		CO3: Learn to find the inverse of Laplace transform and by using it, solution of linear differential equation can be found.
		CO4: Learn to solve PDE of first order using Lagrange's method, Charpit's method and categorised PDE into standard forms.
		CO5: Learn to solve PDE (homogeneous and non - homogeneous) of second and higher order with constant coefficients.

Part C : Learning Resources

Text Books, Reference Books
Suggested Reading:
Text Books:

1. Sharma and Gupta- Integral Transform, Pragati Prakashan Meerut.
2. Sharma and Gupta- Differential Equation Transform, Pragati Prakashan Meerut.
3. Raysinghania- Differential Equation , S. Chand & Company, New Delhi
4. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Reference Book:

1. D.A Murray – Introductory course in differential equation, Orient Longman, India 1967
2. G.S Simnons – Differential Equation, Tata Mcgraw Hill, 1972
3. E.A Codington- An introduction to Ordinary differential equations, Prentice Hall of India 1961
4. H.T.H Piaggio- Elementary Treatise on Differential Equation, and their applications C.B.S Publisher and Distributors, Delhi 1985
5. E.D Rainville- Special Functions The Macmillan Company, New York

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **50**
Continuous Comprehensive Evaluation (CCE): **10**
University Exam (UE): **40**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Objective Type Questions	5 x 1 = 5
	Section (B): Five Short Answer Type Questions	5 x 2 = 10
	Section (C): Five Long Answer Type Question	5 x 5 = 25
	Total	**40**
Any remarks/ suggestions: Nil		

Govt. Holkar (Model, Autonomous) Science College, Indore								
Department of Mathematics								
Syllabus Session 2021-2022								
	Programme : B.Sc.							Class : B.Sc. III Year
			Theory					
Paper	Title of the paper	Paper Code	Paper-wise Maximum Marks	Total Theory Marks	Minimum Passing Marks in Theory	Internal Assessment Maximum Marks	Minimum Passing Marks in Internal Assessment	Total Marks
Paper-1	Linear Algebra and Numerical Analysis	314-I	40	120	40	10	10	150
Paper-2	Real and Complex Analysis	314-II	40			10		
Paper–3	Discrete Mathematics (Third Optional-B)	314-III	40			10		

Pr. H. Yadav

Class: B.Sc. Third Year
Subject: Mathematics
Paper: I

Marks: 40 + (CCE) 10= 50
Code of the Paper:-314- I

Title of the Paper: Linear Algebra And Numerical Analysis

Part A : Introduction for Program B.Sc. Third Year		
1	Pre-requisite (if any)	To study this course a student must have the subject Mathematics in B.Sc. Second Year
2	Course Objectives	Linear Algebra is a very important branch of Mathematics. In this course the students will learn about linear space, linear transformation, inner product space properties and their consequences. Also students will be able to know the various methods of numerical analysis.
	Course Learning outcomes	After the completion of this course the students would be able to
		CO1: Understand the notion of abstract real and complex vector spaces (linear spaces), linear combinations, independent and dependent vectors, basis and dimension of a vector space, extension theorem.
		CO2: Discribe linear transform Cation (L.T.) and its algebra, kernel,range,rank, nullity, matrix representation, eigenvalues, eigenvectors of L. T., diagonalization.
		CO3: Understand the notion of inner product space and its norm, Cauchy - Schwarz's inequality, length of vector, orthogonal and orthonormal sets and basis, Gram -Schmidt orthonormalization process.
		CO4: Discuss various iteration methods, Lagrange interpolation, Newton - Cote's and Gauss quadrature formulae.
		CO5: Understand the various direct and iterative methods of solution of linear equations.

Part B: Content of the Course

Total No. of Lectures-60 Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**		
Unit	**Topics**	**No. of Lectures**
1	Definition and examples of Vector spaces, subspace sum and direct sum of subspace, Linear span, Linear dependence and their basic properties, Basic, Existence Theorem for basic, Extension Theorem Invariance of the number of elements of a basis, Dimension, Finite dimensional vector spaces Dimension of sum of subspace, Quotient space and its dimension.	12
2	Linear transformations and their representation as matrices. Algebra of linear transformations, Rank- Nullity theorem, change of basis, dual space, bi-dual space and natural isomorphism, adjoint of a linear transformation, Eigen values and Eigen vectors of a linear transformation, Diagonalization, Bilinear ,Quadratic and Hermitian forms.	12
3	Inner product space- Cauchy-Schwartz inequality, Orthogonal vectors, orthogonal complements orthonormal sets and bases, Bessel's inequality for finite dimensional spaces. Gram-Schmidt Orthogonalization process.	12
4	Solution of Equation : Bisection Secant, Regula Falsi, Newton's Methods. Roots of second degree polynomial equations. Interpolation: Lagrange interpolation, Divided differences, Interpolation formula using Differences. Numerical Quadrature. Newton Cote's formulae. Gauss Quadrature formulae.	12
5	Linear equations direct methods for solving systems of linear equations (Gauss elimination, LU decomposition, Cholesky decomposition) Iterative methods (Jacobi, Gauss-Seidel reduction methods). Ordinary differential equations : Euler method, Single step method, Ruge-Kutta's method, Multistep methods, Milne Simpson method. Methods based on Numerical integration, Methods based on numerical differentiation.	12

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

Text Books:

1. K.B Dutta- Matrix and Linear Algebra, Prentice hall of India Pvt. Ltd New Delhi 2000.
2. S.S Sastry- Introductory Methods of Numerical Analysis, PHI Learning Pvt. Ltd.

Reference Books:

1. K. Hoffiman and R. Kunze- Linear Algebra, 2nd Edition, Prentice Hall Englewood Cliffs New Jersey, 1971.
2. S.K Jain, A Gunawardena & P.B Bhattacharya- Basic Linear Algebra with MATLAB key college publishing (Springer-Verlag) 2001
3. S. Kumarsaran- Linear Algebra, A Bermetric Approac Prentice- Hall of India 2000
4. Balaguruswamy- Numerical Methods, Tata Mc Graw Hill Publication, New York.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods: **Maximum Marks:** **50** **Continuous Comprehensive Evaluation (CCE):** **10** **University Exam (UE):** **40**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Objective Type Questions	5 x 1 = 5
	Section (B): Five Short Answer Type Questions	5 x 2 = 10
	Section (C): Five Long Answer Type Question	5 x 5 = 25
	Total	**40**
Any remarks/ suggestions: Nil		

Class: B.Sc. Third Year **Marks: 40 + (CCE) 10= 50**
Subject: Mathematics **Code of the Paper:-314- II**
Paper: II

Title of the Paper: Real and Complex Analysis

	Part A : Introduction for Program **B.Sc. Third Year**	
1	**Pre-requisite (if any)**	To study this, course a student must have the subject Mathematicsin B.Sc. Second Year
2	**Course Objectives**	The main aim of this course is to provide students with the knowledge necessary for basic concepts in Real analysis such as Riemann integration and its properties, Improper integrals, Metric space, complex numbers and its continuity and differentiability.
	Course Learning outcomes	After the completion of this course the students would be able to
		CO1: Understand Riemann sums and integral, fundamental theorem of calculus, mean value theorems in integral calculus, Schwartz's ,Young 's implicit function theorems.
		CO2: Understand first and second type of improper integrals and its convergence and divergence, and various integral tests, Fourier series.
		CO3: Understand the notion of metric space and its preliminaries, Cauchy sequence, completeness and Banach contraction principle, Baire category theorem.
		CO4: Discuss the continuity and differentiability of complex functions, Analytic functions, Cauchy-Reimann equations.
		CO5: Power Series Representation of an analytic functions, Taylor's series, laurants series singularities.

Part B: Content of the Course

Total No. of Lectures-60
Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**

Unit	Topics	No. of Lectures
1	Riemann integral, Inerability of continuous and monotonic. The fundamental theorem of integral calculus, Mean value theorems of integral calculus, Partial derivatives and differentiability of real-valued functions of two variables. Schwarz's and Young's theorem, Implicit function theorem.	12
2	Improper integrals and their convergence. Comparison tests. Abel's and Dirichlet's tests. Frullani's integral as a function of a parameter. Continuity derivability and Inemability of an intregral of a function of a parameter. Fourier series of half and full intervals.	12
3	Definition and examples of metric spaces Neighborhoods. Limit points. Interior points. Open and closed sets. Closure and interior. Boundary points Subspace of metric space Cauchy sequences. Completeness. Cantor's intersection theorem. Contraction principle. Real numbers as a complete ordered field. Dense subsets Baire Category theorem. Separable. second countable and first countable spaces.	12
4	Continuous functions. Extension Theorem Uniform continuity. Compactness Sequential Compactness. Totally bounded spaces. Finite intersection property. Continuous functions and compact sets Connectedness.	12
5	Complex Number as ordered pairs. Geometric representation of complex numbers. Continuity and differentiability of complex function. Analytic functions Cauchy-Reimann equations. Harmonic function. Mobius transformation Fixed points Cross ration Inverse Points. Conformal Mappings.	12

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. Mathematical analysis by S.C Malik and Savita Arora. New Age Publication, Delhi.
2. G.F Simmons – Introduction to Topology and Modern Analysis Me Graw Hill New York 1963.
3. L.V Ahlforce , Complex Analysis McGraw Hill, New York.
4. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Recommend Books:

1. Walter Rudin- Real and Complex Analysis, Mc Graw Hill New York,
2. Ponnuswamy- Complex Analysis, Narosa Publication, New Delhi
3. R.V Churchill & J.W Brown Complex Variables and Application. 5th Edition. Mc Graw Hill, New York. 1990

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): 10
University Exam (UE): 40

Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Objective Type Questions	5 x 1 = 5
	Section (B): Five Short Answer Type Questions	5 x 2 = 10
	Section (C): Five Long Answer Type Question	5 x 5 = 25
	Total	**40**
Any remarks/ suggestions: Nil		

Pr. S.K. Sharma

Class: B.Sc. Third Year **Marks: 40 + (CCE) 10= 50**
Subject: Mathematics **Code of the Paper:-314- III**
Paper: III

Title of the Paper: Discrete Mathematics

	Part A : Introduction for Program B.Sc. Third Year	
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in B.Sc. Second Year
2	**Course Objectives**	This course covers the basic concepts of discrete mathematics used in computer science and other disciplines that involve the formal reasoning. The topics include logic, proof, relations, graphs, trees, and Boolean Algebra.
	Course Learning outcomes	After the completion of this course the students would be able to
		CO1: Understand the disjunctive and conjunctive normal form of a Boolean function, equivalence relation and partition of sets.
		CO2 : Understand the posets , lattices and various types of lattices with examples.
		CO3 : Understand the concept of graphs like connected, Euler, etc Hamiltonian path and circuits and algorithms for path.
		CO4 : Understand trees and its type, rank and nullity of a graph.
		CO5 : Understand the matrix representation of a graph, planar graph and its properties.

Part B: Content of the Course

Total No. of Lectures-60
Lectures-Tutorials-Practical (in hours per week): **L-T-P: 4-0-0**

Unit	Topics	No. of Lectures
1	Boolean functions-disjunctive & conjunctive normal forms (canonical & dual canonical), Bool's expansion theorem, Relation-Binary relation, Inverse Relation Composite relation, Equivalence relation, Equivalence classes & its properties Partition of a set.	12
2	Partial order relation, Partially ordered sets, totally ordered sets, Hasse diagram Maximal and Minimal element first and last element. Lattice definition and examples, dual lattice, bounded lattice, distributive lattice, complemented lattice.	12
3	Graph-Definition types of graphs, Subgraphs, Walk, path, circuit, connected and disconnected graphs, Euler graph, Hamiltonian path and circuit, shortest path in weighted graph, Dijkstra's Algorithm for shortest paths.	12
4	Trees and its properties, Rooted tree, Binary tree, Spanning tree, Rank and nullity of a graph, Kruskal's Algorithm and Prim's Algorithm.	12
5	Matrix representation of graphs – Incidence and Adjacency matrix, Cutset and its properties, Planer graphs (definition) Kuratowski's two graphs.	12

Part C: Learning Resources

Text Books, Reference Books and Other Resources
Suggested Reading:

Text Books:

1. C.L Lui- Elements of Discrete Mathematics, Mcgraw Hill New York.
2. Narsing Deo Graph Theory, Prentice Hall.
3. मध्यप्रदेश हिन्दी ग्रंथ अकादमी की पुस्तकें।

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **50**
Continuous Comprehensive Evaluation (CCE): **10**
University Exam (UE): **40**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: University Exam Section:40 Time : 03.00 Hours	Section (A): Objective Type Questions	5 x 1 = 5
	Section (B): Five Short Answer Type Questions	5 x 2 = 10
	Section (C): Five Long Answer Type Question	5 x 5 = 25
	Total	**40**
Any remarks/ suggestions: Nil		

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Mathematics

Syllabus Session 2021-2022

Programme : M.Sc. Mathematics **Class : M.Sc. I Sem.**

S.N.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	Theory Max	Theory Min	Total Max	Total Mini.
1	I	Advanced Abstract Algebra-I	M-11	4	25	9	75	26	100	35
2	II	Real Analysis	M-12	4	25	9	75	26	100	35
3	III	Topology-I	M-13	4	25	9	75	26	100	35
4	IV	Complex Analysis-I	M-14	4	25	9	75	26	100	35
5	V (Optional-I)	Advanced Discrete Mathematics-I	M-15	4	25	9	75	26	100	35
			Total	**20**	**125**		**375**		**500**	

Class: M.Sc. I Semester
Subject: Mathematics
Paper: I

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-11

Advanced Abstract Algebra-I
(Paper- I)

Part A : Introduction for Program M.Sc. Ist Semester		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in B.Sc
2	**Course Objectives**	This course provides students a foundation of advanced study of Algebra. The topics covered normal, subnormal and composition series, extension fields, finite fields and other related concepts, Galois theory and its applications.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1: Understand normal, subnormal and composite series, Jordan - Holder's theorem, solvable and nilpotent groups.
		CO2: Understand algebraic and transcendental extension of fields, Eisenstein criterion of irreducibility and algebraically closed fields.
		CO3: Understand normal and separable extension along with finite field, separable and inseparable extensions.
		CO4: To discuss the fundamental theorems of Galois theory and algebra.
		CO5: To explain the applications of Galois theory, roots of unity polynomial solvable by radicals.

Part B: Content of the Course

Unit	Topics
I	Normal & Sub normal series of groups, Composition series, Jorden-Holder series. Solvable & Nilpotent groups. (1. Chapter 6 Sections 1-3)
II	Algebraic extension of fields, Irreducible polynomials and Eisenstein criterion, Adjunction of roots. Algebraic and Transcendental extension of a field. Algebraically closed fields. (1. Chapter 15 Sections 1-4)
III	Splitting fields, Normal Extensions, Multiple roots, Finite fields, Separable and Insuperable extension. (1. Chapter 16 Section 1-5)
IV	Galois theory, Automorphism group and fixed fields, Fundamental theorem of Galois theory, Fundamental theorem of algebra. (1. Chapter 17 Section 1-3)
V	Application of Galois Theory to classical problems, Roots of unity and cyclotomic polynomials, Cyclic extensions, Polynomials solvable by radicals, Insolubility of general equation of degree 5 by radicals. (1. Chapter 18 Sections 1-3)
	Note: Exercise based on theory are expected to be solved.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. P.B Bhattacharya, S.K Jain and S.R Nagpaul, Basic Abstract Algebra Cambridge University Press.

Reference :

2. I.N Herstein, Topics in Algebra, Wiley Eastern, New Delhi.
3. N. Jacobson, Basic Algebra, Vol. I,II and VIII, Hindustan Publishing Company.
4. Surjeet Singh and Qazi Zameeruddin, Modern Algebra, Eighth Edition, Vikas Publishing House.
5. V. Sahai & V. Bisht, Algebra, Narosa Publishing House.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. I Semester
Subject: Mathematics
Paper: II

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-12

Real Analysis (Paper II)

Part A : Introduction for Program M.Sc. I Semester		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in B.Sc.
2	**Course Objectives**	The aim of this course is to explore the basics of Real Analysis about the real number system, sequences of functions and Riemann integrals.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Understand integrals and its properties, fundamental theorem of calculus.
		CO2 : Know integration of vector valued functions, and Riemann's theorem.
		CO3: Develop the knowledge of sequence and series of functions, Riemann - Stieltjes integration and power series, Different tests.
		CO4 : Know about functions of several variables, linear transformations, Taylor's theorem, inverse function theorem.
		CO5: Explain implicit function theorem, Jacobians, Differential of integral, Stoke's theorem.

Part B: Content of the Course

Unit	Topics
1	Definition and existence of Riemann-Stieltjes integral and its Properties, Integration and differentiation, The fundamental theorem of Calculus.
2	Integration of vector-valued functions, Rectifiable curves. Rearrangements of terms of a series Riemann's theorem.
3	Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-Test Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation, Weierstrass approximation theorem, Power series, uniqueness theorem for power series, Abel's and Tauber's theorems.
4	Functions of several variables, linear transformation, Derivatives in an open subset of R^n, Chain rule, Partial derivatives, Interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem.
5	Implicit function theorem, Jacobians, extremum problem with constraints, Lagrange's multiplier method, Differentiation of integrals, Partition of unity, Differential forms, Stoke's theorem.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. Walter Rudin, Principles of Mathematical Analysis Mc Graw Hill.

Reference:

1. T.M Apostal, Mathematical Analysis Narosa.
2. H.L Rayden, Real Analysis Macmillan (Indian Edition)

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. I Semester
Subject: Mathematics
Paper: III

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-13

Topology- I (Paper III)

Part A : Introduction for Program M.Sc. I Semester		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in B.Sc.
2	**Course Objectives**	To study the countable, uncountable set, cardinality and related theorems, Topological spaces and elementary concepts, continuous functions, countabality, connected spaces.
	Course Learning Outcomes	Students would be able to
		CO1: Understand countable and uncountable sets, cardinality and its arithmetic, including Schroeder – Berstein and Cantor's theorem.
		CO2 : Understand the Basic notions of topological space and its properties, relative topology.
		CO3 : Understand the continuity and homeomorphism in a various topological spaces.
		CO4 : To recognize first and second countable space and related results.
		CO5 : Discuss connected and path connected spaces including component of topological spaces.

Part B: Content of the Course

Unit	Topics
1	Countable and Uncountable sets Infinite sets Axiom of Choice. Cardinal numbers and its arithmetic. Schroeder- Bernstein theorem, Cantor's theorem and their continuum hypothesis. Zorn's lemma. Well-ordering theorem.
2	Definition and examples of topological spaces. Closed sets. Closure dense subset neighborhoods, interior exterior and boundary. Accumulation points and derived sets. Bases and subbases, Subspaces and relative topology.
3	Alternate methods of defining a topology in terms of Kuratowski Closure Operator and Neighbourhood Systems. Continuous functions and homeomorphism.
4	First and Second Countable spaces Lindeiof's theorems. Separable spaces. Second Countablity and Seperability.
5	Path-connectedness, connected spaces. Connectedness on Real line. Components, Locally connected spaces.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

1. J.R Munkers Topology-A-first course Prentice Hall of India.

References:

1. G.F Simmons, Introduction to Topology and Modern Analysis, McGraw Hill.
2. K.D Joshi Introduction to Topology, Willey Eastern.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. First Semester
Subject: Mathematics
Paper: IV

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-14

Paper IV : Complex Analysis-I

	Part A : Introduction for program M.Sc. Ist Semester	
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in B.Sc.
2	**Course Objectives**	The main aim of this course is to introduce and develop a clear understanding of the fundamental concepts of complex analysis such as complex integration and related results, calculus of residues, bilinear transformations.
	Course Learning outcomes	Students would be able to CO1 : Understand various theorems and formulae of Cauchy, Goursat, Poission etc.
		CO2: Discuss the applications of Cauchy's theorem and integral formula, Morera's, Liouville's, Taylor's and Laurent's theorems.
		CO3: Understand the maximum modulus principle, Schwarz's lemma, zeros and singularity of analytic function and related results.
		CO4 : Utilize the Cauchy's residue theorem and its applications.
		CO5: Understand the notion of elementary transformations, conformal Mappings.

(H.Yadav)

Part B: Content of the Course

Unit	Topics
1	Complex integration, Line Integral, Cauchy's fundamental theorem, Cauchy-Goursat theorem, Cauchy integral formula, Poission's integral formula, Higher derivatives. (1. Ch. IV, 2 Ch. III)
2	Morera's theorem Cauchy's inequality Liouville's theorem. The fundamental theorem of algebra, Taylor's theorem, Laurent's theorem. (1. Ch. IV, 2 Ch. III)
3	The maximum modulus principle, Schwartz lemma, Zeros, Singularitites and poles of an analytic function, Meromorphic functions, The argument principle, Rouche's theorem. (1. Ch. V & VI,2 Ch. III & IV)
4	Calculus of residues, Cauchy's residue theorem, Evaluation of integrals with their properties and classifications. (1. Ch. V, 2. Ch. V)
5	Mapping by elementary transformation, Bilinear transformation, Linear group, Critical point, Fixed point, Cross ratio, Normal forms, Definition and examples of conformal mappings. (2. Ch. VI)

(H. Yadav)

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. J.B Convey: Functions of one complex variable, Springer-verlag.
2. B. Singh, V. Karanjgokar & R.S Chandel: Complex Analysis Golden Valley

Reference Book:

3. S. Ponnuswami: Foundation of complex anlysis, Narosha Publishing House.
4. L.V . Ahlforce: Complex Analysis, McGraw Hill.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

(H. Yadav)

Class: M.Sc. First Semester
Subject: Mathematics
Paper: V

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-15

Paper V : Optional-I Advanced Discrete Mathematics-I

Part A : Introduction for program M.Sc. Ist Semester		
1	**Pre-requisite (if any)**	To study this course a student must have the subject Mathematics in B.Sc.
2	**Course Objectives**	The aim of this course is to prepare students to develop mathematical arguments required to learn computer sciences courses. Also the basic concepts of graph theory such as planar graph, Eulerian graph, cycles, trees and matrix representation of graphs are also introduced.
	Course Learning outcomes	Students would be able to
		CO1 : Understand the theory of semigroups, various structures of semigroups, homomorphism of semigroups and direct product.
		CO2 : Understand lattices and its properties, direct product, some special lattices e.g. complimented and distributive etc.
		CO3 : Discuss Boolean algebra, various Boolean forms, Boolean functions and types, applications of Boolean algebra.
		CO4 : Understand the elementary concepts of Graph theory along with planar graph and its properties, trees.
		CO5 : Discuss Euler's formula for connected planar graphs, special trees and its uses, Kruskal's algorithm.

Part B: Content of the Course

Unit	Topics
1	Semigroups & monoids-Definition- semigroups and submonoids (including those pertaining to concatenation operation.) Homomorphism of semogroups and monoids. Congurence relation and Quotient Semigropus. Subsemigropus and submonoids Direct product Basic Homomorphism Theorem.
2	Lattices- Lattices as partially ordered sets. Their properties. Lattices as Algebraic systems. Sublattices. Direct products. homomorphism. Some special Lattice e.g Complete Complemented and Distributive Lattice.
3	Boolean Algebras- Boolean Algebra as Lattices. Various Boolean Identities. The Switching Algebra examples. Subalgebras. Direct Product and Homomorphism. Join-irreducible elements. Atoms and Minterms. Boolean Form and their Equivalence. Minterm Boolean Form, sum of product Canonical Form. Minimization of Boolean Functions. Applications of Boolean Algebra to Switching Theory (using AND, OR a NOT gains.) The kamaugh Map method.
4	Graph Theory- Definition of Graph, Paths, Circuits. Cycle & Subgraphs. Induced Subgraphs. Degree of a vertex Connectivity. Planner graphs and their properties Trees.
5	Euler's Formula for connected planer Grapes complete compkao Bipartie Graphs. Kuruiowsia's Theorem (statement only) and its use. Spanning Trees, Cut-Sets, Fundamental Cut-sets and cycles, Minimal Spanning Trees and Kruskal's Algorithm. Matrix Representation of Groups.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. J.P Tremblay & R. Manobar, Discrete Mathematical Structures, McGraw Hill.
2. N. Deo, Graph Theory with applications, Prentice Hall

References:

1. C.L Liu, Elements of discrete Mathematics McGraw Hill.
2. J.L Gersting Mathematical structures for computer science Press New York.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Mathematics

Syllabus Session 2021-2022

Programme : M.Sc. Mathematics **Class : M.Sc. II Sem.**

S.N.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External assessment Max.	External assessment Min.	Total Max	Total Mini.
1	I	Advanced Abstract Algebra-II	M-21	4	25	9	75	26	100	35
2	II	Lebesgue Measure & Integration	M-22	4	25	9	75	26	100	35
3	III	Topology-II	M-23	4	25	9	75	26	100	35
4	IV	Complex Analysis-II	M-24	4	25	9	75	26	100	35
5	V	Advanced Discrete Mathematics-II	M-25	4	25	9	75	26	100	35
Total					125		375		500	

Class: M.Sc. Second Semester
Subject: Mathematics
Paper: I

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-21

(Paper I): Advanced Abstract Algebra II

Part A: Introduction for program M.Sc. II Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. Ist Semester in Mathematics.
2	**Course Objectives**	To develop skills and to gain knowledge on some of the basic concepts in theory of Modules and linear transformations.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Understand the concept of modules, submodules, direct sums, cyclic and quotient modules, along with homomorphism
		CO2 : Understand completely reducible modules, free modules, linear mapping and its rank.
		CO3 : Discuss noetherian and artinian modules and rings,Hilbert's and Weddeburn's theorem.
		CO4 : Discuss the uniform, primary and finitely generated modules over a PID and applications to finitely generated abelian groups.
		CO5 : Understand the concepts of linear transformation and its algebra, canonical and triangular forms, generalized Jordan form.

Part B: Content of the Course

Unit	Topics
1	Introduction to Modules Examples, Submodules and direct sums, Cyclic module. R-homomorphism's and Quotient modules, Isomorphism. (1. Chapter 14 Sections 1-3)
2	Completely reducible modules Schur's lemma, Free modules, Representation of linear mapping, Rank of linear mapping. (1. Chapter 14 Sections 4-7)
3	Noetherian & Artinian modules and ring, Hilbert basis theorem. Weddeburn- Artin theorem. (1. Chapter 19 Sections 1-3)
4	Uniform modules, Primary modules, Finitely generated modules over a PID, Decomposition theorem, Uniqueness of the decomposition. Application to finitely generated abelian groups. (1. Chapter 19 Sections 4, Chapter 21 Sections 1-3)
5	Linear Transformation, The Algebra of Linear transformation, Characteristic roots. Canonical forms (Triangular form, Nilpotent Transformations, Generalized Jordan form over any field Rational canonical form) (1. Chapter 21 Sections 4,5) (2. Chapter 6 Sections 6.1,6.2,6.5,6.6,6.7)

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
TEXT BOOK:

1. P.B Bhattacharya, S.K Jain and S.R Nagpaul, Basic Abstract Algebra Cambridge University Press.
2. I.N Herstein, Topics in Algebra, Wiley Eastern, New Delhi.

REFERENCE:

3. V. Sahai & V. Bist, Algebra, Narosa Publishing House.
4. N. Jacobson, Basic Algebra I and II, 2nd Ed. W.H Freeman, 1985 and 1989.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **25**
University Exam (UE): **75**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Second Semester
Subject: Mathematics
Paper: II

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:- M-22

(Paper-II): Lebesgue Measure & Integration

	Part A: Introduction for program M.Sc. II Semester	
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. I Semester in Mathematics.
2	**Course Objectives**	The aim of this course is to introduce Lebesgue theory of measure and integration which extends the familiar notions of volume and area under a graph associated with Riemann Integral. It will be demonstrated the Lebesgue integral.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Understand Lebesgue outer measure, Measurable sets, Regular Measurable functions and Non - Measurable sets.
		CO2 : Define integration of Non - negative functions, integration of series, Riemann integrations.
		CO3 : Get an idea of the four derivatives, functions of bounded variation, differentiation and integration.
		CO4 : Know about spaces, convex functions, Jensen's, Holder's and Minkowski's inequality.
		CO5 : Understand about dual spaces, convergence in measure. Uniform convergence and almost uniform convergence.

Part B: Content of the Course

Unit	Topics
1	Lebesgue outer measure. Measurable sets. Regularity Measurable functions. Borel and Lebesgue measurability. Non-measurable sets.
2	Integration of Non-negative functions. The General integral. Integration of series Reimann and Lebesgue integrals.
3	The Four derivatives. Functions of Bounded variation Lebesgue Differentiation Theorem, Differentiation and integration.
4	The L-spaces, convex functions, Jensen's inequality. Holder and Minkowski inequalities. Completeness of L^p
5	Dual of space when $1< p<$ convergence in Measure Uniform. Convergence and almost uniform convergence.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
TEXT BOOKS:

1. G. de Barra Measure theory and integration, Wiley Eastern (Indian Edition)

REFERENCES:

2. Walter Rudin, Principles of Mathematical Analysis McGraw Hill, International student edition.
3. H.L Royden, Real Analysis, Macmillan, Indian Edition.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Second Semester
Subject: Mathematics
Paper: III

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-23

(Paper-III): Topology-II

Part A: Introduction for program M.Sc. II Semester		
1	**Pre-requisite (ifany)**	To study this course a student must have to pass M.Sc. I Semester in Mathematics.
2	**Course Objectives**	To study the separation axioms and various types of compactness, Tychonoff product of different topological spaces, Nets and filters, and elementary homotopy theory.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		CO1 : Understand the separation axioms and inter-relationship, distinguish Urysohn's Lemma and the Tietze extension theorem.
		CO2 : Discuss various compactness like countably compact, sequentially compact, local compact in a metric and topological spaces.
		CO3 : Discuss the arbitrary product of different topological spaces and Tychonoff's theorem
		CO4 : Discuss net and filters and their properties and results.
		CO5 : Understand the homotopy, path homotopy, fundamental group and fundamental theorem of algebra.

Part B: Content of the Course

Unit	Topics
1	Separation axiom T0,T1,T2,T3,T4 : Their characterizations and basis properties. Urysohn's lemma. Tietze extensioin theorem
2	Compactness continuous function and compact sets. Basic properties of compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local compactness and one point compactification. Stone-vech compactification. Compactness in metric spaces. Equivalence of compactness, countable compactness and sequential compactness in metric spaces.
3	Tychonoff product topology in term of standard sub-base and its characterizations. Projection maps. Separation axiom and product spaces. Connectedness and product spaces. Compactness and product spaces (Tychonoff's theorem) Countability and product spaces.
4	Embedding and metrization Embedding lemma and Tychonoff embedding. The urysohn metrization theorem. Net and filters, Topology and convergence of nets Hausdroffness and nets. Compactness and nets. Filters and their convergence. Canonical way converting nets to filters and vice-versa. Ultra filters and compactness.
5	The fundamental group and covering spaces-Homotopy of paths. The fundamental group. Covering spaces. The fundamental group of the circle and the fundamental theorem of algebra.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Book:

1. James R. Munkres, Topology, A First Course, prentice Hall of India Pvt. Ltd. New Delhi.

Reference Book:

1. G.F Simmons, Introduction to topology and modern analysis, McGraw Hill Book Company.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **25**
University Exam (UE): **75**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Second Semester
Subject: Mathematics
Paper: IV

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-24

(Paper-IV): Complex Analysis- II

Part A : Introduction for program M.Sc. II Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. I Semester in Mathematics.
2	**Course Objectives**	The main aim of this course is to enable the students for further deeper topics of complex analysis and it will provide basic topics needed for students to pursue research in pure mathematics.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		CO1 : Understand the space of continuation function and its space, Arzela - Ascoli, Hurwitz's, Montel and Riemann mapping theorems.
		CO2 : Understand the notion of inner product, Gamma function and properties, Riemann zeta function, Runge's, Mittag - Leffler's theorems.
		CO3 : Utilize entire function and its order, Jensen's inequality and formula, Hadamard factorization and three circle theorems, Borel's theorems.
		CO4 : Understand the analytic continuation function its uniqueness and power series method, Schwarz principle etc.
		CO5 : Study the Harmonic function and related theorems as Bloch's , Little Picard, Montei – Caratheodory, Great Picard theorems etc.

(M.Yadav)

Part B: Content of the Course

Unit	Topics
1	Space of continuous analysis functions, Arzela-Ascoli theorem, Space of analytical functions Hurwitz's theorem, Montel theorem Riemann mapping theorem. (1. Ch. VII, 2. Ch. VIII)
2	Infinite product of complex numbers and their absolute convergence. Gamma functions and its properties, Riemann zeta functions and its properties, Relation between Gamma and Riemann zeta function, Riemann functional equations, Rung's thereom. Mittage-leffler's theorem. (1. Ch. VII & VIII, 2. Ch. IX & X)
3	Entire functions, Weirstrass factorization theorem, Jenson's inequality, Jenson's formula, Poisson-Jenson's formula, order of an entire functions, Hadamard factorization thereom. Hadamard three circle thereom. Exponential coverenges, Borel's theorem. (1. Ch. VIII & XI, 2. Ch. XII)
4	Analytical continuation Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytical continuation. Schwartz's reflection principle, Monodromy thereom and its consequences. (1. Ch. IX, 2. Ch. XI)
5	Harmonic functions, Harmonic functions on a disk, Harnack's inwquality and Harnack's theorem Dirichlet problem, Green's function, Bloch's thereom, Little picard theorem, Schottky's thereom, Montel-carastheodory theorem, Great-picard theorem, Univalent functions, Biberbach's conjecture and kobe's ¼ theorem. (1. Ch. X & XII, 2. Ch. XIII, XIV, & XV)

(M. Yadav)

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. J.B Convey: Functions of one complex variable, Springer-verlag.
2. B. Singh V. Karanjgokar & R.S Chandel: Complex Anlaysis Golden Valley.

Reference Books:

1. S. Ponnuswami: Function of complex Analysis, Narosha Publishing House.
2. L.V Ahlfoce: Complex Analysis, McGrew Hill.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **25**
University Exam (UE): **75**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

(H. Yadav)

Class: M.Sc. Second Semester
Subject: Mathematics
Paper: V

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-25

(Paper-V): Advanced Discrete Mathematics-II

Part A : Introduction for program M.Sc. II Semester		
1	**Pre-requisite (ifany)**	To study this course a student must have to pass M.Sc. I Semester in Mathematics.
2	**Course Objectives**	The main object of this course is to introduce students with the fundamental concepts of graph theory and its applications and how the problems can be modelled by graphs and physical systems by finite state machines. Also formal languages are used to model language and to communicate with computers.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		CO1 : Understand the elementary concepts of graph theory and the properties of trees. Dijkrta's and Washell's algorithms.
		CO2 : Understanding finite state machines and its functioning and equivalence, finite automata.
		CO3 : To study the non - deterministic finite automata and its equivalence along with Moore and Mealy machines.
		CO4 : Understand turing machine, grammar and language,derivations.
		CO5 : To utilize the sentential form, context free and sensitive grammar and languages, regular expressions, polish notations.

Part B: Content of the Course

Unit	Topics
1	Directed graphs. Indegree and outdegree of a vertex, weighted undirected graph dijkrta's algorithm, strong connectivity and washell's algorithm directed trees, search trees, tree traversals.
2	Introductory computability theory- Finite State Machines and their Transition Table Diagrams. Equivalence of finite State Machines. Reduced Machine Homomorphism. Finite automata Acceptors.
3	Non-deterministic Finite Automata and equivalence of its power to that of deterministic finite automata. Moore and mealy machines.
4	Turing Machine and partial Recursive functions. Grammar and languages-phrase structure grammers, rewriting rules, derivations.
5	Sentential Form, Language generated by grammar, Regular, Context- Free and context Sensitive grammars and languages. Regular sets. Regular expressions and the pumbhaj lemma Kleen's theorem. Nation of syntax analysis polish notations conversion of infix expressions to polish notations. The reverse Polish notations.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. J.P Tremblay & R. Manobar, Discrete Mathematics Structures, McGraw Hil.
2. N. Deo, Graph theory with applications pretice-Hall

Reference Books:

3. C.L Liu, elements of discrete mathematics McGraw Hill.
4. J.L Gersting Mathematical structures Computer Science Press New York.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:		
Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Mathematics

Syllabus Session 2021-2022

Programme : M.Sc. Mathematics **Class : M.Sc. III Sem.**

S.N.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External assessment Max.	External assessment Min.	Total Max	Total Mini.
1	I	Functional Analysis	M-31	4	25	9	75	26	100	35
2	II	Advanced Special Functions	M-32	4	25	9	75	26	100	35
3	III	Advance Fuzzy Mathematics	M-33	4	25	9	75	26	100	35
	IV	Operation Research-I	M-34	4	25	9	75	26	100	35
4	V	Analytic Number Theory	M-35	4	25	9	75	26	100	35
5	VI	Mathematical Modeling		4	25	9	75	26	100	35
			TOTAL	20	125	---	375	---	500	---

Class: M.Sc. Third Semester
Subject: Mathematics
Paper: I

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-31

(Paper-I): Functional Analysis

Part A : Introduction for program M.Sc. III Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. II Semester in Mathematics.
2	**Course Objectives**	To explore the concepts of normed linear spaces, Banach spaces, quotient spaces, and relevance of operators, dual spaces.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Understand the normed linear space, Banach space and their properties.
		CO2 : Discuss finite dimensional normed linear spaces and its properties along with the Riesz lemma.
		CO3 : Understand the quotient space of a normed linear space, linear operators with properties.
		CO4 : Understand the normed, bounded and continuous linear operators.
		CO5 : Understand the theory of bounded linear functional and dual spaces.

Part B: Content of the Course

Unit	Topics
1	Normed linear spaces, Properties of Normal linear spaces, Branch Space & Example. Convex Sets in Normal linear spaces. [TB-1: Art 3.1,3.2,2.2,2.3 & TB-2: Chapter VI
2	Finite Dimensional normed linear spaces & Subspaces. Basic Properties of finite Dimensional Normed linear spaces. Equivalent norms, Riesz lemma and compactness. [TB-1: Art, 2.4,2.5 & TB-2 Chapter VI]
3	Quotient Spaces of normed linear spaces and its completeness, Linear operators and their elementary properties. [TB-1: Art. 2.6 & TB-2 Chapter VI]
4	Normed Linear operators & bounded Linear operators & continuous operators. [TB-1: Art 2.7,2.10-1,2.10-2& TB-2 Chapter VII]
5	Linear functional bounded Linear functional, Dual spaces with examples. [TB-1: Art. 2.8,2.10-3 to 10-7 & TB- 2 Chapter VIII up to Art.3]

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. E, Kreyszig, Introductory Functional with application, john Wiley & Sons New York
2. B.K Lahiri, The World Press Private Limited Calcutta (W.B)

Referance Books:

1. B. Choudhary and Sundarshan Nanda Functional Analysis with applications, Wiley Eastern ltd.
2. G.F Simmons, Introduction to Topology & Modern Analysis Mc Graw Hill, New York

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **25**
University Exam (UE): **75**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Third Semester
Subject: Mathematics
Paper: II

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-32

(Paper- II): Group: Advanced Special Functions

Part A : Introduction for program M.Sc. III Semester		
1	**Pre-requisite (ifany)**	To study this course a student must have to pass M.Sc. II Semester in Mathematics.
2	**Course Objectives**	This course is designed not only for professionals, mathematicians, Physicists,engineers and chemists, but also for well trained graduate students, even research workers in special functions may notice, however, some results or techniques which he / she is not already familiar with.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Understand Euler constant, the Euler product, Weierstrass definition Gamma function, the beta function, the fractional function, Legendre and Gauss multiplication formula.
		CO2 : Get knowledge of hypergeometric function, integral representation of hypergeometric function, the continuous function relations etc.
		CO3 : Understand generalized hypergeometric functions, the exponential and binomial
		CO4 : Get an idea of Bessel function, index half an odd integer, Bessel's d Taylor's differential equation.
		CO5 : Get knowledge of the confluent hypergeometric function, Kummer's formulae, orthogonal polynomials, expansion of polynomials.

Part B: Content of the Course

Unit	Topics
1	The Gamma & Beta Functions: The Euler of Mascheroni constant γ, the Gamma function, A Series for $\Gamma'(z)/\Gamma(z)$ The Euler Product for Γz the difference equation Euler integral for Γz Beta function The value $\Gamma(z)\Gamma(1-z)$, Factorial Functions. Legendre's duplication formula, Gauss multiplication theorem.
2	The Hyper geometric functions: A simple integral evaluation of F (a,b,c,1). The Contiguous function relation. The hyper geometric differential equation. Elementary series manipulations. Simple Transformation. Relation between function Z and 1-z Art 30-34, Art 37-39.
3	Generalized Hyper geometric Functions: The functions pFq A Simple integral. Saalchiitz Theorem, Whipple's Theorem, Dixon's theorem. Art 44-46, Art 49-53.
4	Bassel functions: Definition of $J_n(Z)$ Bassel's differential equation, Differential recurrence relations. A pure recurrence relation. A Generating functions, Bassel's integral index half an odd integer. Art 57-64
5	The Confluent Hyper geometric function and orthogonal polynominals. Basic property of ${}_1F_1$. Kummer's first formula. Kummer's second formula orthogonal polynominals: simple sets of polynominals, orthogonality, An equivalent condition for orthogonality, Zeros of orthogonality, Zero's of orthogonal polynominals, Expansion of polynominals. The Three-term recurrence relation Art 68-70, Art 78-83.

Part C: Learning Resources

Text Books, Reference BooksSuggested Readings:

Text Books:

1. Rainville E.D; Special function, The Macmillan Co. New York 1971.

Referance Books:

1. Shrivastava, H.M Gupta, K.C & Goyal, S.P the H-Functions of one and two variables with applications, soth Asian publication, New Delhi.
2. Saran, N. Sharma S.D and Trivedi, Special functions with application, pragati prakashan 1986.
3. Lebdev, N.N Special functions and their Applications, prentice Hall, Englewood cliffs, New Jersey, USA 1995

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Third Semester
Subject: Mathematics
Paper: III

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -M-33

Advanced Fuzzy Mathematics

Part A: Introduction for program M.Sc. III Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. II Semester inMathematics.
2	**Course Objectives**	After the completion of the course, the students will be able to learn About various terminologies important in fuzzy mathematical Programming, Fuzzy Decision and Fuzzy Operators in Fuzzy Mathematical Programming
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Define a Fuzzy set membership function, representation of member function, support, height equality of two Fuzzy sets.
		CO2 : Get an idea of union and intersection of two Fuzzy sets, compliment of Fuzzy sets, Normal Fuzzy sets, Fuzzy cardinality.
		CO3 : Understand important operation in Fuzzy product of two Fuzzy sets, Power of Fuzzy sets, difference of two Fuzzy sets.
		CO4 : Development an understanding general properties of operations and Fuzzy sets, Important theorem in Fuzzy sets.
		CO5 : Know about comparison of α - cut and strong α - cut of compliment of Fuzzy sets.

(V Ravi)

Part B: Content of the Course

Unit	Topics
1	Fuzzy Versus Crips Number system Interval sets, Representation of a set type of sets, subsets, Universal sets, Operation on sets, some important results on Venn diagrams fuzzy sets fuzzy set definition different types of Fuzzy sets general Definition and properties of Fuzzy sets.
2	Other important operations general properties: Fuzzy Vs crips some important theorem extension principal for Fuzzy compliments further operations on Fuzzy sets.
3	t-norms and t-conorms Defination of Intersection and Union by Hamacher's Yager's Union and intersection of two Fuzzy sets as defined by Hamacher's yager's Union and Intersection of two Fuzzy sets as defined by defined by Dubois and Prade Aggregation Operations Extension Principles for Fuzzy sets Summary.
4	Extension principle for fuzzy sets- The zadeh's extension principle.
5	Fuzzy Numbers Algebraic Operations with Fuzzy Numbers Binary Operations with Fuzzy numbers Binary Operations of Two Fuzzy Numbers some special extended operations extended operations for L-R Representation of Fuzzy sets Fuzzy arithmetic operations on Fuzzy numbers in the form of α – Cut Sets.

(V Ravi)

Part C: Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. Fuzzy Set Theory and its Application by H.J Zimmermann Allied publication ltd. New Delhi 1991
2. Fuzzy sets and fuzzy logic by G.J Klir and B. Yuan Prentice-Hall of India, New Delhi, 1995

Referance Books:

1. Fuzzy Sets and uncertainty and Information by G.J Kalia tina A. Foljer Prentice Hall of India.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **25**
University Exam (UE): **75**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

(V Reddy)

Class: M.Sc. Third Semester
Subject: Mathematics
Paper: IV

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -M-34

(Paper- IV): Operation Research-I

Part A: Introduction for program M.Sc. III Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. II Semester in Mathematics.
2	**Course Objectives**	To understand mathematical techniques to optimize cost and time for market and society.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : To understand operations research origin development and characteristics.
		CO2 : Various models of operations research. Linear programming, mathematical formulations.
		CO3 : Methods for linear programming.
		CO4 : To solve by simplex method. Big M, two phase method.
		CO5 : To understand Duality and its characteristics.

Part B: Content of the Course

Unit	Topics
1	Operations research and its scope, Origin and development of operations research characteristics of operation research.
2	Model in operation Research, Phase of operation research, Uses and limitations of operation Research, Linear Programming problems Mathematical Formulation Graphical solution method.
3	Mathematical Formulation Graphical solution method.
4	General Linear programming problem: Simplex method exceptional cases, artificial variable techniques: Big M Method, two phase Method and Cyclic Problems, problem of degeneracy.
5	Duality Fundamental Properties of duality and theorem of duality.

Part C: Learning Resources

Text Books, Reference BooksSuggested Readings:

Text book:

1. Kanti Swarup P.K Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi.

Referance Books:

1. S.D Sharma Operation Research
2. F.S Hiller and G.J Lieberman Industrial Engineering Series, 1995 (This book comes with CD containg software.
3. G. Hadley Linear Programming, Narosa Publishing House 1995.
4. G. Hadley's Linear and Dynamic programming Addison-Wesley Reading Mass.
5. H.A Taha, Operations Research- An introducing, Macmillan publishing Co. Inc New York
6. Prem Kumar Gupta and D.S Hira, Operation Research, an Introduction S. Chand & Company Ltd. New Delhi
7. N.S Kambo, Mathematical Programming Techniques, Affiliated East-West Pvt. Ltd.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time: 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Class: M.Sc. Third Semester
Subject: Mathematics
Paper: V

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -M-35

(Paper-V): Analytic Number Theory

Part A: Introduction for program M.Sc. III Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. II Semester in Mathematics.
2	**Course Objectives**	Analytic Number theory is a branch of number theory which uses to investigate various properties of positive Integers. The course enable the students to acquire the knowledge of basic concepts of arithmetical functions. Dirichlet multiplication and average of arithmetical functions. Also to get the knowledge about Dirichlet characters, Dirichlet theorem on primes in a given arithmetic progression. To understand the concept of Dirichlet series and its absolute convergence. After completion of this course students will about able to understand
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Several arithmetic functions, their multiplication which are used throughout the syllabus. Also some important results on average of arithmetical functions.
		CO2 : Characters of a group, group of characters and the orthogonality relation for characters.
		CO3 : Dirichlet characters, sums involving Dirichlet's characters, non - vanishing Dirichlet L - function.
		CO4 : Dirichlet theorem on primes in arithmetic progression.
		CO5 : Dirichlet series and its absolute convergence, multiplication of two Dirichlet series and Euler products.

Part B: Content of the Course

Unit	Topics
1	Arithmetical Functions and Dirichlet Multiplications Introduction, Definition of the Mobius function μ(n), Euler totient function ø(n). A relation connecting μ and ø. The product formal for ø (n). the Dirichlet product of arithmetical functions. Dirchlet inverse and Mobines inversion formula. The Mangoldt function. Multiplicative function multiplicative function and Dirchlet Multiplication. The big 'oh' Notation Euler's summation formula, some elementary asaympotic formulas.
2	Able's identity for arithmetic functions. Finite abelian groups & their characters: - Construction of subgroups. The character group. The orthogonality relations for characters. Theorem 4.2, Chap6-6.4-6.7
3	Dirichlet characters. Sums involving Dirchlet characters, The non-vanishing og L (1, χ) for real non principle χ. Dirchlet theorem on primes, primes of form 4n-1 and 4n+1. Art 6.8-6.10, Chap 7 art 7.1,7.2
4	The plan of the proff of Dirchlet theorem of primes, Distribution of primes in arithmetic progression Art- 7.3- 7.9
5	Dirchlet Series and Euler Products:- Definition and different types of Dirichlet series the half-plane of absolute convergence of a Dirchlet series. The function defined by a Dirchlet series, Uniqueness theorem, multiplication of Dirichlet series, Euler product Chap 11 art 11.1 -11.5

Part C: Learning Resources

Text Books, Reference Books Suggested Readings:

Text Books:

1. T.M Apostol, Introduction to Analytical Number Theory, Narosa Publication House 1989.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:		
Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Class: M.Sc. Third Semester
Subject: Mathematics
Paper: VI

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -M-35

(Paper VI): Interdisciplinary Theory Paper
Mathematical Modeling

Part A: Introduction for program M.Sc. III Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. II Semester in Mathematics.
2	**Course Objectives**	This course is an introduction to mathematical modeling based on elementary functions to describe and explore real world phenomena in data. This course contain Mathematical Modeling and its techniques, classification and characteristics first order differential equations, growth and decay population growth. ODE mathematical model in medicine. PDE model for stochastic epidemic process and general communication network map coloring problem.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Understand Mathematical Modeling and its techniques, classification and characteristics.
		CO2 : Define first order differential equations, growth and decay population growth.
		CO3 : Explain ODE mathematical model in medicine.
		CO4 : Apply non linear differential equation models for population growth, PDE model for stochastic epidemic process with no removal model for traffic on highway.
		CO5 : Understand general communication network map coloring problem.

Part B: Content of the Course

Unit	Topics
1	Simple situation requiring mathematical modelling. Techniques classification and characteristics of mathematical models. Limitations of mathematics modeling.
2	Setting up first order differential equations, qualitative solutions, stabile wweity of solutions, growth and decay population models, exponential and logistic population models.
3	Compartment models through system of ODE. Mathematics models in medicine, arms race, battels and international trade in terms of system of ODE.
4	Non-linear difference equation models for population growth probability generating function, fourth method of obtaining partial differential equation models. PDE model for a stochastic epidemic process with no removal. Model for traffic on a highway.
5	General Communication networks general weighted digraphs, map-coloring problems.

Part C: Learning Resources

Text Books, Reference Books
Suggested Readings:

Reference Books:

1. Kapoor JN: Mathematics models in biology and medicine EWP (1985)
2. Martin Brann C.S Coleman, DA Drew (Eds) differential equation models.
3. C.L Liu, Elements of discrete mathematics.
4. A.M Law and W.D Ketton, Simulation modeling and analysis McGraw Hill Int. Ed (Second Edition) 1991.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Govt. Holkar (Model, Autonomous) Science College, Indore										
Department of Mathematics										
Syllabus Session 2021-2022										
Programme : M.Sc. Mathematics								Class: M.Sc. IV Sem.		
S.N.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Min.)	External assessment Max.	External assessment Min.	Total Max	Total Mini.
1	I	Functional Analysis II	M-41	4	25	9	75	26	100	35
2	II	Advance Special Functions II	M-42	4	25	9	75	26	100	35
3	III	Advance Fuzzy Mathematics II	M-43	4	25	9	75	26	100	35
	IV	Operation Research II	M-44	4	25	9	75	26	100	35
		Theory of Linear Operators II								
4	V	Analytic Number Theory II	M-45	4	25	9	75	26	100	35
			Total	20	125		325		500	

Class: M.Sc. Fourth Semester
Subject: Mathematics
Paper: I

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-41

(Paper-I): Functional Analysis II

Part A: Introduction for program M.Sc. IV Semester		
1	Pre-requisite (if any)	To study this course a student must have to pass M.Sc. III Semester in Mathematics.
2	Course Objectives	The aim of this course is to develop a deeper and rigorous understanding of functional analysis, their properties.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Understand uniform boundedness theorem, open mapping theorem and its applications, closed graph theorem.
		CO2 : Utilize Hahn - Banach theorem for real and complex normed linear spaces.
		CO3 : Discuss reflexive and Hilbert spaces with properties, orthonormal sets, Parsval's and Bessel's inequality.
		CO4 : Discuss the projection mapping, projection and Riesz representation theorems.
		CO5 : Explain the adjoint of operator and reflexivity in Hilbert space, and variety of operators.

Part B: Content of the Course

Unit	Topics
1	Uniform roundedness theorem and some of its consequences. Weak and strong convergence. Open mapping theorem, closed graph theorem. [TB-1: Art. 4.7,4.8,4.12,4.13 & TB-2 Chapter VIII & X]
2	Hahn-Banach theorem for real linear space, Hahn-Banach theorem for complex linear space and Normal linear space. [TB-1: Art 4.2,4.3 & TB-2: Chapter VIII]
3	Reflexive Space, Inner product space and Hilbert space and their properties, Orthonormal sets, Bessel's Inequality, Orthonormal sets and Parseval's Identity. [TB-1 Art. 3.3,3.4,3.5-2,3.5-3,3.6 & TB-2: Chapter IX & Chapter XVII Art.3]
4	Projection Mapping, Projection theorem, Riesz representation theorem. [TB-1: Art 3.3-3 to 3.3-7,3.8 & TB-2: Chapter IX]
5	Adjoint of an operator on Hilbert space, reflexivity of Hilbert space, Self-adjoint operators, Positive operators Projection normal and unitary operators. [TB-1: Art 3.9,3.10,4.6-6 & tb-2: Chapter X]

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

Text Books:

1. E. Kreyszing: Introductory Functional Analysis with applications, John Wiley & Sons, New York.
2. B.K Lahiri, The world press Private Limited Calcutta (W.B)

Reference Books:

1. B. Choudhary and Sudarshan Nanda. Functional Analysis with application, Wiley Eastern Ltd.
2. G.F Simmons, Introduction to topology & Modern Analysis Mc Graw Hill, New York.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **25**
University Exam (UE): **75**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Fourth Semester
Subject: Mathematics
Paper: II

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the Paper:-M-42

(Paper II): Advanced Special Functions II

Part A : Introduction for program M.Sc. IV Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. III Semester in Mathematics.
2	**Course Objectives**	This course is designed not only for professionals, mathematicians, Physicists, engineers and chemists, but also for well-trained graduate Students. Many of the standard concepts and methods which are Useful in the detailed study of special functions are included.
	Course Learning outcomes	On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.
		CO1 : Get an idea of the generating function concept, another class of generating functions, properties of many polynomial sets.
		CO2 : Understand Legender's polynomials, Bateman's generating functions, hypergeometric form of Legender's polynomials, special properties of Legender's polynomials.
		CO3 : Get knowledge of Hermite polynomials, expansion of polynomials, more generating functions, recurrence relations.
		CO4 : Understand Laguree polynomials, generating functions, recurrence Relations, expansion of polynomials, special properties of Legurce polynomials.
		CO5 : Get an idea of Jacobi polynomials, Bateman's generating function, The Rodrigues formula, orthogonality, mixed relations.

Part B: Content of the Course

Unit	Topics
1	Generating Functions: The generating function concept. Generating functions of the form $G(2xt-t^2)$ Sets generated by e^{xt} (xt). The generating functions A (T) exp [-xt/(1-t another class of generating functions Art 71-75.
2	Legendre Polynomials: Generating function for Legendre polynomials, differential recurrence relation, pure recurrence relation. Rodrigues formula, Legendre Differential equation, Bateman's generating function. Hyper geometric forms of Pn(x) Laplace first integral form, orthogonality Art 86-93, Art 97-99.
3	Hermite polynomials: Definition of Hermite polynomials $H_n(x)$, recurrence relation, Hermite differential equation, Rodrigues formula, orthogonality, Expansion of polynomials more generating functions. Art 103-111.
4	Laguerre Polynomials: The Laguerre polynomials $L_n(x)$, Generating Functions, Pure recurrence relations, Differential recurrence relation, Rodrigues formulas, orthogonality, expansion of polynomials special property. Art 112-119,121.
5	Jacobi Polynomial: Jacobi Polynomial, other forms of Jacobi Polynomials, Batemans generating function Rodrigues formula. Orthogonality. Art 132-135.

Part C : Learning Resources

Text Books, Reference BooksSuggested Readings:

Text Books:

1. Rainville, E.D Special Functions, The Macmillan Co. New York 1971.

Reference Books:

1. Shrivastava, H.M Gupta, K.C and Goyal, S.P. The H-Functions of one and two variables with application south asia publication New Delhi.
2. Saran N. Sharma S.D and Trivedi Special functions with application , Pragati Prakashan 1986.
3. Labder N.N Special functions and Their Applications, Prentice Hall, Englewood Cliffs, New Jarsey. USA 1995.
4. Whittaker, E.T and Watson G.N Acourse of modern Analysis Cmabridge University Press, London 1963.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Fourth Semester
Subject: Mathematics
Paper: III

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -M-43

(Paper III): Advance Fuzzy Mathematics II

Part A: Introduction for program M.Sc. IV Semester		
1	**Pre-requisite (ifany)**	To study this course a student must have to pass M.Sc. III Semester in Mathematics.
2	**Course Objectives**	After the completion of the course, the students will be able to learn About Linear Programming with Fuzzy Resources and objective with Fuzzy parameters in the objective function & Imprecise Coefficients.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge andUnderstanding of the subject.**
		CO1 : Define convex Fuzzy sets, types of Fuzzy sets. Further operation on Fuzzy sets, Cartesian product, Algebraic product.
		CO2 : Understand extension principle and application image, inverse image of Fuzzy sets, product and division of Fuzzy numbers.
		CO3 : Apply Fuzzy relation on Fuzzy sets. The union and intersection of Fuzzy sets.
		CO4 : Understand about Fuzzy graph, Fuzzy subgraph, path of Fuzzy Graph, Fuzzy function on Fuzzy sets, Fuzzy function.
		CO5 : Develop knowledge of Fuzzy logic, its connective. Tautologies Contradiction. Logical connective for Fuzzy logic. Linguistic hedges Fuzzy quantifiers.

Part B: Content of the Course

Unit	Topics
1	Fuzzy Relation and Fuzzy Graphs-Fuzzy relation of Fuzzy set, composition of Fuzzy Relation Min-Max composition and it's properties, Fuzzy equivalence relation, Fuzzy compatibility relation equation Fuzzy Graphs, similarity relation.
2	Possibility Theory Fuzzy Measure Evidence theory, necessity measure, Possibility measure possibility distributions Possibility theory and Fuzzy sets possibility theory verses probability theory.
3	Fuzzy Logic- An overview of classical Logic Multivalued logic Fuzzy proposition Fuzzy quantifiers linguistic. Variables and hedges, Inference from conditional Fuzzy Proposition, the compositional rule of inference.
4	Fuzzy System: Introduction, Fuzzy rule based system, De russification, Examples on fuzzy systems.
5	Fuzzy Control: Assumption in Fuzzy Control. System Design Fuzzy Control Models, Fuzzy Neural Networks Fuzzy Automata.

(V Rect)

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:
Text Books:

1. Fuzzy Set Theory and its Application by H.J Zimmermann, Allied Publication ltd. New Delhi 1991.
2. Fuzzy Sets and Fuzzy Logic by G.J Klir and B. Yuan Prentice-Hall of India New Dehi 1995.

Reference Books:

1. Fuzzy Sets and uncertainly and Information by G.J Kalia tina A. Foljer-Prentice-Hall of India.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Fourth Semester
Subject: Mathematics
Paper: IV

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -M-44

(Paper IV): Operation Research II

Part A: Introduction for program M.Sc. IV Semester		
1	**Pre-requisite (ifany)**	To study this course a student must have to pass M.Sc. III Semester in Mathematics.
2	**Course Objectives**	To understand mathematical models for market to optimize cost and time.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		CO1 : Solve replacement problems Money value present worth fractional Discount ratio.
		CO2 : Solve assignment problem mathematical formulation.
		CO3 : Understand and solve transformations problems Northwest corner method Least cost method.
		CO4 : To learn network analysis construction of network technique and advances of the network.
		CO5 : To develop an idea for Game Theory Solution by Linear programming Non Linear programming technique.

Part B: Content of the Course

Unit	Topics
1	Transportation problems: North-West Corner Method Least-Cost Method. Vogel's Approximation Method, MODI Method,
2	Exceptional cased and problem of degeneracy, Assignment Problems.
3	Network analysis constraints in network, Construction of networks, Critical Path Method (CPM) PERT, PERT Calculation, Resource Leveling by Network Techniques and advances of network (PERT/CPM) Simulation: Monte –Carlo Simulation,
4	Simulation of Networks, Advantage and Limitation of Simulation.
5	Game Theory Two Persons, Zero Sum Games Maximax Minimax principle games without saddle points- Mixed strategies Graphical solution of 2xm and mx2 games, Solution by Linear Programming Non-Linear programming Techniques Kuhn Tucker Conditions Non-negative Constrains.

Part C : Learning Resources

Text Books, Reference BooksSuggested Readings:

Text Books:

1. Kanti Swarup P.K Gupta and Manmohan Operations Research, Sultan Chand & Sons, New Delhi.

Reference Books:

1. S.D Sharma, Operation Research,
2. F.S Hiller and G.J Lieberman Industrial Engineering Series 1995.
3. G. Hadley, Linear Programming Narosa Publishing House 1995.
4. G. Hadley's Linear and dynamic programing Addison-Wesley Reading Mass.
5. H.A Taha Operations Research- An introduction, Macmillan publishing co. Inc. New York.
6. Prem Kumar Gupta and D.S Hira, Operations Research, an Introduction S. Chand & Company Ltd. New Delhi.
7. N.S Kambo Mathematical Programming Techniques Affiliated East-West Pvt. Ltd. New Delhi Madras.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Fourth Semester
Subject: Mathematics
Paper: V

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -M- 44

(Paper-IV): Theory of Linear Operators-II

Part A: Introduction for program M.Sc. IV Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. III Semester in Mathematics.
2	**Course Objectives**	To Understand theory of bounded self adjoint, operators Hillbert adjoint operators, multiplication and differential operators.
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		CO1 : Define bounded self adjoint linear operators.
		CO2 : Define projection on operators.
		CO3 : Understand extension of spectral theorem to continuous function.
		CO4 : Define Hilbert adjoint operators.
		CO5 : Understand Multiplication and differential operators.

Part B: Content of the Course

Unit	Topics
1	Bounded self-adjoined linear operators and their spectral properties. Positive operators and their square roots. (Art. No. 9.1-9.4 from 1)
2	Projection operators and their properties. Spectral family bounded self-adjoint operators and their spectral family. (Art No. 9.5-9.8 from 1)
3	Spectral representation of bounded self-adjoint linear operators. Extension of spectral theorem to continuous functions. Properties of the spectral family of a bounded self-adjoined linear operator (Art No. 9.9-9.11 from1)
4	Unbounded linear operators and their Hilbert adjoint operators. Hilbert adjoint operators, symmetric and self-adjoint linear operators. Closed linear operators and closures. (Art No. 10.1-10.3 from1)
5	Spectral properties of self-adjoint linear operators. Spectral representation of unitary operators. Spectral representation of self-adjoint linear operators. Multiplication & differentiation operators. (Art. No. 10.4-10.7 from1)

Part C : Learning Resources

Text Books, Reference BooksSuggested Readings:

Text Books:

1. E. Kreyszing: Introductory Function Analysis with applications, John-Wiley & Sons, New York 1978.

Reference Book:

2. B.K Lahiri: Elements of Functional analysis, The word press Pvt. Ltd. Calcutta, 1998.
3. B. Choudhary and S. Nanda: Functional analysis with applications, Wilsey Eastern Ltd.
4. N. Dunford & J.T Schwartz: Linear operators- 3 part, Interscience Wiley, New York, 1958-71.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:		**100**
Continuous Comprehensive Evaluation (CCE):		**25**
University Exam (UE):		**75**
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	15 x 5 = 75
	Total	**100**
	Credits	**04**

Class: M.Sc. Fourth Semester
Subject: Mathematics
Paper: VI

Marks: 75 + (CCE) 25 = 100
Credit: 4
Code of the Paper: -M-45

(Paper V): Analytic Number Theory- II

Part A: Introduction for program M.Sc. IV Semester		
1	**Pre-requisite (if any)**	To study this course a student must have to pass M.Sc. III Semester in Mathematics.
2	**Course Objectives**	The course enable the students to acquire the knowledge of Dirichlet – series which play an important role in analytic number theory. The course studies most usually Riemann Zeta function, Dirichlet series. Bernoulli numbers. Upon completion this course students would be able to understand
	Course Learning outcomes	**On completion of the course, the student will be profound in complete Knowledge and Understanding of the subject.**
		CO1 : The convergence of Dirichlet - series and its analytic properties.
		CO2 : The mean value formula, an integral formula for the coefficient of Dirichlet - series. Also the basic concepts of Hurwitz zeta function.
		CO3 : Riemann Zeta function and Dirichlet L - functions. Hurwitz zeta Functions and its integral representation.
		CO4 : Analytic continuation of Hurwitz zeta functions, Reimann zeta function and Dirichlet L - functions. Hurwitz's formula and the fundamental equations.
		CO5 : Bernoulli polynomials and Bernoulli numbers and their properties.

Part B: Content of the Course

Unit	Topics
1	The half-plane of convergence of a Dirichlet series. Analytical properties of Dirichlet series. Dirichlet series expressed as exponential of Dirichlet series.
2	The mean value formula for Dirchlet series. An integral formula for the coefficient of a Dirchlet series. An integral formula for the partial sums of a Drichlet series. Perron's formula Art 11.10-11.12
3	An Introduction of the Riemann zeta function and Dirichlet L-function. Gamma function and its properties. Hurwitz zeta function and integral representation Hurwitz zeta functions chapter 12 Art 12.-12.4
4	The Analytic Continuation of Hurwitz zeta function. The analytic continuation of Riemann zeta function and Dirichlet L-function. The Hurwitz's formula. The functional equation for the Riemann zeta function and Hurwitz's zeta functions Art 12.5-12.9.
5	Evaluation of ξ (-n.a). Properties of Bernoulli numbers and Bernoulli polynomials. Differential equation satisfied by Bernoulli polynomials. Recursion formula for computing Bernoulli numbers. Formula for L (O,x). Art 12.11-12.13

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

Text Books:

1. T.M Apostol Introduction to Analytic Numbers Theory, Narosa Publication House,1989.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: **100**
Continuous Comprehensive Evaluation (CCE): **25**
University Exam (UE): **75**

Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Class Test	10
	Assignment/ Presentation	15
	Total	**25**
External Assessment: University Exam Section:75 Time : 03.00 Hours	Five Long Questions	**15 x 5 = 75**
	Total	**100**
	Credits	**04**

Prof. B.N. Nandeeshwar

Semester-I

B.C.A.

Academic Year: 2021-2022

BCA PART I Semester **Academic Year: 2021-2022**

Course of studies for the BCA – I Semester

BCA – I Sem Course

SCHEME OF MARKS

Course	Theory Max. Marks		Practical Max. Marks	Max. Marks	Min. Marks
	Internal	External			
BCA-101 Mathematics – I	15	85	--	100	5 + 28
BCA-102 Statistics – I	15	85	--	100	5 + 28
BCA-103 Programming & Problem solving through C – I	15	85	--	100	5 + 28
BCA-104 PC Software	15	85	--	100	5 + 28
BCA-105 Digital Computer Organization	15	85	--	100	5 + 28
BCA-106 English	10	40	--	50	3 + 14
BCA-107 Programming & Problem solving through C – I Practical	--	---	50	50	17
BCA-108 PC Software Practical	--	--	50	50	17
Total Marks	85	465	100	650	--

Class: B.C.A. I Sem
Subject: Mathematics
Paper: I

Marks: 15 +85 =100
Code of the Paper:- 151

Title of the Paper: Mathematics-I

Part A : Introduction for Program B.CA. First Sem		
1	**Pre-requisite (if any)**	To study this, course a student have mathematics subject in 12th Class.
2	**Course Objectives**	The aim of this course is to understand the concept of basic mathematical methods of matrices, complex numbers and differential calculus. To apply methods to solve engineering problems. To analyze engineering problems and evaluate.
	Course Learning outcomes	After the completion of this course the students would be able to
		CO1 : The concept of function of one variable and limits, fundamental properties of limits.
		CO2 : Successive differentiation, Rolle's mean value and Taylor's theorems.
		CO3 : About Normal, curvature, asymptotes, and integration of hyperbolic function.
		CO4 : About vector function and its applications, partial derivatives.
		CO5 : The basic concepts and the fundamental principles of the transformations of matrices which is useful to find rank of matrices.

Part B: Content of the Course

Unit	Topics
1	Review of concepts of function of one variable: define a function. Types of function: Limits: define working rule for finding out the limit, fundamental property of limit, problems based on limits: Continuity: define point of discontinuity, classification of discontinuity, problems based on continuity & discontinuity Differentiability: condition for derivability and problems.
2	Successive differentiation, Rolles theorem, Mean value theorem, Taylor's theorem, Taylor's & Maclaurin's series, Intermediate forms.
3	Tangents, Normals, Curvature, asymptotes, integration of hyperbolic function and reduction formula
4	Differentiation of vector function, gradient, directional derivatives, divergence and curl, vector function of several scalar variables and their partial derivative, level surface gradient in Cartesian and polar coordinates, divergences of vector and curl of a vector.
5	Matrix – definition, types of matrix, special matrix elementary transformation of matrix, inverse of matrix – adjoint methods and Gaussian elimination, normal from of matrix, rank of matrix, nullity of matrix (their applications) consistency and solution of linear simultaneous equations.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

TEXT BOOK:
A text book of calculus by Dr. H.K.Pathak, & D.C. Agrawal 2010

REFERENCE BOOKS :
1. A text book of calculus by Dr. H.S.Sharma, Ratan Prakashan
2. Vector Calculus & Geometric by Dr. H.K.Pathak, & D.C. Agrawal
3. Discrete Mathematics by Dr. H.K.Pathak, & D.C. Agrawal – (shikha sahitya prakashan

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100**
Continuous Comprehensive Evaluation (CCE):	**15**
University Exam (UE):	**85**

Pr. N. Patel

Semester-II

B.C.A.

Academic Year: 2021-2022

BCA PART II Semester **Academic Year: 2021-2022**

Course of studies for the BCA – II Semester

BCA – II Semester Course

SCHEME OF MARKS

Course	Theory Max. Marks		Practical Max. Marks	Max. Marks	Min. Marks
	Internal	External			
BCA-201 Mathematics – II	15	85	--	100	5 + 28
BCA-202 Statistics – II	15	85	--	100	5 + 28
BCA-203 Programming & Problem solving through C – II	15	85	--	100	5 + 28
BCA-204 Introduction to Information System	15	85	--	100	5 + 28
BCA-205 Operating System Fundamentals	15	85	--	100	5 + 28
BCA-206 Hindi	10	40	--	50	3 + 14
BCA-207 Programming & Problem solving through C – II Practical	--	---	50	50	17
BCA-208 PC Internet Practical	--	--	50	50	17
Total Marks	85	465	100	650	--

Class: B.C.A. II Sem
Subject: Mathematics
Paper: I

Marks: 15 +85 =100
Code of the Paper:- 251

Title of the Paper: Mathematics-I

Part A: Introduction for Program B.CA. First Sem		
1	**Pre-requisite (if any)**	To study this, course a student have mathematics subject in 12th Class.
2	**Course Objectives**	The objective of this course is to help students to gain knowledge about advanced calculus. Students learn Students would be able to understand
	Course Learning outcomes	After the completion of this course the students would be able to
		CO1 : To trace curves (Cartesian and polar form) and test convergence of improper integrals.
		CO2 : About gamma and beta functions.
		CO3 : To evaluate multiple integrals in finding areas and volumes. Also they learn vector integration and their applications.
		CO4 : To find limit, continuity, and differentiability of functions of several Variables. Also they learn partial derivatives and mean value theorems.
		CO5 : To find maxima and minima of functions of two and three variables. Also, they learn tests to find convergence and divergence of series.

Part B: Content of the Course

Unit	Topics
1	Curve tracing : Tracing curves with equations in Cartesian & polar forms. Improper integrals : Convergence of improper integrals. Evaluation of convergent improper integrals.
2	Gamma and Beta function and their properties, some important deductions (duplication formula) Rectification L length curve, intrinsic equation.
3	Multiple integrals : Integration of functions of two & three variables, Double & triple integrals, Dirichlet integral use double & triple integral in finding areas and volumes. Vector integration : Indefinite and definite, surface and volume integrals, Gauss and stokes theorems and some applications.
4	Partial differential : Function of several variables, Limits, Continuity and differentiability, Partial derivatives, Eulers Theorem, Mean Theorem & Tailors Theorem.
5	Maxima & Minima function of two and three variables, convergence and divergence of series : Definition and various tests.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

TEXT BOOK
A text book of higher calculus for B.Sc II by Dr. H. K. Pathak& D.C. Agrawal ,Shiksha Sahitya Prakashan.

REFERENCE BOOK
A text book of higher calculus for B.Sc II by Dr. H. S. Sharma Ratan Prakashan

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:	
Maximum Marks:	**100**
Continuous Comprehensive Evaluation (CCE):	**15**
University Exam (UE):	**85**

B. Vivek Rathi

Semester-III

B.C.A.

Academic Year: 2021-2022

BCA PART III Semester **Academic Year: 2021-2022**

Course of studies for the BCA – III Semester

BCA – III Semester Course

SCHEME OF MARKS

Course	Theory Max. Marks		Practical Max. Marks	Max. Marks	Min. Marks
	Internal	External			
301 Discrete Mathematics	15	85	--	100	5 + 28
302 Data Structure Using C	15	85	--	100	5 + 28
303 Object Oriented Programming Using C++	15	85	--	100	5 + 28
304: Unix Operating System	15	85	--	100	5 + 28
305: Accounting And Financial Management	15	85	--	100	5 + 28
306: Communication Skills	15	85	--	100	5 +28
BCA-307: Practical- Data Structure Using C	--	---	50	50	17
BCA-908: Practical- Object Oriented Programming Using C++	--	--	50	50	17
BCA-908: Practical- Unix Operating System			50	50	17
Total Marks	90	510	150	750	--

Class: B.C.A. III Sem
Subject: Mathematics
Paper: I

Marks: 15 +85 =100
Code of the Paper:- 351

Title of Paper: Discrete Mathematics

	Part A : Introduction for Program B.CA. Third Sem	
1	**Pre-requisite (if any)**	To study this, course a student have mathematics subject in 12th Class.
2	**Course Objectives**	The objective of this course is Syllabus cover algebra of Logic, Boolean Algebra and its properties, sets and Functions Mathematical reasoning, Combinatories used to develop computer programs and code in language of software development, Relation on set and Graph theory Language and Grammers are useful in the development of hardware of computer system.
	Course Learning outcomes	After the completion of this course the students would be able to
		CO1 : To understand algebra of Logic, Tautologies contradiction and programming language. Boolean Algebra is bone to develop binary code for computer.
		CO2 : Introduction to set theory, operations and Mathematical reasoning explained in this unit. It is used to solve different problem.
		CO3 : Provide knowledge of basics of counting. The sum rule, the product rule Pigen hole Principle permutations with repetitions. Applications of combination to solve committee problems, word problems etc.
		CO4 : Knowledge of Relation Importance of relation in computer science. Types of relation and their applications is basis of this unit.
		CO5 : Graph theory is useful in time scheduling problem. In this unit student learn terminology of graph, types of graph, graph coloring, Tree and its properties. Language and Grammar is the basis for development of programming Language.

Part B: Content of the Course

Unit	Topics
1	**Algebra of Logic:** Recall of Statements & Logical Connectives, Tautologies & Contradictions, Logical Equivalence, Propositions, Predicates, Quantifiers: Universal & Existential Quantifiers. **Boolean Algebra:** Boolean Algebra and its Properties, De- Morgan's Laws.
2	**Sets and Functions:** Introduction to Set Theory, Set Operations: Union , Intersection, Difference, Complement, Fuzzy Sets. **Mathematical Reasoning:** Introduction to methods of proof, mathematical induction, Use of mathematical induction to solve different problems.
3	**Combinatorics:** The basics of counting, The sum rule, The product rule, The pigeonhole principle, Permutations with repetitions, Permutations without repetitions, Circular Permutations, Applications of Combinations, Applications of Combinatory to solve committee problems, word problems, puzzle problems etc. Advanced counting techniques, recurrence relations, solving recurrence relations.
4	**Relations:** Relation Definition, Importance of relations in computer science, Relations and their properties, Unary relations, Binary relations, Ternary relations, n-ary relations and their applications, closures of relations, equivalence relations, Representing relations, composite relation, operations on relations – union, intersection and join.
5	**Graph:** Graph terminology, types of graph connected graphs, components of graph, Euler graph, Hamiltonian Path and circuits, graph coloring, chromatic number. Tree: Definition, Types of tree (rooted, Binary), Properties of trees, Binary search Tree. Languages and Grammars: Introduction, Phrase-Structure grammar, Importance of grammar and language theory in computer science.

Part C : Learning Resources

Text Books, Reference BooksSuggested Readings:

TEXT BOOK:

Kenneth H. Rosen, "Discrete Mathematics and its Applications" , Mc.Graw Hill,2002.

REFERENCE BOOKS:

1. J.P. Tremblay & R. Manohar, "Discrete Mathematical Structure with applications to computer science" , Mc.Graw Hill,1975.
2. A text book of Discrete Mathematics by H. K. Pathak and D.C.Agrawal, Shiksha Sahitya Prakashan, Meerut. (Text).
3. Seymour Lipschutz , M. Lipson, "Discrete Mathematics" Tata Mc.Graw Hill,2005.
4. N. Deo, Graph Theory with Application to Engineering and Computer Science, Prentice Hall of India.
5. C.L. Liu, Elements of Discrete Mathematics, Mc. Graw Hill Book Co.

Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:	
Maximum Marks:	**100**
Continuous Comprehensive Evaluation (CCE):	**15**
University Exam (UE):	**85**

Semester-IV

B.C.A.

Academic Year: 2021-2022

BCA PART IV Semester **Academic Year: 2021-2022**

Course of studies for the BCA – IV Semester

BCA – IV Semester Course
SCHEME OF MARKS

Course	Theory Max. Marks		Practical Max. Marks	Max. Marks	Min. Marks
	Internal	External			
401: Computer Oriented Numerical Methods (Using "C" Language)	15	85	--	100	5 + 28
402: Software Engineering	15	85	--	100	5 + 28
403: Database Management System	15	85	--	100	5 + 28
404: Programming with JAVA	15	85	--	100	5 + 28
405: Environment Awareness and Green Computing	15	85	--	100	5 + 28
406: Entrepreneurship	15	85	--	100	5 + 28
407: Practical- Computer Oriented Numerical Methods (Using "C" Language)	--	--	50	50	17
407: Practical- Database Management System	--	--	50	50	17
407: Practical- Programming with JAVA	--	--	50	50	17
Total Marks	90	510	150	750	--

BCA PART IV Semester **Academic Year: 2021-2022**

Course of studies for the BCA – IV Semester

BCA – IV Semester Course
SCHEME OF MARKS

Course	Theory Max. Marks		Practical Max. Marks	Max. Marks	Min. Marks
	Internal	External			
401: Computer Oriented Numerical Methods (Using "C" Language)	15	85	--	100	5 + 28
402: Software Engineering	15	85	--	100	5 + 28
403: Database Management System	15	85	--	100	5 + 28
404: Programming with JAVA	15	85	--	100	5 + 28
405: Environment Awareness and Green Computing	15	85	--	100	5 + 28
406: Entrepreneurship	15	85	--	100	5 + 28
407: Practical- Computer Oriented Numerical Methods (Using "C" Language)	--	---	50	50	17
407: Practical- Database Management System	--	--	50	50	17
407: Practical- Programming with JAVA	--	--	50	50	17
Total Marks	90	510	150	750	--

Pr. N. Patil

Semester-V

B.C.A.

Academic Year: 2021-2022

Class: B.C.A. V Sem
Subject: Mathematics
Paper: I

Marks: 15 +85 =100
Code of the Paper:- 551

Title of Paper: Linear Algebra and Geometry

	Part A : Introduction for Program B.CA. V Sem	
1	**Pre-requisite (if any)**	To study this, course a student have mathematics subject in 12th Class.
2	**Course Objectives**	To introduce the students with concepts of Linear Algebra and Three Dimensional Geometry.
	Course Learning outcomes	After the completion of this course the students would be able to
		CO1 : About Graphs, subgroups, normal subgroups, quotient group and their properties.
		CO2 : About vector spaces, quotient space and their properties.
		CO3 : Matrix representation of a linear transformation, its rank and nullity and eigenvalues and eigenvectors.
		CO4 : About elliptical and hyperbolic paraboloid, ellipsoid and tangential planes.
		CO5 : About cones and enveloping cylinders of conicoid.

Part B: Content of the Course

Unit	Topics
1	Groups. Definition, Order of an element. Subgroups: Definition, Necessary and Sufficient Condition. Coset Decomposition. Right and Left Cosets, Lagrange's Theorem. Definitions and Basics of Normal Subgroups, Quotient Group, Homomorphism and Isomorphism of groups, Kernel of Homomorphism.
2	Vector Spaces. Vector space, Subspace and Quotient Space, Linearly Dependent and Independent Vectors. Linear Maps. Definition and properties. Homomorphism and Isomorphism of Vector spaces, Kernel of a Linear Map.
3	Matrix Representation of a Linear Map. Rank and Nullity of Linear Map, Fundamental Theorem of Vector Space Homomorphism. Eigen Values and Eigen vector of Matrix, Cayley Hamilton Theorem: Proof and Applications.
4	Parabolic, definition and description, Elliptical and Hyperbolic paraboloid, Parabolic of revolution. Tangent planes and Normal to a parabolic. The Ellipsoid, Tangent & Normal plane to it, director sphere of an ellipsoid, conjugate diameters and diametrical planes to ellipsoid, locus of chords.
5	The definition and description, finding equation of Cone, standard equation, condition of general Quadratic equation representing cone. Angle between two generators, enveloping Cone of conicoid, right circular Cone. The Cylinder definition, equation, right circular Cylinder, enveloping cylinder to a conicoid.

Part C : Learning Resources

Text Books, Reference Books
Suggested Readings:

Text Books:

(1) Linear Algebra by I. N Herstein, Wiley Publisher.
(2) Analytical Geometry of Three Dimensions by P. K. Jain, New Age International Publisher.

Reference Books:

(1) Linear Algebra Schaum's Series by Seymour Lipschutz &Mark Lipson, Mc-Graw Hill Publisher.
(2) Linear Algebra by S. N. Goel, Kedarnath Ramnath Publication, Meerut.
(3) Linear Algebra by Kenneth Hoffman and Ray Kunze, Prentice Hall of India Pvt. Ltd. New Delhi.
(4) Solid Geometry by M.L. Khanna, S.P Nigam, S.S. Gangwar, Jai Prakash Nath Publication Meerut.
(5) Solid Geometry by P.N. Chatterjee, Ram Prasad & Sons Publisher Bhopal.
(6) Coordinate Geometry of Three Dimensions by D.C Agrawal Shree Sai Prakashan Meerut .

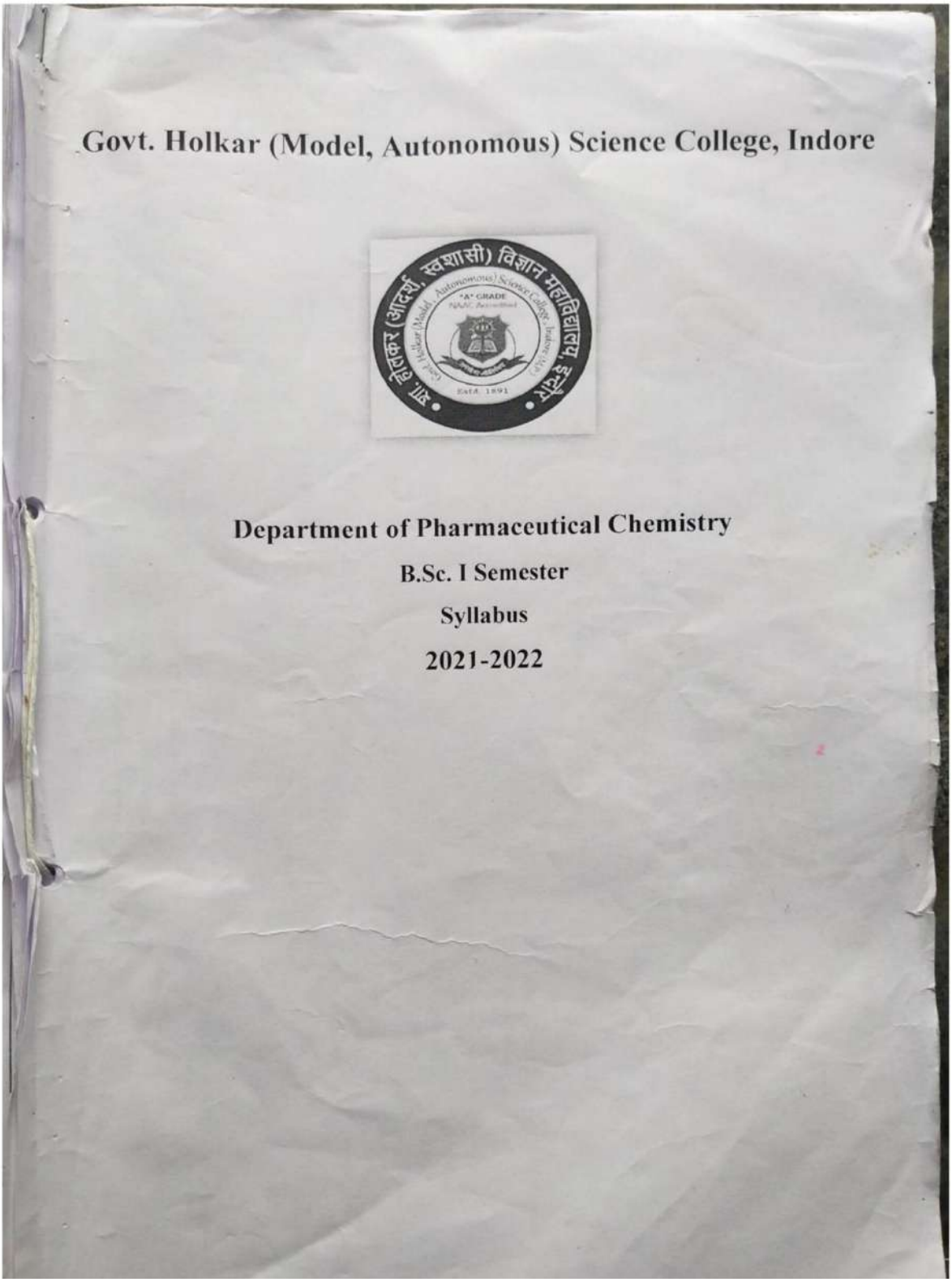
Part D : Assessment and Evaluation

Suggested Continuous Evaluation Methods:	
Maximum Marks:	**100**
Continuous Comprehensive Evaluation (CCE):	**15**
University Exam (UE):	**85**

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Pharmaceutical Chemistry

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development



Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department : Pharmaceutical Chemistry

Syllabus Session 2021-22

Programme : Certificate in Science **Class :B.Sc. I Sem.**

Sn. No.	Subject	Paper Title	Theory Max. Marks 100				Practical Max. Marks 100				Total credits
			Credits	CCE	External assessment	Min Marks	Credits	Internal assessment	External assessment	Min. Marks	
1	Subject-I (Major)	Pharmaceutical Inorganic Chemistry (Paper-I)	4	25	75	33	2	25	75	33	6
2	Subject-II (Minor)	Pharmaceutical Organic Chemistry (Paper-II)	4	25	75	33	2	25	75	33	6
3	Open Elective	Fundamentals of Drug Chemistry	4	25	75	33	-	-	-	-	4
4	Vocational	-	-	-	-	-	-	-	-	-	-
5	Field Project	-	-	-	-	-	-	-	-	-	-

First Year [redacted] Theory Paper-I (Semester I)

Part-A: Introduction			
Program: Certificate course	Class: B.Sc I Sem	Year: 2021	Session: 2021 – 2022
Subject: Pharmaceutical Chemistry			

1.	Course Code	[redacted]	
2.	Course Title	Pharmaceutical Inorganic Chemistry (Paper-I)	
3.	Course Type	Subject I (Major)	
4.	Pre-requisite (If any)	To study this course, a student must have had the subject Chemistry in 12th class.	
5.	Course Learning Outcomes	The course would enable the students to develop the concept of pharmaceutical inorganic compounds and their application in daily life. This will provide a foundation for various applied fields in pharmaceutical chemistry. The students will be able to: - •Describe about preparation and properties of gastrointestinal and topical agents. • Explain the preparation, properties, identification and assay of dental products. • Describe role of physiological ions, physiological acid base balance and electrolytes.	
6.	Credit Value	Theory-4	
7.	Total Marks	Max. Marks: 25 + 75	Min. Passing Marks: 33

Part-B: Content of the Course

Total numbers of Lectures (in hours per week): 2 hours per week

Total Lectures: 60 hours; L – T – P: 4 – 0 – 0

Units	Topics	No. of Lectures
I	**Historical background & Pharmaceutical Inorganic Chemistry** **1. Historical background:** 1.1 A brief historical background of pharmaceutical inorganic chemistry in the context of India and Indian culture 1.2 A brief biography of Prof. R. N. Chopra. **2. Pharmaceutical Inorganic Chemistry** **2.1 Preparation and properties of Gastrointestinal agents**	12

29/5/21 29/10/21

	2.2 General method of preparation, physical property, assay, identification, storage condition, test for purity and use of inorganic compounds belonging to the following class: Gastrointestinal agent- 2.3 acidifiers 2.4 antacids-sodium bicarbonate, potassium citrate, aluminium hydroxide gel, aluminium phosphate, magnesium oxide, magnesium hydroxide, magnesium carbonate, tribasic calcium phosphate, magnesium trisilicate 2.5 adsorbents and protectives-kaolin, bismuth subnitrate, bismuth sub carbonate, activated charcoal, talc. **Key Words:** Gastrointestinal agents, Properties, Preparation.	
II	**1.Preparation and properties of Topical agents** 1.1 Preparation, property, assay, identification, purity and use of the following class: Topical agents- 1.2 Protectives-Bentonite, Zinc oxide, Calamine, Zinc stearate, Titanium dioxide, silicon polymers 1.3 Astringents-Definition, therapeutic use-Alums, Aluminium sulphate, Zinc sulphate, Zinc chloride 1.4 Antimicrobials-classification, mechanism of action-Hydrogen peroxide, Sodium perborate, Potassium permanganate, Sodium hypochlorite, Iodine, Boric acid, Borax, Silver nitrate, Mild Silver protein, Sulphur, Selenium sulphide, Zinc undecenoate. **Key Words:** Topical agents, Properties, Preparation.	12
III	**1. Preparation and properties of Dental products** 1.1 Dental Products: Role of fluorides as anticaries agents. Sodium fluoride, Stannous fluoride. 1.2 Dentifrices: Definition, polishing agents, uses. Calcium carbonate, Dicalcium phosphate, Sodium metaphosphate, Strontium chloride. Cement and fillers: Zinc oxide. Inhalants: Oxygen, Carbon dioxide, Nitrous oxide. **Key Words:** Dental products, Properties, Preparation.	12
IV	**1. Physiological ions and electrolytes** 1.1 Discussion on the physiological role of chloride, phosphate, bicarbonate, sodium, potassium, calcium, magnesium. 1.2 Electrolytes used for replacement therapy-Sodium chloride, Potassium chloride, Calcium chloride, Calcium lactate, Calcium gluconate, Dibasic calcium phosphate, Tribasic calcium phosphate, Magnesium chloride. **Key Words:** Role of ions, Electrolytes.	12

29/5/21

29/X/21

V	**1. Physiological acid-base balance and electrolytes** 1.1 Introduction to physiological acid base balance, its importance. 1.2 Electrolytes used in acid base therapy. Sodium acetate, Potassium acetate, Sodium bicarbonate, Potassium bicarbonate, Sodium citrate, Potassium citrate, Sodium lactate, Ammonium chloride. 1.3 Electrolyte combination therapy, official combination electrolyte infusions, oral rehydration solutions. **Key Words:** Acid-base balance, Electrolytes.	12

Part C: Learning Resources

Text Books, Reference Books, Other resources

1. Rogers Inorganic Pharmaceutical Chemistry-Soine, Wilson.
2. Inorganic, Medicinal and Pharmaceutical Chemistry by J. H. Block, E. B. Roche, T. O. Soine and C. O. Wilson.
3. Bentley and Driver's Text Book of Pharmaceutical Chemistry, Oxford University Press, 2020.
4. Pharmaceutical and Medical Inorganic Chemistry: An updated version of Inorganic Pharmaceutical Chemistry by P. Gundu Rao, Vallabh Prakashan, 2009.
5. Indian Pharmacopoeia, The Controller of Publication, Delhi, 2007.
6. Pharmaceutical Chemistry-Inorganic by G. R. Chatwal, Himalaya Publishing House, 2018.

Suggestive digital platforms web links

1. https://ugcmoocs.inflibnet.ac.in
2. https://pharmabookbank.files.wordpress.com/2019/03/12.1.mchem_.pdf
3. https://archive.org/details/KDTEssentialsOfMedicalPharmacology7thEdition
4. http://www.fao.org/docrep/W7295E/w7295e00.htm#Contents

Suggested equivalent online courses:

29/5/21

29/X/21

Part D: Assessment and Evaluation		
Maximum Marks:	100	
Continuous Comprehensive Evaluation (CCE):	25	
University Examination (UE)	75	
Time: **02.00 Hours**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test	15
	Assignment/Presentation	10
	Total	**25**
External Assessment: University Examination	Section (A): Three Very Short Questions (50 Words Each)	03 x 03 = 09
	Section (B): Four Short Questions (200 Words Each)	04 x 09 = 36
	Section (C): Two Long Questions (500 Words Each)	02 x 15 = 30
	Total	**75**
Any remarks/suggestions:		

29/5/21

29/X/21

First Year Practical Paper-I (Semester-I)

Part-A: Introduction			
Program: Certificate course	**Class:** B.Sc. I Sem.	**Year :** 2021	**Session:** 2021 -2022
Subject: Pharmaceutical Chemistry			
1.	**Course Code**		
2.	**Course Title**	**Pharmaceutical Inorganic Chemistry Lab (Paper-I)**	
3.		**Subject-I (Major)**	
4.	**Pre-requisite (If any)**	To study this course, a student must have had the subject Chemistry in 12th class.	
5.	**Course Learning Outcomes**	After completing this practical course, students are expected to • Explain the pharmacopoeia, test of impurity & purity and analysis of pharmaceutical compounds. • Demonstrate titrimetric methods of analysis of inorganic compounds. • Design gravimetric methods of analysis.	
6.	**Credit Value**	**2**	
7.	**Total Marks**	Max. Marks: 25 + 75	Min. Passing Marks: 33

Part-B: Content of the Course		
Total numbers of Lectures (in hours per week): 2 hours per week **Total Lectures: 30 hours; L - T - P : 0 - 0 - 2**		
	Topics	
	1. Pharmaceutical Preparations: (i) Potash alum and Chrome alum (ii) Aromatic waters, solutions. Mouth washes (iii) Tinctures, Milk of Magnesia (iv) Mohr*s salt (v) Aluminium hydroxide gel, Lotions, Syrups (vi) Glycerites. Gargles (vii) Emulsions, Suspensions, (viii) Infusions, Mucilage, Jellies (ix) Decoctions. 2. Limit Test: Chloride, iron, sulphate and lead. 3. Titrimetric estimations:	

	(i) Preparation and standardization of sodium hydroxide and oxalic acid. (ii) Estimation of ferrous sulphate using potassium dichromate, oxalic acid and potassium permanganate. (iii) Assay of copper sulphate by Iodometry (iv) Analysis of ammonium chloride, borax, zinc oxide and sodium carbonate. 4. Gravimetric methods of analysis of copper, nickel and sulphate	

Part C: Learning Resources
Text Books, Reference Books, Other resources
1. Practical Pharmaceutical Chemistry by A. H. Beckett and J. B. Stenlake, 4th Edition, Part-II, Continuum International Publishing Group Ltd, 2000. 2. A Practical Book of Pharmaceutical Inorganic Chemistry by K. B. Patil, N. B. Patil and P. A. Patil, IP Innovative Publication, 1st edition, 2019. 3. Text Book of Pharmaceutical Inorganic Chemistry-Theory & Practical by V. N. Rajasekaran, CBS Publisher, 2019. 4. Practical Pharmaceutical Inorganic Chemistry by K. S. Jain, M. G. Shinde, J. N. Kadam, Nirmal Prakashan, 2020. **Suggestive digital platforms web links:** 1. https://ugcmoocs.inflibnet.ac.in 2. https://pharmabookbank.files.wordpress.com/2019/03/12.1.mchem_.pdf
Suggested equivalent online courses:

Part-D: Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction/Quiz	**10**	**Viva Voce on Practical**	**15**
Attendance	**5**	**Practical Record File**	**10**
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	**10**	**Table work / Experiments**	**50**
TOTAL	**25**		**75**
Any remarks/suggestions:			

29/5/21 29/5/21

FIRST YEAR SYLLABUS FOR PHARMACEUTICAL CHEMISTRY

First Year Theory Paper-II (Semester-I)

Part-A: Introduction

Program: Certificate course **Class:** B.Sc. **I Sem.** **Year:** 2021 **Session:** 2021 -2022

Subject: Pharmaceutical Chemistry

Course Code	[illegible]
Course Title	**Pharmaceutical Organic Chemistry-II (Paper-II)**
Course Type	**Subject-II (Minor)**
Pre-requisite (If any)	To study this course, a student must have had the subject Chemistry in 12th class.
Course Learning Outcomes	The course would enahle the students to develop the concept of pharmaceutical organic compounds and their application in daily life. This will provide a foundation for various applied fields in pharmaceutical chemistry. The students will be able to • Describe the basic concept about pharmaceutical organic chemistry. • Explain the stereochemistry and reaction mechanism of organic compounds. • Demonstrate reaction mechanism and application of organic reactions.
Credit Value	Theory-**4**
Total Marks	Max. Marks: 25 + 75 Min. Passing Marks: 33

Part-B: Content of the Course

Total numbers of Lectures (in hours per week): 2 hours per week Total Lectures: 60 hours L-**T**-**P**. **4**-**0**-**0**

Units	Topics	No. of Lectures
I	**Historical background & Pharmaceutical Organic Chemistry** 1. **Historical background:** ■1.1 A brief historical background of pharmaceutical chemistry in the context of India and Indian culture 1.2 A brief biography of Prof. Bishnupada Mukerjee **2. Pharmaceutical Organic Chemistry** 2.1 Atomic and molecular orbitals	10

	2.2 Covalent bond, hybrid orbitals, intra- and inter-molecular forces, bond length and bond dissociation energy 2.3 Dipole moment, polarity of the bond, polarity of the molecule, electronegativity 2.4 Inductive effect, resonance, hyperconjugation 2.5 Hydrogen bonding. **Key Word:** Atomic orbitals, molecular orbitals, covalent bond, polarity, resonance, inductive effect.	
II	**Stereochemistry** **1. Optical isomerism** 1.1 Optical activity and chirality, enantiomers, diastereoisomers, meso compounds, RS configuration 1.2 Absolute configuration, methods of determining configuration, molecules with more than one chiral centre 1.3 Reaction of chiral molecules 1.4 Racemic modification and resolution of racemic mixture. **2. Geometrical isomerism** 2.1 Nomenclature and methods of determination. **Key Word:** Optical isomers, absolute configuration, racemic mixture, geometrical isomers	12
III	**1. Synthesis and Structure of organic compounds** 1.1 Nomenclature 1.2 Preparation and structure of: alkanes, alkenes, alkynes, cycloalkanes 1.3 Dienes, benzene, polyaromatic compounds, arenes 1.4 Alcohols, ethers, epoxides, amino-nitro-compounds, phenols 1.5 Aldehydes and ketones carboxylic acids and their functional derivatives. **Key Words:** Nomenclature, preparation, structure of organic compounds.	12
IV	**1. Reaction mechanism** 1.1 Reactive intermediates: carbocations, carbanions, carbenes, free radicals, nitrenes and nitronium ions-their generation, fate and applications. 1.2 Nucleophilic substitution reactions-SN^1 and SN^2 reactions, mechanism, kinetics, order of reactivity and stereochemistry. 1.3 Electrophilic substitution reaction, types and mechanism. 1.4 Free radical mechanism.	12

29/5/21

29/X/21

	Key Words: Organic intermediates, Nucleophilic reaction, Electrophilic reactions, Free radical mechanism.	
V	**1. Synthesis and application of Organic reactions** 1.1 Aldol condensation, 1.2 Claisen-Schmidt condensation, 1.3 Cannizzaro reaction, 1.4 Crossed aldol and Crossed Cannizzaro reactions, 1.5 Benzoin condensation, 1.6 Perkin condensation, 1.7 Witting reaction, 1.8 Reformatsky reaction, 1.9 Michael addition, 1.10 Sandmeyer's reaction, 1.11 Hoffmann rearrangement, 1.12 Kolbe and 1.13 Reimer-Tieman reactions. **Key Words:** Name reactions, Application, Synthesis.	14

Part C: Learning Resources
Text Books, Reference Books, Other resources
Suggested Readings: 1. Organic Chemistry by I. L. Finar, Volume 1, 6th edition, Pearson Education India, 2002. 2. Organic Chemistry Volume 2: Stereochemistry and the Chemistry Natural Product, 5th edition by I. L. Finar, Pearson Education India, 2002 3. Organic Chemistry by R. T. Morrison and R. N. Boyd, 6th edition, Pearson Education India, 2018. 4. Organic Chemistry by J. Clayden, N. Greeves, S. Warren and P. Wothers, Oxford University Press, 2001. 5. Wilson & Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry by Beale, Wolters Kluwer India Pvt Ltd, 2010. 6. Bentley and Driver's Text Book of Pharmaceutical Chemistry by L. M. Atherden, Eighth edition, Oxford University Press, 2020. 7. A Guide Book to Mechanism in Organic Chemistry by Peter Sykes, 6th edition, Pearson Education India, 2003. 8. Reaction mechanism in organic chemistry by S. P. Mukherjee, S. P. Singh and Rajeev Beri, Macmillan India Limited, New Delhi. **Suggestive digital platforms web links** 1. http://ccras.nic.in/sites/default/files/viewpdf/jimh/BIHM_1995/7%20to%2019.pdf 2. https://pharmabookbank.files.wordpress.com/2019/03/12.1.mchem_.pdf

29/5/21 29/5/21

Suggested equivalent online courses/resources:

1. https://www.jnu.ac.in/Faculty/bsbalaji/Nomenclature-1.mp4

Part D: Assessment and Evaluation		
Maximum Marks:		100
Continuous Comprehensive Evaluation (CCE):		25
University Examination (UE)		75
Time: **02.00 Hours**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test	15
	Assignment/Presentation	10
	Total	**25**
External Assessment: University Examination	Section (A): Three Very Short Questions (50 Words Each)	03 x 03 = 09
	Section (B): Four Short Questions (200 Words Each)	04 x 09 = 36
	Section (C): Two Long Questions (500 Words Each)	02 x 15 = 30
	Total	**75**
Any remarks/suggestions:		

Vacharya

29/5/21

29/8/24

First Year Practical Paper-II (Semester-I)

Part-A: Introduction

Program: Certificate course **Class:** B.Sc. I Sem. **Year:** 2021 **Session:** 2021 -2022

Subject: Pharmaceutical Chemistry

Course Title	**Pharmaceutical Organic Chemistry Lab (Paper-II)**
Course Type	**Subject-II (Minor)**
Pre-requisite (If any)	To study this course, a student must have had the subject Chemistry in 12th class.
Course Learning Outcomes	After completing this practical course, students are expected to • Describe about laboratory practices, hazards and calibration of glass wares. • Demonstrate synthesis, structure and identification of organic compounds. • Design experimental set up of various name reactions.
Credit Value	**02**
Total Marks	Max. Marks: 25 + 75 Min. Passing Marks: 33

Part-B: Content of the Course

Total numbers of Lectures (in hours per week): 2 hours per week Total

Lectures: 30 hours; L - T - P : 0 - 0 - 2

Topics

1. Introduction to good laboratory practices
2. Study of possible hazards in the laboratory.
3. Study of various glass wares used in the laboratory.
4. Preparation, structure and identification of organic compounds and their derivatives: Phenols, amides, carbohydrates, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, hydrocarbons, anilids. nitro-compounds.
5. Purification of organic compounds by crystallization using the following solvents:
   a. Water
   b. Alcohol
   c. Alcohol-Water

	6. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus) 7. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds 8. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)	

Part C: Learning Resources
Text Books, Reference Books, Other resources
1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)
3. Arora, V., Arora P., Shah, S. K., Umarkar, A. R., Pharmaceutical Organic Chemistry-I (Theory and Practical), S. Vikas and Company (PV), 2017.
Suggestive digital platforms web links: **1. Indian Pharmacopoeia draft monographs** **2. http://www.uspbpep.com/**
Suggested equivalent online courses:

Part-D: Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction/Quiz	**10**	**Viva Voce on Practical**	**15**
Attendance	**5**	**Practical Record File**	**10**
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	**10**	**Table work / Experiments**	**50**
TOTAL	**25**		**75**
Any remarks/suggestions:			

29/5/21 29/5/21

First Year Open Elective (Semester I)

Part-A: Introduction

Program: Certificate course **Class:** B.Sc I Sem **Year:** 2021 **Session:** 2021 -2022

Subject: Pharmaceutical Chemistry

1	**Course Code**	
	Course Title	**Fundamentals of Drug Chemistry**
	Course Type	Elective
	Pre-requisite (If any)	To study this course, a student must have had the subject Chemistry in 12th class.
5.	**Course Learning Outcomes**	The course would enable the students to develop the basic fundamentals of drug. This will provide an understanding of basic concepts of drug chemistry. The students will be able to • Understand the basic concept about drug chemistry. • illustrate the active distribution of drugs in living organisms. • Demonstrate the concept of drug metabolism and activity of drugs.
6.	**Credit Value**	4
7.	**Total Marks**	Max. Marks: 25 + 75 Min. Passing Marks: 33

Part-B: Content of the Course

Total numbers of Lectures (in hours per week): 2 hours per week

Total Lectures: 60 hours; L-T-P: 4-0-0

Units	Topics	No. of Lectures
	1. Concept of drug	10
	1.1 Introduction of drugs	
	1.2 History of drug in Indian context	
	1.3 Introduction of Ayurveda	
	1.4 Nomenclature of drugs	
	1.5 Classification of drugs on the basis of sources (Natural -Plants, animals. Microorganisms. Minerals. Marine. Geographical origin and Synthetic drugs)	
	1.6 Introduction to IP. BP. USP and Extra Pharmacopoeia. **Key Word:** IP. pharmacopeia. Ayurveda, drugs, natural drugs	

II **1. Routes of drug administration** 14

1.1 Oral route

1.2 Sublingual and Rectal route

1.3 Injection routes (Intravenous, Intramuscular, Subcutaneous, Intraarterial. Intra-articular, Intra thecal, Intra dermal)

1.4 Vaginal route

1.5 Ocular route

1.6 Optic route

1.7 Nasal route

1.8 Inhalation route

1.9 Nebulization route

1.10 Cutaneous route and trans dermal route

1.11 Advantages and disadvantages of all the mentioned routes.

Key Word: Ocular route, drug administration. Nasal route, trans dermal route

III **1.** ADME (absorption, distribution, metabolism, excretion) 10

1.1 Modes of drug absorption (active, passive and Facilitated)

1.2 Basic concepts about distribution of drugs

1.3 bio-transformation of drugs

1.4 Excretion of drugs

1.5 Mechanism of drug action

1.6 Factors modifying drug effects

1.7 Drug toxicity

1.8 Methods of prolonging drug action

1.9 Drug Assay.

Key Words: Drug absorption, ADME. drug mechanism, drug assay

IV **1. Drug Design- A Rational** Approach 14

1.1 Introduction

1.2 Analogues and Pro drugs

1.3 Concept of lead prodrugs

	1.4 Soft drugs and design of son drug 1.5 Factors governing drug design 1.6 Rational approach to drug design 1.7 Drug design and development 1.8 Molecular Hybridization 1.9 Rigidity and flexibility v/s Drug design 1.10 Tailoring of drugs. **Key Words:** Analogues. Pro drugs. Drug design. Molecular Hybridization, soft drugs	
V	**1.** Activity **of** drugs 1.1 Introduction of some common drugs with their classification and example of one drug each: 1.1.1 Analgesics. Anti -Inflammatory and Antipyretic. Local and General Anesthetic. Sedatives, hypnotics and Tranquilizers 1.1.2 Cardiovascular drugs 1.1.3 Diuretics 1.1.4 Antineoplastic Agents 1.1.5 Insulin and Oral Hypoglycemic agents 1.1.6 Expectorants and antitussive 1.1.7 Antimalarial 1.1.8 Anticonvulsants and Muscle Relaxants 1.1.9 CNS Stimulants 1.1.10 Antihistamines and Anthelminthic 1.1.11 Antibiotics. Antimycobacterial and Antiviral drugs 1.1.12 Steroids **Key Words:** Analgesics. CNS Stimulants. Antibiotics, Insulin	12

29/5/21

29/X/21

Part C: Learning Resources
Text Books, Reference Books. Other resources
Suggested Readings: 1. Ashutosh kar Pharmaceutical Drug analysis, New Age International 2. G.R.Chatwal. Pharmaceutical Chemistry Inorganic Vol. I. Himalaya Publishing House, Mumbai. 3. Kokate Purohit, Gokhle Text Book of Pharmacognosy Nirali Publication 4. Dr. J. L. Jain. Fundamentals of Biochemistry, S. Chand & Company Ltd. New Delhi. 5. F.S. K. Barar. Essentials of Pharmacotherapeutics. S. Chand & Company Ltd. New Delhi. 6. R. S. Gaud & Dr. G.D. Gupta. Practical Pharmaceutics. CBS Publishers and Distributors. New Delhi. 7. N.C.Choudhary and N. K .Gurbani, Pharmaceutical chemistry.Vallabh Prakashan, Delhi. 8. N. K.. Jain, Textbook of Professional Phamacy Vallabh Prakashan. Delhi 9. Jahangir Moini Pharmacy Terminology (-'engage Learning 10. Gerhard Nahler Dictionary of Pharmaceutical Medicines Springer-Verlag Wien GmbJ I **Suggestive digital platforms web links** 1. https://cdsco.aov.in/opcnems/opencms/en/llome/ 2. https://cdscoonline.LiOv.in/CDSCO/Guidelines 3. http://v\\vw.dru«zscontrol.orLi/
Suggested equivalent online courses: 1. http:/Vccras.nic.in/sites/default/1iles/vie\\pdf/iimh/BIIIIM 1995/7%20to%2019.pdf

Part D: Assessment and Evaluation		
Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 University Examination (UE) 75 Time: **02.00 Hours**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test	15
	Assignment/Presentation	10
	Total	**25**
External Assessment: University Examination	Section (A): Three Very Short Questions (50 Words Each)	03 x 03 = 09
	Section (B): Four Short Questions (200 Words Each)	04x09 = 36
	Section (C): Two Long Questions (500 Words Each)	02 x 15-30
	Total	**75**
Any remarks/suggestions:		

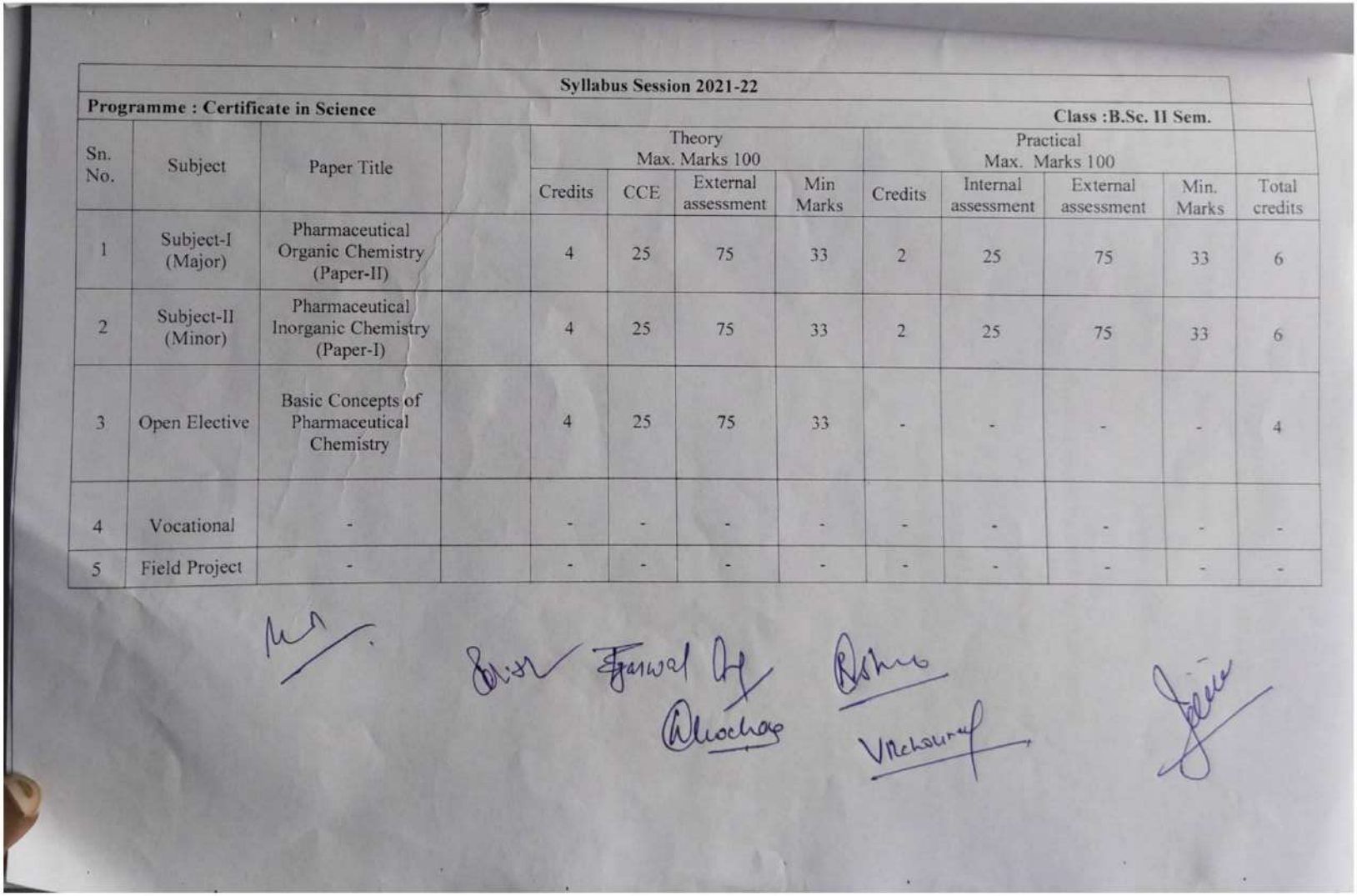
Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

B.Sc. II Semester

Syllabus

2021-2022



Syllabus Session 2021-22

Programme : Certificate in Science **Class :B.Sc. II Sem.**

Sn. No.	Subject	Paper Title	Theory Max. Marks 100				Practical Max. Marks 100				
			Credits	CCE	External assessment	Min Marks	Credits	Internal assessment	External assessment	Min. Marks	Total credits
1	Subject-I (Major)	Pharmaceutical Organic Chemistry (Paper-II)	4	25	75	33	2	25	75	33	6
2	Subject-II (Minor)	Pharmaceutical Inorganic Chemistry (Paper-I)	4	25	75	33	2	25	75	33	6
3	Open Elective	Basic Concepts of Pharmaceutical Chemistry	4	25	75	33	-	-	-	-	4
4	Vocational	-	-	-	-	-	-	-	-	-	-
5	Field Project	-	-	-	-	-	-	-	-	-	-

FIRST YEAR SYLLABUS FOR PHARMACEUTICAL CHEMISTRY

First Year Theory Paper-II (Semester-II)

Part-A: Introduction

ogram: Certificate course **Class:** B.Sc. II Sem. **Year:** 2021 **Session:** 2021 -2022

Subject: Pharmaceutical Chemistry

Course Code	
Course Title	**Pharmaceutical Organic Chemistry-II (Paper-II)**
Course Type	**Subject-I (Major)**
Pre-requisite (If any)	To study this course, a student must have had the subject Chemistry in 12th class.
Course Learning Outcomes	The course would enahle the students to develop the concept of pharmaceutical organic compounds and their application in daily life. This will provide a foundation for various applied fields in pharmaceutical chemistry. The students will be able to • Describe the basic concept about pharmaceutical organic chemistry. • Explain the stereochemistry and reaction mechanism of organic compounds. • Demonstrate reaction mechanism and application of organic reactions.
Credit Value	Theory-4
Total Marks	Max. Marks: 25 + 75 Min. Passing Marks: 33

Part-B: Content of the Course

Total numbers of Lectures (in hours per week): 2 hours per week Total Lectures: 60 hours L-T-P. 4-0-0

nits	Topics	No. of Lectures
I	**Historical background & Pharmaceutical Organic Chemistry** 1. **Historical background:** ■1.1 A brief historical background of pharmaceutical chemistry in the context of India and Indian culture 1.2 A brief biography of Prof. Bishnupada Mukerjee **2. Pharmaceutical Organic Chemistry** 2.1 Atomic and molecular orbitals	10

2.2 Covalent bond, hybrid orbitals, intra- and inter-molecular forces, bond length and bond dissociation energy

2.3 Dipole moment, polarity of the bond, polarity of the molecule, electronegativity

2.4 Inductive effect, resonance, hyperconjugation

2.5 Hydrogen bonding.

Key Word: Atomic orbitals. molecular orbitals, covalent bond, polarity, resonance, inductive effect.

iStereochemistry

1. Optical isomerism

1.1 Optical activity and chirality. enantiomers, diastereoisomers. meso compounds. RS configuration

1.2 Absolute configuration, methods of determining configuration, molecules with more than one chiral centre

1.3 Reaction of chiral molecules

1.4 Racemic modification and resolution of racemic mixture.

2. Geometrical isomerism

2.1 Nomenclature and methods of determination.

Key Word: Optical isomers, absolute configuration, racemic mixture, geometrical isomers

M i **1. Synthesis and Structure of organic compounds**

1.1 Nomenclature

1.2 Preparation and structure of: alkanes, alkenes. alkynes, cycloalkanes

1.3 Dienes, benzene, polyaromatic compounds, arenes

1.4 Alcohols, ethers, epoxides, amino-nitro-compounds. phenols

1.5 Aldehydes and ketones carboxylic acids and their functional derivatives. **Key Words:** Nomenclature, preparation, structure of organic compounds.

IV **1. Reaction mechanism**

1.1 Reactive intermediates: carbocations. carbanions. carbenes, free radicals, nitrenes and nitronium ions-their generation, fate and applications.

1.2 Nucleophilic substitution reaclions-SN^1 and SN^2 reactions, mechanism, kinetics, order of reactivity and stereochemistry.

1.3 Electrophilic substitution reaction, types and mechanism.

1.4 Free radical mechanism.

29/1/21

	Key Words: Organic intermediates. Nucleophilic reaction, Electrophilic reactions. Free radical mechanism.		
V	**1. Synthesis and application** oi* **Organic reactions**		14
	1.1 Aldol condensation.		
	1.2 Claisen-Schmidt condensation,		
	1.3 Cannizzaro reaction.		
	1.4 Crossed aldol and Crossed Cannizzaro reactions.		
	1.5 Benzoin condensation.		
	1.6 Perkin condensation,		
	1.7 Witting reaction.		
	1.8 Reformatsky reaction.		
	1.9 Michael addition.		
	1.10 Sandmeyer's reaction.		
	1.11 Hoffmann rearrangement.		
	1.12Kolbe and		
	1.13 Reimer-'I ieman reactions.		
	Key Words: Name reactions, Application. Synthesis.		

Part C: **Learning Resources**

Text Books. Reference Books. Other resources

Suggested Readings:

1. Organic Chemistry by 1. L. Finar, Volume 1. 6th edition, Pearson Education India. 2002.
2. Organic Chemistry Volume 2: Stereochemistry and the Chemistry Natural Product. 5th edition by I. L. Finar, Pearson Education India. 2002
3. Organic Chemistry by R. T. Morrison and R. N. Boyd, 6"1 edition, Pearson Education India. 2018.
4. Organic Chemistry by J. Clayden, N. Greeves, S. Warren and P. Wothers. Oxford University Press, 2001.
5. Wilson & Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry **by** Beale, Wolters Kluwer India Pvt Ltd. 2010.
6. Bentley and Driver's Text Book of Pharmaceutical Chemistry by L. M. Atherden, Eighth edition, Oxford University Press. 2020.
7. A Guide Book to Mechanism in Organic Chemistry by Peter Sykes, 6th edition, Pearson Education India, 2003.
8. Reaction mechanism in organic chemistry by S. P. Mukherjee, S. P. Singh and Rajeev Beri. Macmillan India Limited, New Delhi.

Suggestive digital platforms web links

1 ■ http://ccras.nic.in/sites/default/tiles/viewpdr/jimh/BllMM 1995/7%20to%2019.pdf

2. https://pharmalxv >kbank. riles.wordpress.com/2019/Q3/12.1 .mchem .pdf

29/8/21

Suggested equivalent online courses/resources:

1. https://www.jnu.ac.in.TaculU-'hshalaji Vmienel;ij uje.1 .mp4

Part D: Assessment and Evaluation		
Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 University Examination (UE) 75 Time: **02.00 Hours**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test	15
	Assignment'Presentation	10
	Total	**25**
External Assessment: University Examination	Section (A): Three Very Short Questions (50 Words Each)	03 x 03 - 09
	Section (B): Four Short Questions (200 Words Each)	04 x 09 - 36
	Section (C): Two Long Questions (500 Words E.*ch)	02 x 15 = 30
	Total	**75**
Any remarks/suggestions:		

First Year Practical Paper-II (Semester-II)

Part-A: Introduction

Program: Certificate course **Class:** B.Sc. II Sem. **Year:** 2021 **Session:** 2021 -2022

Subject: Pharmaceutical Chemistry

Course Code	
Course Title	**Pharmaceutical Organic Chemistry Lab (Paper-II)**
Course Type	**Subject-I (Major)**
Pre-requisite (If any)	To study this course, a student must have had the subject Chemistry in 12th class.
Course Learning Outcomes	After completing this practical course, students are expected to • Describe about laboratory practices, hazards and calibration of glass wares. • Demonstrate synthesis, structure and identification of organic compounds. • Design experimental set up of various name reactions.
Credit Value	
Total Marks	Max. Marks: 25 + 75 Min. Passing Marks: 33

Part-B: Content of the Course

Total numbers of Lectures (in hours per week): 2 hours per week Total

Lectures: 30 hours; L - T - P : 0 - 0 - 2

	Topics	
	1. Introduction to good laboratory practices 2. Study of possible hazards in the laboratory. 3. Study of various glass wares used in the laboratory. 4. Preparation, structure and identification of organic compounds and their derivatives: Phenols, amides, carbohydrates, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, hydrocarbons, anilids. nitro-compounds. 5. Purification of organic compounds by crystallization using the following solvents: a. Water b. Alcohol c. Alcohol-Water	

	6. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus) 7. Effect of impurities on the melting point - mixed melting point of two unknown organic compounds 8. Determination of boiling point of liquid compounds, (boiling point lower than and more than 100 °C by distillation and capillary method)	

Part C: Learning Resources

Text Books, Reference Books. Other resources

1. Mann, F.G. & Saunders. B.C. *Practical Organic Chemistry,* Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell. A.R. *Practical Organic Chemistry, 5th Ed.,* Pearson (2012)
3. Arora. V., Arora P., Shah, S. K., Umarkar, A. R., Pharmaceutical Organic Chemistry-I (Theory and Practical), S. Vikas and Company (PV), 2017.

Suggestive digital platforms web iinks:

1. **Indian Pharmacopoeia draft monographs**
2. **http://www.uspbpep.com/**

Suggested equivalent online courses:

Part-D: Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction/Quiz	**10**	**Viva VOCP on Practical**	**15**
Attendance	**5**	**Practical Record File**	**10**
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	**10**	**Table work / Experiments**	**50**
TOTAL	**25**		**75**
Any remarks/suggestions:			

29/9/21

First Year Theory Paper-I (Semester II)

Part-A: Introduction			
Program: Certificate course	Class: B.Sc II Sem	Year: 2021	Session: 2021 – 2022
Subject: Pharmaceutical Chemistry			
1.	Course Code		
2.	Course Title	Pharmaceutical Inorganic Chemistry (Paper-I)	
3.	Course Type	subject-II (minor)	
4.	Pre-requisite (If any)	To study this course, a student must have had the subject Chemistry in 12th class.	
5.	Course Learning Outcomes	The course would enable the students to develop the concept of pharmaceutical inorganic compounds and their application in daily life. This will provide a foundation for various applied fields in pharmaceutical chemistry. The students will be able to: - •Describe about preparation and properties of gastrointestinal and topical agents. • Explain the preparation, properties, identification and assay of dental products. • Describe role of physiological ions, physiological acid base balance and electrolytes.	
6.	Credit Value	Theory-4	
7.	Total Marks	Max. Marks: 25 + 75	Min. Passing Marks: 33

Part-B: Content of the Course		
Total numbers of Lectures (in hours per week): 2 hours per week Total Lectures: 60 hours; L – T – P: 4 – 0 – 0		
Units	Topics	No. of Lectures
I	**Historical background & Pharmaceutical Inorganic Chemistry** **1. Historical background:** 1.1 A brief historical background of pharmaceutical inorganic chemistry in the context of India and Indian culture 1.2 A brief biography of Prof. R. N. Chopra. **2. Pharmaceutical Inorganic Chemistry** **2.1 Preparation and properties of Gastrointestinal agents**	12

29/5/21 29/10/21

	2.2 General method of preparation, physical property, assay, identification, storage condition, test for purity and use of inorganic compounds belonging to the following class: Gastrointestinal agents 2.3 acidifiers 2.4 antacids-sodium bicarbonate, potassium citrate, aluminium hydroxide gel, aluminium phosphate, magnesium oxide, magnesium hydroxide, magnesium carbonate, tribasic calcium phosphate, magnesium trisilicate 2.5 adsorbents and protectives-kaolin, bismuth subnitrate, bismuth sub carbonate, activated charcoal, talc. **Key Words:** Gastrointestinal agents, Properties, Preparation.	
II	**1.Preparation and properties of Topical agents** 1.1 Preparation, property, assay, identification, purity and use of the following class: Topical agents- 1.2 Protectives-Bentonite, Zinc oxide, Calamine, Zinc stearate, Titanium dioxide, silicon polymers 1.3 Astringents-Definition, therapeutic use-Alums, Aluminium sulphate, Zinc sulphate, Zinc chloride 1.4 Antimicrobials-classification, mechanism of action-Hydrogen peroxide, Sodium perborate, Potassium permanganate, Sodium hypochlorite, Iodine, Boric acid, Borax, Silver nitrate, Mild Silver protein, Selphur, Selenium sulphide, Zinc undecenoate. **Key Words:** Topical agents, Properties, Preparation.	12
III	**1. Preparation and properties of Dental products** 1.1 Dental Products: Role of fluorides as anticaries agents: Sodium fluoride, Stannous fluoride. 1.2 Dentifrices: Definition, polishing agents, uses. Calcium carbonate, Dicalcium phosphate, Sodium metaphosphate, Strontium chloride. Cement and fillers: Zinc oxide. Inhalants: Oxygen, Carbon dioxide, Nitrous oxide. **Key Words:** Dental products, Properties, Preparation.	12
IV	**1. Physiological ions and electrolytes** 1.1 Discussion on the physiological role of chloride, phosphate, bicarbonate, sodium, potassium, calcium, magnesium. 1.2 Electrolytes used for replacement therapy-Sodium chloride, Potassium chloride, Calcium chloride, Calcium lactate, Calcium gluconate, Dibasic calcium phosphate, Tribasic calcium phosphate, Magnesium chloride. **Key Words:** Role of ions, Electrolytes.	12

Vacant 29/5/21 29/X/21

V	**1. Physiological acid-base balance and electrolytes** 1.1 Introduction to physiological acid base balance, its importance. 1.2 Electrolytes used in acid base therapy. Sodium acetate, Potassium acetate, Sodium bicarbonate, Potassium bicarbonate, Sodium citrate, Potassium citrate, Sodium lactate, Ammonium chloride. 1.3 Electrolyte combination therapy, official combination electrolyte infusions, oral rehydration solutions. **Key Words:** Acid-base balance, Electrolytes.	12

Part C: Learning Resources

Text Books, Reference Books, Other resources

1. Rogers Inorganic Pharmaceutical Chemistry-Soine, Wilson.
2. Inorganic, Medicinal and Pharmaceutical Chemistry by J. H. Block, E. B. Roche, T. O. Soine and C. O. Wilson.
3. Bentley and Driver's Text Book of Pharmaceutical Chemistry, Oxford University Press, 2020.
4. Pharmaceutical and Medical Inorganic Chemistry: An updated version of Inorganic Pharmaceutical Chemistry by P. Gundu Rao, Vallabh Prakashan, 2009.
5. Indian Pharmacopoeia, The Controller of Publication, Delhi, 2007.
6. Pharmaceutical Chemistry-Inorganic by G. R. Chatwal, Himalaya Publishing House, 2018.

Suggestive digital platforms web links

1. https://nptel.ac.in/courses/104101098/
2. https://pharmabookbank.files.wordpress.com/2019/03/12.1.mchem_.pdf
3. https://archive.org/details/KDTEssentialsOfMedicalPharmacology7thEdition
4. http://www.fao.org/docrep/W7295E/w7295e0u.htm#Contents

Suggested equivalent online courses:

29/5/21

29/X/21

Part D: Assessment and Evaluation

Maximum Marks:		100
Continuous Comprehensive Evaluation (CCE):		25
University Examination (UE)		75
Time: **02.00 Hours**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test	15
	Assignment/Presentation	10
	Total	**25**
External Assessment: University Examination	Section (A): Three Very Short Questions (50 Words Each)	03 x 03 = 09
	Section (B): Four Short Questions (200 Words Each)	04 x 09 = 36
	Section (C): Two Long Questions (500 Words Each)	02 x 15 = 30
	Total	**75**
Any remarks/suggestions:		

29/5/24 29/X/24

First Year Practical Paper-I (Semester-II)

Part-A: Introduction		
Program: Certificate course	**Class:** B.Sc. II Sem.	**Year :** 2021 **Session:** 2021 -2022
Subject: Pharmaceutical Chemistry		
1.	**Course Code**	
2.	**Course Title**	**Pharmaceutical Inorganic Chemistry Lab (Paper-1)**
3.	**Course Type**	**Subject-II (Minor)**
4.	**Pre-requisite (If any)**	To study this course, a student must have had the subject Chemistry in 12th class.
5.	**Course Learning Outcomes**	After completing this practical course, students are expected to • Explain the pharmacopoeia, test of impurity & purity and analysis of pharmaceutical compounds. • Demonstrate titrimetric methods of analysis of inorganic compounds. • Design gravimetric methods of analysis.
6.	**Credit Value**	**2**
7.	**Total Marks**	Max. Marks: 25 + 75 Min. Passing Marks: 33

Part-B: Content of the Course	
Total numbers of Lectures (in hours per week): 2 hours per week **Total Lectures: 30 hours; L - T - P : 0 - 0 - 2**	
	Topics
	1. Pharmaceutical Preparations: (i) Potash alum and Chrome alum (ii) Aromatic waters, solutions. Mouth washes (iii) Tinctures, Milk of Magnesia (iv) Mohr*s salt (v) Aluminium hydroxide gel, Lotions, Syrups (vi) Glycerites. Gargles (vii) Emulsions, Suspensions, (viii) Infusions, Mucilage, Jellies (ix) Decoctions. 2. Limit Test: Chloride, iron, sulphate and lead. 3. Titrimetric estimations:

	(i) Preparation and standardization of sodium hydroxide and oxalic acid. (ii) Estimation of ferrous sulphate using potassium dichromate, oxalic acid and potassium permanganate. (iii) Assay of copper sulphate by Iodometry. (iv) Analysis of ammonium chloride, borax, zinc oxide and sodium carbonate. 4. Gravimetric methods of analysis of copper, nickel and sulphate.	

Part C: Learning Resources
Text Books, Reference Books, Other resources
1. Practical Pharmaceutical Chemistry by A. H. Beckett and J. B. Stenlake, 4th Edition, Part-II, Continuum International Publishing Group Ltd, 2000. 2. A Practical Book of Pharmaceutical Inorganic Chemistry by K. B. Patil, N. B. Patil and P. A. Patil, IP Innovative Publication, 1st edition, 2019. 3. Text Book of Pharmaceutical Inorganic Chemistry-Theory & Practical by V. N. Rajasekaran, CBS Publisher, 2019. 4. Practical Pharmaceutical Inorganic Chemistry by K. S. Jain, M. G. Shinde, J. N. Kadam, Nirmal Prakashan, 2020.
Suggestive digital platforms web links: 1. https://ugcmoocs.inflibnet.ac.in 2. https://pharmabookbank.files.wordpress.com/2019/03/12_1-mchem_.pdf
Suggested equivalent online courses:

Part-D: Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction/Quiz	10	Viva Voce on Practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	10	Table work / Experiments	50
TOTAL	25		75
Any remarks/suggestions:			

Vachoux 29/5/21 29/5/21

First Year Open Elective – Pharmaceutical Chemistry

Part-A: Introduction

Program: course Certificate | **Class:** B.Sc. II Semester | **Year:** 2021 | **Session:** 2021 -2022

Subject: Pharmaceutical Chemistry

Course Code	
Course Title	**Basic Concepts of Pharmaceutical Chemistry**
Course Type	Elective
Pre-requisite (If any)	To study this course, a student must have had the subject Chemistry in 12th class.
Course Learning Outcomes	The course would enable the students to develop the basic concept of pharmaceutical chemistry and their application in daily life. This will provide a foundation for various applied fields in pharmaceutical chemistry. The students will be able to • Describe the basic concept about pharmaceutical chemistry. • Explain the activities of pharmaceutical compounds. • Demonstrate the concept of drug metabolism and pharmacokinetics in human body.
Credit Value	4
Total Marks	Max. Marks: 25 + 75 Min. Passing Marks: 33

Part-B: Content of the Course

Total numbers of Lectures (in hours per week): 2 hours per week Total Lectures: 60 hours; L-T-P: 4-0-0

Units	Topics	No. of Lectures
I	**1. Basic Concepts of Pharmaceutical Chemistry**	10
	1.1 History of pharmacy in India	
	1.2 Importance of chemistry in pharmacy	
	1.3 Important aspects of pharmaceutical chemistry	
	1.4 History of pharmacopeia	
	1.5 Monograph	
	1.6 Literature collection	
	1.7 Data handling and expression of analytical results- documentation and record keeping	
	Key Word: Pharmaceutical chemistry, pharmacopeia, monograph, pharmacy, data handling.	

29/X/21

II	**I. Activity of Pharmaceuticals** 1.1 Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs. 1.1.1 Antimetabolites (including sulphonamides). 1.1.2 Chemotherapeutic agents used in Protozoal. Parasitic and other infection 1.1.3 Antineoplastic agents 1.1.4 Anti-viral including anti - HIV agents. 1.1.5 Immunosuppressives and immunoslimulants. 1.1.6 Amino acids, peptide, nucleotides and related drugs a. Thyroid and Anti thyroid drugs b. Insulin and oral hypoglycaemic agents c. Peptidomimetics and nucleotide-mimelics. **Key Word:** Chemotherapeutic agents, antineoplastic agents. HIV agents, nucleotides	14
III	1. **Concepts of drugs** 1.1 Classification of drugs based on: 1.1.1 Therapeutic classes 1.1.2 Drug targets 1.1.3 Mechanism of action 1.1.4 Chemistry 1.2 Sources and uses of natural drug products 1.3 Drug metabolism and Concepts of Pro-drugs 1.4 Diagnostic agents 1.5 Pharmaceutical Aids **Key Words:** Therapeutic drugs, natural drug products. Drug-metabolism, Pro-drugs.	10
IV	**1. Drug metabolism** 1.1 General aspects: drug targets, concepts of drug binding, affinity, selectivity. 1.2 Drug Absorption 1.3**Distribution** and elimination 1.4 Routes **of** Drug Administration 1.5 Absorption of drugs and factors affecting Absorption 1.6 Meaning of pharmaceutical dose and dosage formula 1.7 Factors affecting Pharmaceutical dose 1.8 Types of drug-drug interactions 1.9 Dose response relationship **Key Words:** Drug absorption, pharmaceutical dose, drug-drug interactions, dose response relationship.	14

29/X/21

	ι Biomolecules anil pharmacokinetics 1.1 Physiology of biomolecules 1.2 Physiological functions of carbohydrates, lipids and Proteins 1.3 Digestion and biological oxidation of Carbohydrates, fats and proteins. 1.4 Principles of basic and clinical pharmacokinetics 1.5 Adverse drug reactions and treatment of poisoning 1.6 ADME drug interactions 1.7 Bioassay of drugs and biological standardization 1.8 Discovery and development of new drugs **Key Words:** Biomolecules, Carbohydrates, ADME. Bioassay of drugs	12

Part C: Learning Resources

Text Books. Reference Books, Other resources

Suggested Readings:

1. G.R.Chatwal, Pharmaceutical Chemistry Inorganic Vol. ι Himalaya Publishing House. Mumbai.
2. Dr. J. L. Jain, Fundamentals of Biochemistry* S. Chand A: Company Ltd. New Delhi.
3. F.S. K. Barar, Essentials of Pharmacotherapeutics. S. Chand & Company Ltd. New Delhi.
4. R. S. Gaud & Dr. G.D. Gupta. Practical Pharmaceutics. CBS Publishers and Distributors. New Delhi.
5. N.C.Choudhary and N.K.Gurbani. Pharmaceutical chemistry.Vallabh Prakashan, Delhi.
6. N. K. Jain, Textbook of Professional Phamacy Vallabh Prakashan. Delhi
7. B.M. Mi thai. A text boots of Pharmaceutical formulation. Vallabl Prakashan, Delhi.
8. Stenlake & Beckett. Practical Pharmaceutical Chemistry Part 1, CBS Publ ishers and Distributor's. New Delhi.

Suggestive digital platforms web links

1. https://ugcmoocs.innibnet.ac.in
2. https://pharmabookbank.files.wordprcss.eom/2Q19/03/12.1.mchem_.pdf

Suggested equivalent online courses:

29/4/21

Part D: Assessment and Evaluation		
Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 University Examination (UE) 75 Time: **02.00 Hours**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test	15
	Assignment/Presentation	10
	Total	**25**
External Assessment: University Examination	Section (A): Three Very Short Questions (50 Words Each)	03 x 03 - 09
	Section (B): Four Short Questions (200 Words Each)	04 x 09 = 36
	Section (C): Two Long Questions (500 Words Each)	02 x 15-30
	Total	**75**
Any remarks/suggestions		

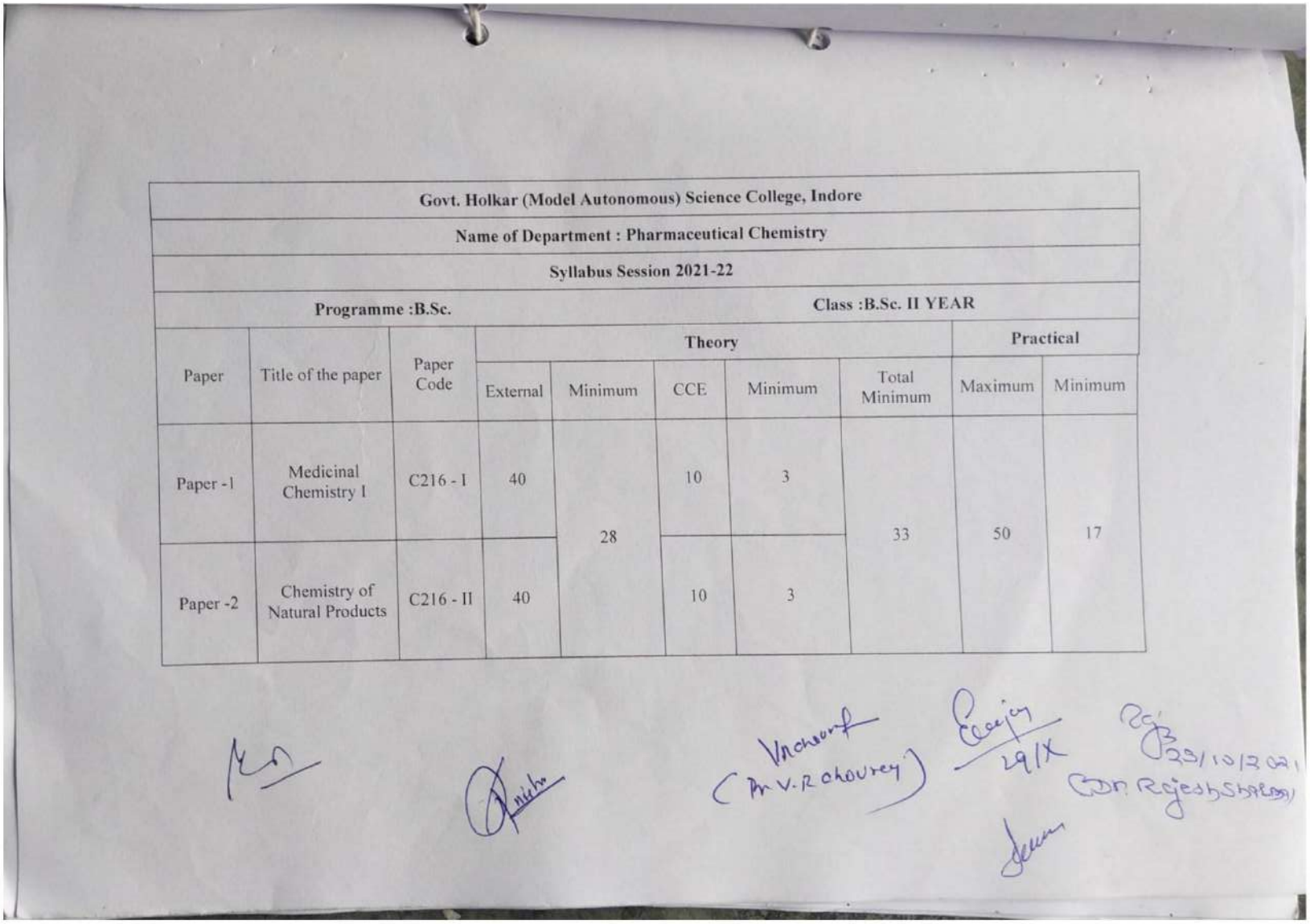
Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

B.Sc. II Year

Syllabus

2021-2022



Govt. Holkar (Model Autonomous) Science College, Indore									
Name of Department : Pharmaceutical Chemistry									
Syllabus Session 2021-22									
Programme :B.Sc.							Class :B.Sc. II YEAR		
Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -1	Medicinal Chemistry I	C216 - I	40	28	10	3	33	50	17
Paper -2	Chemistry of Natural Products	C216 - II	40		10	3			

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

Class : B.Sc. II Year — Marks: 40 + (CCE) 10 = 50

Subject : Pharmaceutical Chemistry — Code of the paper C216-I

Paper: I

Title of the paper - Medicinal Chemistry I

Part A : Introduction for Code PC (B.Sc. II Year I Paper)		
1	Pre- requisite (if any)	
2	Course Objectives	To make students understand various categories of drugs & their classification, Mode of action, SAR, synthesis, uses and adverse effects of some common drugs of a particular category and physicochemical properties in relation to biological action.
	Course Learning outcomes	After successful completion of this course students should be able to
		216-I-1 Explain physicochemical properties of a pharmaceutical compound in relation to biological action.
		216-I-2 Describe general anesthetics & local anesthetics ,their classification MOA, S AR synthesis uses adverse effects of some common compounds of these categories of drugs.
		216-I-3 Describe hypnotics, sedatives & anti -convulsants their classification, MOA, SAR , synthesis, uses and adverse effects of some common compounds of these classes of drugs.
		Describe analgesics, antipyretics and anti-histamines their classification, MOA, SAR , synthesis, uses and adverse effects of some common compounds of these classes of drugs.
		Describe diuretics and anti-hypertensives , their classification, MOA, SAR , synthesis, uses and adverse effects of some common compounds of these classes of drugs.

29/X/21

23/10/21

C 218-I

B.Sc. (Pharmaceutical Chemistry)
Second Year

Paper I — **Medicinal Chemistry-I** — *Max. Marks : 40*

Unit 1 Physicochemical properties in relation to biological action (Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.)

Unit 2 General anesthetics : Classification, mechanism of action, synthesis of nitrous oxide, halothane, thiopental sodium and chloroform

Local anesthetics: Classification, mechanism of action, SAR, synthesis of procaine hydrochloride, benzocaine, lignocaine hydrochloride

Unit 3 Hypnotic and sedative: Classification, mechanism of action, SAR of barbituric acid derivatives and synthesis of barbital, allobarbital, hexobarbital. SAR of benzodiazepines and synthesis of diazepam, alprazolam, zolpidem.

Anti-convulsants: Classification, mechanism of action and synthesis of phenobarbital and phenytoin sodium.

Unit 4 Analgesics and antipyretics: Classification, mechanism of action and SAR of morphine analogue, mechanism of action, mechanism of action and SAR of salicylic acid , aryl alkanoic acid derivatives, synthesis of aspirin and paracetamol

Anti-histaminics: Classification, mechanism of action and SAR ethanolamine derivatives, synthesis of diphenhydramine hydrochloride, promethazine hydrochloride.

Unit 5 Diuretics: Classification, mechanism of action and SAR. Synthesis and uses of hydrochlorthiazide, hydroflumethiazide, ethacrynic acid, furosemide, acetazolimide.

Antihypertensives : Classification, mechanism of action, SAR. Synthesis of captopril, propranolol hydrochloride.

Books Recommended

1. Foye's Medicinal Chemistry
2. Wilson and Gisvold's Text Book of Organic and Medicinal Chemistry
3. Medicinal Chemistry by A. Kar
4. Medicinal Chemistry by Sriram, and Yogeeeswari
5. Medical Pharmacology, Tripathi
6. Pharmaceutical Chemistry, Chatwal

28.04.17 — Dr. P. Nik — 28.4.17 — Vrchoury — 29/4/14

23/10/2021

Part B : Content of the Course
As Per Higher Education

Part C : Learning Resources -

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 50 Continuous Comprehensive Evaluation (CCE): 10 External Exam (EE) : 40		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 10	Class Test Assignment/Presentation	10
External Assessment: External Exam : 40 Time : 3 hours	40	40
		50

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : B.Sc. II Year
Subject : Pharmaceutical Chemistry

Marks: 40 + (CCE) 10 = 50
Code of the paper: 216-II

Paper: 2
Title of the paper - Chemistry of natural products

Part A : Introduction for Code PC (B.Sc. II Year II Paper)		
1	Pre- requisite (if any)	
2	Course Objectives	To make students understand about various natural products present naturally as a drug in plants , animals ,minerals etc.
	Course Learning outcomes	After successful completion of the course students should be able to
		216-II-1 Explain heterocyclic compounds naturally present in plants and animals
		216-II-2 Describe naturally present carbohydrates fats and oils and their pharmaceutical importance
		216-II-3 Explain amino acids, proteins and nucleic acids biologically present.
		216-II-4 Explain naturally occurring alkaloids & glycosides and their pharmaceutical usage.
		216-II-5 Describe terpenes and their medicinal uses. Steroids as a biological & medicinal compound.

29/1/24

C-216-II

Paper II **Chemistry of Natural Products** *Max. Marks : 40*

Unit 1 Heterocyclic compounds: Nomenclature, structure and reactions of imidazoles, oxazoles, pyrazoles, pyran, pyrimidine, purine, indole, isoquinolone.

Unit 2 Carbohydrate: Classification, nomenclature, Monosaccharide: glucose and fructose and their reactions, cyclic structure of D-glucose, Disaccharides: Maltose, lactose and sucrose, polysaccharides: Starch, cellulose, dextran, glycogen, inulin.

Fats : Fats, oils, waxes, fatty acids, physio-chemical properties, phospholipids, lecithenes, cephalins, plasmogens, glycolipids

Unit3 Amino acids : Classification, structure and stereochemistry of amino acids, properties of amino acids.

Protein : Classification, properties of proteins, primary, secondary and tertiary structure of proteins.

Nucleic acids: Introduction, structure of DNA and RNA.

Unit 4 Aklaloids: Classification, general introduction, composition, chemistry and chemical classes, biosources, therapeutic uses and commercial applications of quinine, morphine, reserpine.

Glycoloids: Classification, general introduction, composition, chemistry and chemical classes, biosources, therapeutic uses and commercial applications of senna, aloes, bitter almond. .

Unit 5 Terpenes: Classification, isolation, general introduction, composition, chemistry and chemical classes, biosources, therapeutic uses and commercial applications of citral, carvone, menthol, thymol, camphor.

Steroids: Isolation, nomenclature, chemistry of cholesterol, ergosterol, stigmasterol and cartosone.

Books Recommended

1. Heterocyclic chemistry, R.K. Bansal
2. Organic Chemistry by Morrison and Boyd
3. Heterocyclic Chemistry by T.L. Gilchrist
4. Chemistry of organic Natural products Vol. I and II by O.P. Agarwal.
5. Organic Chemistry Vol. II by Finar

28.04.17 28-4-17 29/4/17

Part B : Content of the Course
As Per Higher Education

Part C : Learning Resources -

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 50 Continuous Comprehensive Evaluation (CCE): 10 External Exam (EE) : 40		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 10	Class Test Assignment/Presentation	10
External Assessment: External Exam : 40 Time : 3 hours	40	40
		50

B.Sc. (Pharmaceutical Chemistry) Second Practicals

Max. Marks : 50

1. Purification of pharmaceutical organic compounds: Decolourization, recrystallization, sublimation
2. Preparation of benzocaine and phenytoin.
3. Preparation of aspirin and paracetamol.
4. Determination of partition coefficient for any two drugs.
5. Determination of iodine value, acid value and saponification value.
6. Isolation of caffeine from tea and casein from milk.
7. Separation of amino acids by paper chromatography
8. Identification test of carbohydrate, proteins.
9. Separation of sugars by thin layer chromatography.
10. Separation of plant pigments by column chromatography
11. Synthesis of benzyl, thalimide, sulphanic acid
12. Viva-voce
13. Practical Record

28.04.17

B.Sc II Year
Practicals Pharmaceutical Chemistry

Time 4 hrs. Max. Marks-50

I - Synthesis **10 Marks**

(1) Acetanilide (2) Aspirin (3) Liniment
(4) Paracetamol (5) Pthalimide (6) Cold Reliving Balm
(7) 1-Phenyl-azo β naphthol (8) Sulphanilic acid (9) Eardrop
(10) Benzocaine (11) Phenytoin (12) Benzil. (13) Phenyl Benzoate

II - (A) Isolation & Identification **12 Marks**

(1) Starch from potatoes. (2) Casein from milk.
(3) Caffeine from tea leaves. (4) Lycopene from tomatoes.

(B) Determination of partition coefficient for any two drugs.

(C) Purification of pharmaceutical organic compounds- decolorization, recrystallization and Sublimation.

(D) Determination of Iodine value, acid value and saponification value.

(E) Assay of (i) Aspirin (ii) Citric acid (iii) Sodium bicarbonate

III - Identification **06 Marks**

Aspirin, Paracetamol, Ibuprofen, Analgin, chloroquine, metronidazole, Ascorbic acid,Carbohydrates and proteins.

IV- Chromatography **08 Marks**

(1) Separation of plant pigments by column chromatography.
(2) Separation of sugars by thin layer chromatography.
(3) Separation of amino acids by paper chromatography.

V- Viva **06 Marks**

VI- Practical Record **08 Marks**

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

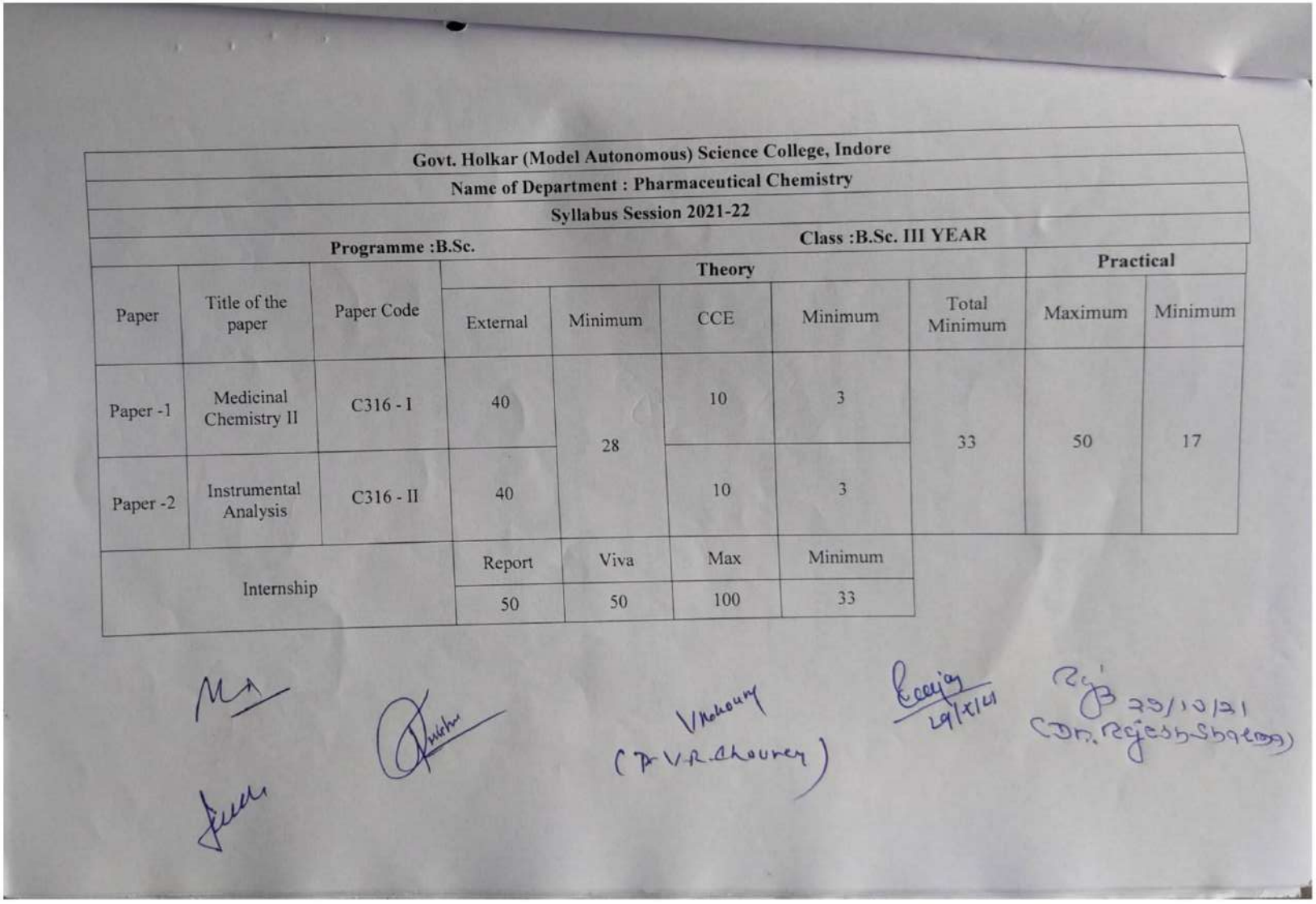
Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

B.Sc. III Year

Syllabus

2021-2022



Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department : Pharmaceutical Chemistry

Syllabus Session 2021-22

Programme :B.Sc. **Class :B.Sc. III YEAR**

Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -1	Medicinal Chemistry II	C316 - I	40	28	10	3	33	50	17
Paper -2	Instrumental Analysis	C316 - II	40		10	3			
Internship			Report	Viva	Max	Minimum			
			50	50	100	33			

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : B.Sc. III Year
Subject : Pharmaceutical Chemistry

Marks: 40 + (CCE) 10 = 50
Code of the paper : C316-I

Paper: 1
Title of the paper - Medicinal Chemistry II

	Part A : Introduction for Code PC (B.Sc. III Year I Paper)	
1	Pre- requisite (if any)	
2	Course Objectives	To make students understand various categories of drugs & their classification , MOA, SAR, synthesis and adverse effects of some important compound of these categories of drugs.
	Course Learning outcomes	After successful completion of this course students should be able to **316-I-1** Describe adrenergic anticoagulants, expectorants and antitussives agents their classification MOA, SAR , synthesis, uses and adverse effects of compounds of these categories of drugs.
		316-I-2 Explain historical background, SAR classification of antibiotics and classification, MOA and synthesis of sulphonamides.
		316-I-3 Explain MOA, SAR and classification of antimalarials , Anti tubercular drugs and antiamoebics.
		316-I-4 Explain MOA classification of anti diabetics and antineoplastics. types of cancer.
		316-I-5 Describe various approaches of drug design.

B.Sc. (Pharmaceutical Chemistry) C-316-I
Third Year
Medicinal Chemistry-II

Paper I Max. Marks: 40

Unit 1 Adrenergic: Classification, mechanism of action and SAR of ethylamine analogue, synthesis of adrenaline, epinephrine, norepineprine, ephedrine, dopamine.

Anticoagulants : Classification, mechanism of action, synthesis and uses of heparin, dicoumarol

Expectorants and anti-tussives: Classification, mechanism of action. Synthesis of acetylcysteine, guaifensin and noscapine.

Unit 2 Antibiotics: Historical background, Structure activity relationship, Chemical classification of β-Lactam antibiotics: Penicillin, Cepholosporins, Aminoglycosides: Streptomycin and neomycin, Tetracyclines: Tetracycline, Macrolide: Azithromycin; constitution and synthesis and uses of chloramphenicol.

Sulphonamide : Classification and mechanism of action, synthesis and uses of suphacetamide, sulphaguianide, dapsone

Unit 3 Anti-malarial : Classification, mechanism of action, SAR of 4-amino quinolines, synthesis of chloroquine phosphate, amidiaquine hydrochloride, primquine phosphate

Anti-tubercular drugs: Classification, mechanism, synthesis and uses of para amino salicylic acid, isoniazid, rifampicin.

Anti-amoebic : Classification, mechanism of action and synthesis and uses of metronidazole.

Unit 4 Anti-diabetic : Classification. Mechanism, synthesis and uses of metformin, sitagliptin, glimperide.

Anti-neoplastic: Types of cancer, Classification, mechanism , synthesis and uses of 5-fluoro uracil, 6-mercaptopurine, thiotepa, busulphan.

Unit 5 Drug Design:Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity, relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis, Free Wilson analysis. Introduction to 3D QSAR approaches.

28.04.17 28.4.17 29/X/24

Books Recommended

1. Foye's Medicinal Chemistry
2. Wilson and Gisvold's Text Book of Organic and Medicinal Chemsitry
3. Medicinal Chemistry by A. Kar
4. Medicinal Chemistry by Sriram, and Yogeeeswari
5. Medical Pharmacology, Tripathi
6. Pharmaceutical Chemistry, Chatwal

Part B : Content of the Course

As Per Higher Education

Part C : Learning Resources -

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam

Maximum Marks : 50

Continuous Comprehensive Evaluation (CCE): 10 External Exam (EE) : 40

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 10	Class Test Assignment/Presentation	10
External Assessment: External Exam : 40 Time : 3 hours	40	40
		50

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : B.Sc. III Year
Subject : Pharmaceutical Chemistry

Marks: 40 + (CCE) 10 = 50
Code of the paper : C316-II

Paper: 2
Title of the paper - Instrumental Analysis

Part A : Introduction for Code PC (B.Sc. III Year II Paper)		
1	Pre- requisite (if any)	
2	Course Objectives	To make students understand and learn various analytical techniques and instrumentation used in analysis of a pharmaceutical compound or preparations.
	Course Learning outcomes	After successful completion of their course students should be able to **316-II-1** Describe conductometric , potentiometric and polarographic methods with their instrumentation and applications.
		316-II-2 Explain UV& IR spectroscopy with their principle. Instrumentation and applications.
		316-II-3 Explain principles & instrumentation of NMR and mass spectroscopy and interpretation of NMR
		316-II-4 Describe various types of chromatography and their applications like TLC ,paper etc.
		316-II-5 describe various types of chromatography their instrumentation and applications like gas HPLC etc.

29/XI/14

C-316-II (3)

Paper II

Instrumental Analysis

Max. Marks : 40

Unit 1 Conductometry- Introduction, Conductivity cell, Conductometric titrations, applications.

Potentiometry-Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

Polarography - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications

Unit 2 UV: Principle, instrumentation and application of UV spectroscopy.

IR: Principle, instrumentation and application of UV spectroscopy.

Unit 3 NMR: Principle, The spinning nucleus, Mangneic and non magentic nuclei, rules to find nuclear spin, efffcet of external magnetic field, precessional motion and frequency, chemical shift: measurment, shielding and deshileding, factors affecting spin-spin coupling, coupling constants, Instrumentation, intepretation of NMR spectra.

MASS: Principle, instrumentation, types of ions and use of mass spectometry in the determination of molecular weight

Unit 4 Chromatography : Introduction to chromatography

Adsorption and partition column chromatography-Methodology, advantages, disadvantages and applications.

Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications

Unit 5 Gas chromatography-Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications

High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

Books Recommended

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Instrumental Methods of Chemical Analysis by Chatwal.
3. Pharmaceutical Analysis by Kar.
4. Beckett and Stenlake's, Practical Pharmaceutical Chemistry Vol. I and II.

Part B : Content of the Course
As Per Higher Education

Part C : Learning Resources -

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 50 Continuous Comprehensive Evaluation (CCE): 10 External Exam (EE) : 40		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 10	Class Test Assignment/Presentation	10
External Assessment: External Exam : 40 Time : 3 hours	40	40
		50

B.Sc. (Pharmaceutical Chemistry) Third Practicals

Max. Marks : 50

1. Preparation of N-phenyl azo β-naphthol and diphenyl thiourea.
2. Preparation of methyl orange and phenolphthalein.
3. Interpretation of given UV spectrum.
4. Interpretation of given IR spectrum.
5. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
6. Assay of paracetamol by UV-Spectroscopy
7. Estimation of dextrose by colorimetry
8. Weight variation, hardness, friability, and disintegration test of tablets.
9. Systematic separation and identification of organic binary mixture.
10. Separation of mixture of amino acid and determination of Rf value by thin layer chromatography.
11. Demonstration experiment on HPLC.
12. Demonstration experiment on Gas Chromatography.
13. Viva-voce
14. Practical record

28.04.17

29/10/2021

B.Sc. III Year
Practicals Pharmaceutical Chemistry

Time 4 hrs. Max. Marks-50

I- **Pharmaceutical Preparations** **06 Marks**

(1) Pain relieving balm (2) Iodine contaning muscle relaxant
(3) Calamine lotion (4) Cold cream

II- **Synthesis** **08 Marks**

(1) Methyl red (2) N-phenyl azo β-naphthol (3) Diphenyl thiourea
(4) Methyl orange (5) Phenolphthalein

III- **Instrumentation** **12 Marks**

(1) Weight variation (2) Hardness (3) Friability
(4) Disintegration test of tablet
(5) Determination of absorption maxima of organic compounds
(6) Assay of paracetamol by U-V Spectroscopy
(7) Estimation of dextrose by colorimetry
(8) Interpretation of given UV spectrum
(9) Interpretation of given IR spectrum
(10) Demonstration experiment on HPLC
(11) Demonstration experiment on Gas Chromatography

IV- **Chromatography** **10 Marks**

(1) TLC of tablets
(2) TLC of organic compounds
(3) TLC of food dyes
(4) Inorganic ions by radial chromatography
(5) TLC of amino acid

V- **Viva** **06 Marks**

VI- **Practical Record** **08 Marks**

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

...vt. Holkar (Model, Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

Certificate Course on Health and Hygiene

Syllabus

2021-2022

फार्मारसायन विभाग शा.होलकर (स्वशासी) विज्ञान महाविद्यालय, इन्दौर

क्र.....

दिनांक 22.09.2021

से,

प्राचार्य
शा0 (स्वशासी) होलकर विज्ञान महाविद्यालय
इन्दौर,

विषयः– फार्मारसायन विभाग द्वारा प्रस्तावित सर्टिफिकेट कोर्स का नाम, शुल्क तथा अन्य जानकारी देने बाबत्।

महोदय,

निवेदन है, कि आपके द्वारा चाही गई सर्टिफिकेट कोर्स का नाम, शुल्क तथा अन्य जानकारी निम्नानुसार आपकी ओर प्रेषित है।

Programme Title- Certificate Course on "Health and Hygiene"

Objectives-

- To emphasize the importance of hygiene, personal and community health and recognize their inter relationship.
- Appreciate different dimensions of health & the role of proper nutrition.

Eligibility- 12th Pass

Age limit- As per the directives of Govt. of Madhya Pradesh, there is no upper age limit for admission.

Admission Procedure- The admissions will be done as per merit.

Seats- 50 (reservation as per state govt. rules)

Duration- One semester (Six months)

Fee- Rs. 4000/-

Course Outcomes- On completion of this Course, the students will be able to understand

- what is healthy diet.
- Get basic knowledge on various foods and about adulteration.

विभागाध्यक्ष
फार्मारसायन विभाग

Department of Pharmaceutical Chemistry

Certificate course on Health and Hygiene

Credits

Unit I: Basics of Nutrition

Nutrition – definition, importance, Good nutrition and mal nutrition, Balanced Diet: Basics of Meal Planning.

Carbohydrates –functions, dietary sources, effects of deficiency.

Lipids –functions, dietary sources, effects of deficiency.

Proteins –functions, dietary sources, effects of deficiency.

Vitamins- functions, food sources, effects of deficiency,

Macro and micro minerals –functions, effects of deficiency; food sources of Calcium, Potassium and Sodium; food sources of Iron, Iodine and Zinc.

Unit II: Concept of Health and Hygiene

Health - Introduction, Determinants of health, Key Health Indicators, Environment health & Public health; Health-Education: Principles and Strategies.

Evolution of the Concept of Health and Hygiene, Basic Health and Hygiene Problems and Making Appropriate Intervention.

Hygiene – Definition; Personal, Community, Medical and Culinary hygiene; WASH (Water, Sanitation and Hygiene) programme. Community & Personal Hygiene: Environmental Sanitation and Sanitation in Public places.

Disaster Management – Containment, Control and Prevention of Epidemics and Pandemics – Acts, Guidelines and Role of Government and Public.

UNIT III: Food and Adulteration

Food adulteration – Introduction, definition of Food adulteration.

Food spoilage and Preservation Food Spoilage. Food Preservation- Traditional techniques: Refrigeration, freezing, drying, salt, sugar, smoking, pickling, jellying and juggling.

Advanced technique: Pasteurization, artificial food additives, vacuum packing, irradiation, high pressure food preservation (Pascalization), bio-preservation.

New adulterants in foods; Poisonous substances, Foreign matter, Cheap substitutes, Spoiled parts.

Adulteration through Food Additives – Intentional and incidental.

Introduction to food laws, National and International food laws, Governing bodies.

UNIT IV: Cosmeticology and Cosmetic Preparations:

Fundamentals of cosmetic science, structure and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin, hair, and dentifrice preparations like cream, lotion, shampoo, soap, Paste, Powder.

UNIT V: Health Policy & Health Organizations:

Health Indicators and National Health Policy of Govt. of India-2017, Functioning of various nutrition and health organizations in India viz., NIN (National Institution of Nutrition), FNB (Food and Nutrition Board), ICMR (Indian Council of Medical Research), IDA (Indian Dietetics Association), WHO-India, UNICEF-India.

National Health Mission: National Rural Health Mission (NRHM) Framework, National Urban Health Mission (NUHM) Framework.

Women & Child Health Care Schemes: Janani Shishu Suraksha Karyakaram (JSSK), Rashtriya Bal Swasthya Karyakram(RBSK).

Practicals

1. Study of laboratory instruments.
2. Measurement of Blood pressure and Sugar in blood and Urine.
3. Calculation of Body Mass Index (BMI).
4. Qualitative analysis of Carbohydrates (Molisch's test, Fehling's test, Benedict's test, Tollen's test, Iodine test).
5. Qualitative analysis of Protein (Biuret test, Xanthoproteic test, Millions test, Ninhydrin test).
6. Determine the saponification value of given oil.
7. Preparation of sanitizer (Gel and Liquid).
8. Preparation of calamine lotion.
9. Preparation of cold cream.
10. Preparation of $KMnO_4$ gargles.
11. Preparation of medicated soap.
12. Preparation of floor cleaner.
13. Estimation of Phosphate Content in Soft Drinks.
14. Testing adulteration of Milk and products:

A) Physical Tests: Detergent Test, Filter Test and Flow Test
B) Chemical Tests: Clot on boiling test, Test for starch and cane sugar in Milk.
C) Test for Buffaloes Milk in Cow's Milk.
D) Test for added colours in Milk.
E) Test for skim milk power in milk.
F) Detect the presence of added carbonates and bicarbonates in milk.
G) Test for soda in milk.

15. Adulteration of Ghee: Test for vegetable fat: Nitric acid test, Soda ash test, Test for added alkali.
16. Analysis of butter: Test for Dalda in butter.

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

M.Sc. I Semester

Syllabus

2021-2022

Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department - Pharmaceutical Chemistry
Syllabus Session 2021 -22
Programme : M.Sc. (Subject).. Pharmaceutical Chemistry
Class : M.Sc. I Sem.

Sr. No	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Minimum)	External Assessment Max.	External Assessment mini	Total Max	Total Mini
1	Core 1	PRINCIPLES OF INORGANIC PHARMACEUTICAL CHEMISTRY- I	PC-11	4	25	9	75	26	100	35
2	Core 2	PRINCIPLES OF ORGANIC PHARMACEUTICAL CHEMISTRY- I	PC-12	4	25	9	75	26	100	35
3	Core 3	PRINCIPLES OF PHYSICAL PHARMACY –I	PC-13	4	25	9	75	26	100	35
4	Core 4	PHARMACEUTICAL ANALYSIS-I	PC-14	4	25	9	75	26	100	35
5	Practical 1	---	PRPC-11	3	---	---	75	---	75	26
6	Practical 2	---	PRPC-12	3	---	---	75	---	75	26
7	Seminar I	---	---	1	---	---	25	---	25	9
8	Seminar II	---	---	1	---	---	25	---	25	9
		---	---	**24**	**100**	---	**500**	---	**600**	---

29/X/21

(Dr. V.R. Chouksey)

29/10/2021
Dr. Rajesh Shrivastava

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. I Sem.
Subject : Pharmaceutical Chemistry
Paper: Core 1
Title of the paper - Principles of Inorganic Pharmaceutical Chemistry - I

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the paper : PC-11

Part A : Introduction for Code PC (M.Sc. I Sem. I Paper)		
1	Pre- requisite (if any)	Bachelor level degree under 10+2+3 pattern with chemistry one of the subjects.
2	Course Objectives	To make students understand about basic concepts of coordination chemistry, metal ligand complexes and bioinorganic chemistry
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-11-1 Explain coordination chemistry
		PC-11-2 Explain nature of metal- ligand bonding in complexes
		PC-11-3 Describe reactions of mechanism of transition metal complexes.
		PC-11-4 Explain dental products and various components used as a drugs.
		PC-11-5 Explain bioinorganic chemistry in biological systems.

29/X/21

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. I Semester Pharmaceutical Chemistry Session 2021-22

Paper – 1: Principles of Inorganic Pharmaceutical Chemistry – I **(PC-11)** M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Basic Concepts of Coordination Chemistry :** Classification of Ligands, Chelation , Coordination number and Stereochemistry of complexes, Structure determination of complexes, Inner metallic complexes, Werner's coordination theory.
Unit II	**Nature of Metal-Ligand Bonding in complexes:** Crystal Field Theory- Importance features of CFT, Splitting of d orbitals in Octahedral, Tetragonal, Square planar & Tetrahedral complexes, Applications of CFT, Limitations of CFT, Ligand field theory for Octahedral & Tetrahedral complexes.
Unit-III	**Reaction Mechanism of Transition Metal Complexes:** a) Ligand Substitution Reactions in Octahedral Complexes-Transition state, types of substitution reactions, mechanism of ligand substitution reactions (SN Reactions), Hydrolysis reactions ,acid hydrolysis, base hydrolysis. b) Ligand Substitution Reactions in Square planar Complexes- Trans-effect, factors affecting the rate of substitution reactions in square planar complexes. c) Electron Transfer Reactions, Mechanism of one electron transfer reactions-Inner sphere mechanism and outer sphere mechanism.
Unit-IV	**(a)** Cationic and anionic Components of Inorganic Drugs useful for Systemic Effect **(b)** Complexing and Chelating Agents used in Therapy, **(c)** Gases and Vapours : Oxygen Anesthetic and Respiratory Stimulants. **(d)** Dental Products : Dentifrices, Anti-Caries Agents.
Unit-V	**Bioinorganic Chemistry** Metallo Porphyrins : Biochemistry of Iron, Heme iron and Non Heme-Proteins, Biochemistry of Haemoglobin and Myoglobin, Nitrogen Fixation in Bacterial Nitrogenase Systems , Essential and Trace Element in Biological Systems.

29/X/21

Part C : Learning Resources -

oks Suggested

Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
Inorganic Chemistry, J.E. Huhey, Harpes & Row
Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon.
Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty, Pergamon.
Pharmaceutical Chemistry Inorganic II Chatwal, G.R., Himalaya Publishing House.

Part D – Assessment and Evaluation

ggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
ıximum Marks : 100
ntinuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

ernal Assessment: ntinuous Comprehensive aluation (CCE) : 25	Class Test Assignment/Presentation	25
ternal Assessment: ternal Exam : 75 me : 3 hours	75	75
		100

29/X/21

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

ss : M.Sc. I Sem. Marks: 75 + (CCE) 25 = 100
)ject : Pharmaceutical Chemistry Credit : 4
)er: Core 2
le of the paper - Principles of Organic Pharmaceutical Chemistry-I Code of the paper : PC-12

Part A : Introduction for Code PC (M.Sc. I Sem. II Paper)	
Pre- requisite (if any)	Bachelor level degree under 10+2+3 pattern with chemistry one of the subjects.
Course Objectives	To make students understand the concept of stereochemistry, mechanism of organic reactions and some reactions of synthetic applications.
Course Learning outcomes	After successful completion of this course students should be able to
	PC-12-1 Explain concept of stereochemistry and conformational analysis.
	PC-12-2 Describe mechanisms of various organic reactions.
	PC-12-3 Explain concept of aromaticity & anti-aromaticity.
	PC-12-4 Describe mechanisms of some molecular rearrangement reactions.
	PC-12-5 Describe mechanisms of some reactions of synthetic applications.

24/X/21

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. I Semester Pharmaceutical Chemistry Session 2021-22

Paper – 2: Principles of Organic Pharmaceutical Chemistry-I **(PC-12)** M. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Stereochemistry and Conformational Analysis** Concept of chirality, recognition of symmetry elements and chiral Structure, R-S Nomenclature, optical activity without asymmetric Carbon Atom (Allenes, Spirans and Biphenyls) Geometrical isomerization of olefins and oximes, E-Z Nomenclature, conformational analysis of simple cyclic (Chair and Boat cyclohexanes) and acyclic Systems. Effect of confirmation of reactivity in acyclic compounds and cyclohexanes. Interconversion of Fischer, Newman and Sawhorse Projections. Stereoselective synthesis (partial and absolute asymmetric Synthesis).
Unit II	**a) Mechanism of Organic Reactions:** Types of organic reactions and mechanisms Method of determining reaction mechanisms. Neighboring group mechanism, hydrolysis of ester, E1 and E2 Mechanism. **b) Reaction Intermediates:** Introduction ,structure, formation and examples of participation in chemical reaction of the carbonium ion, carbanion, and free radicals.
Unit-III	**Aromaticity** Concept and theory of aromaticity and antiaromaticity Huckle's rule and its limitations, Benzenoid and Non benzenoid Compounds, cyclopentadienyl anion, tropylium cation, Azulenes, annulenes, ferrocene .
Unit-IV	**Reactions ,Synthetic applications and Mechanisms of the following Organic Reactions and Molecular rearrangements:** Pinacol- Pinacolone rearrangement, Benzilic Acid rearrangement, Beckmann rearrangement , Hoffmann rearrangement , Curtius rearrangement, Claisen rearrangement.
Unit-V	**Reactions , Synthetic Applications and Mechanisms of the Following Name Reactions :** Mannich reaction , Meerwein Pondorf Verley reduction , Oppenauer oxidation, Diel's Alder reactions, Reformatsky reaction.

29/X/21

Part C : Learaing Resources -

oks Suggested

Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.
A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press.
Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
Modern Organic Reactions, H.O. House, Benjamin.
Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professionals.
Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
Some Modern Methods of Organic Synthesis, W.Carruthers,Cambridge University Press
Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International.
Stereochemistry Chemistry of Carbon Compounds, E.L Eliel, McGraw Hill.

Part D – Assessment and Evaluation

ggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
aximum Marks : 100
ntinuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

ternal Assessment: ntinuous Comprehensive valuation (CCE) : 25	Class Test Assignment/Presentation	25
xternal Assessment: xternal Exam : 75 me : 3 hours	75	75
		100

29/X/14

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

: M.Sc. I Sem. Marks: 75 + (CCE) 25 = 100
ct : Pharmaceutical Chemistry Credit : 4
r: Core 3
of the paper - Principles of Physical Pharmacy – I Code of the paper : PC-13

Part A : Introduction for Code PC (M.Sc. I Sem. III Paper)	
Pre- requisite (if any)	Bachelor level degree under 10+2+3 pattern with chemistry one of the subjects.
Course Objectives	To make students understand about basic and important laws, phenomena and micromeritics of physical pharmacy.
Course Learning outcomes	After the successful completion of this course students should be able to
	PC-13-1 Describe complexation and protein binding.
	PC-13-2 Explain kinetics of reactions and drug stability.
	PC-13-3 Explain diffusion & dissolution of drug compound.
	PC-13-4 Describe interfacial phenomena & buffer systems.
	PC-13-5 Explain micromeritics, and their importance.

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. I Semester Pharmaceutical Chemistry Session 2021-22

Paper – 3: Principles of Physical Pharmacy – I **(PC-13)** M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Complexation and Protein Binding:-** Introduction, classification of complexation: Metal Complexes, Organic Molecular complexes, Inclusion complexes. Application of complexation, methods of analysis: Job's method of continuous variation, pH titration method, Distribution method, solubility method, Spectroscopy. **Protein Binding:-** Introduction, Methods of determining protein binding, applications. Thermodynamic treatment of stability constants.
Unit II	**Kinetics:-** Rates and Orders of Simple and Complex Reactions, Methods for determining order of reaction, Influence of Temperature and other factors on Reaction Rates, Theories of Rates, Effect of Solvent and Ion Strength, Acid Base Catalysis, Decomposition and Stabilization of Medicinal Agents, Photo degradation, Kinetics in the Solid States, Solid Dosage Forms, Drug stability, causes of drug instability and their prevention, Accelerated Stability Analysis.
Unit-III	**Diffusion and Dissolution:-** Diffusion & Dissolution- Procedures and Apparatus, factors affecting dissolution, Steady-State Diffusion. Drug Release- Polymer Matrices & Granular Matrices. Multilayer Diffusion, Membrane Control and Diffusion Layer Control, Diffusion Principles in Biological Systems, Thermodynamics of Diffusion, Fick's First & Second Law, Diffusion and Ecology.
Unit-IV	**Interfacial Phenomena:-** General Principles, Liquid Interfaces, Methods of measurement of surface and interfacial tension. Adsorption at Liquid Interfaces, Adsorption at Solid Interfaces, Applications of Surface Active Agents, HLB system, Electric Properties of Interfaces. **Buffers and Buffering Agents:-** Introduction, Buffer action, Buffer equation, Buffer capacity, Factors affecting pH of buffer solutions, buffers in pharmaceutical and biological systems, buffered isotonic solutions, Methods of adjusting tonicity.
Unit-V	**Micromeritics:-** Introduction, Importance in pharmacy, fundamental properties of collection of particles, Methods for Determining Particle Size, Particle Shape, surface area, Methods for Determining surface area (Adsorption method, Air Permeability method) Density of powders, Derived Properties of Powders.

29/X/14

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part C : Learning Resources –

ks Suggested

Physical Chemistry, P.W. Atkins, ELBS Publication.
Chemical Kinetics. K.J. Laidler, McGraw-Hill.
Kinetics and Mechanism of Chemical Transformation J. Rajaraman and J. Kuriacose, Mc Millan
Micelles, Theoretical and Applied Aspects, V. Moraoi, Plenum Publ.
Essentials of Physical Pharmacy, Sanjiv Aggarwal, Anmol Publication
Chemical Kinetics, V.B. Patania, Campus Books International
Physical Pharmacy, David Attwood, Alexander T. Florence, Pharmaceutical Press.

Part D – Assessment and Evaluation

ggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam
aximum Marks: 100
ntinuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

ternal Assessment: ntinuous Comprehensive valuation (CCE) : 25	Class Test Assignment/Presentation	25
ternal Assessment: ternal Exam: 75 me : 3 hours	75	75
		100

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

: M.Sc. I Sem. Marks: 75 + (CCE) 25 = 100
ct: Pharmaceutical Chemistry Credit : 4
: Core 4
of the paper - Pharmaceutical Analysis I Code of the paper: PC-14

Part A : Introduction for Code PC (M.Sc. I Sem. IV Paper)	
Pre- requisite (if any)	Bachelor level degree under 10+2+3 pattern with chemistry one of the subjects.
Course Objectives	To make students understand and interpret various types of spectroscopy.
Course Learning outcomes	After successful completion of this course students should be able to
	PC-14-1 Explain principle applications and interpretation of infrared spectroscopy
	PC-14-2 Describe principle & instrumentation of NMR spectroscopy
	PC-14-3 Describe Raman spectroscopy
	PC-14-4 Explain principle, instrumentation and applications of ESR Spectroscopy
	PC-14-5 Explain principle, instrumentation and applications of AAS.

29/9/21

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. I Semester Pharmaceutical Chemistry Session 2021-22

Paper – 4: Pharmaceutical Analysis I (PC-14)

M. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Infrared Spectroscopy:**-Review of Linear Harmonic Oscillator, Vibrational Energies of Diatomic Molecules, Zero Point Energy, Force Constant and Bond Strength, Anharmonicity, Vibration-Rotation Spectroscopy, P.Q.R Branches,Vibration of Polyatomic Molecules, Selection Rules, Normal Modes of Vibration, Group Frequencies, Overtones, Hot Band, Factor Affecting Band Positions, Applications of IR Spectroscopy in Pharmaceutical analysis, Interpretation of IR Spectra of Following Compounds :- Paracetamol , Ibuprofen, Aspirin and Diclofenac sodium.
Unit II	**Nuclear Magnetic Resonance Spectroscopy (NMR):**-Introduction, Principle of NMR, modes of nuclear spin, Basic ideas of instrument, Nuclear Resonance, Saturation, Shielding and Deshielding of Magnetic Nuclei, Chemical Shift and its Measurements, Factors Influencing Chemical Shift, Spin-Spin coupling , Coupling Constant, Factors Influencing Coupling Constant, Spin Decoupling.
Unit-III	**Raman Spectroscopy:**-Introduction, Classical and Quantum Theories of Raman Effect, Pure Rotational, Vibrational and Vibrational-Rotational Raman Spectra, Selection Rules, Mutual Exclusion Principle, Resonance Raman Spectroscopy, Coherent Anti Stokes Raman Spectroscopy (CARS).
Unit-IV	**Electron Spin Resonance Spectroscopy:**-Introduction , Principle , Instrumentation , Zero Field Splitting and Kramer's Degeneracy, Factors Affecting the 'g' Value, Hyperfine interactions - Isotropic and Anisotropic Hyperfine interactions , Hyperfine Splitting constants, Spin Hamiltonian, Spin Densities and Mc Connell Relationship, Applications of ESR.
Unit-V	**(a) Flame Emission Spectroscopy** Introduction, Principle, Instrumentation , Effects of solvent , Factors affecting intensity of Emitted Radiation , Interferences, Advantages and Applications. **(b) Atomic Absorption Spectroscopy** Introduction, Theory, Instrumental Aspects of Atomic Absorption Spectroscopy , Interferences- Spectral interferences and non-spectral interferences in AAS and Applications of AAS in Pharmaceutical Analysis.

29/5/14

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part C : Learning Resources -

Books suggested

. Modern Spectroscopy, J.M. Hollas, John Viley.
. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V.Parish, Ellis Harwood.
. Physical Methods in Chemistry, R.S. Drago, Saunders College Puplication
. Fundamentals of Molecular Spectroscopy, C. N. Banwell, Mc Graw Hill Puplication
. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill Puplication
. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill Puplication
. Molecular Structure and Spectroscopy, G. Aruldas, Phi Learning, Pvt. Ltd.
. Spectroscopy, V. B. partania, S. Campus Books international Publication.
0. Instrumental Methods of Chemical Analysis, G.W. Ewing, McGraw Hill Book Company.

Part D – Assessment and Evaluation

uggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

nternal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

29/4/21

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Department of Pharmaceutical Chemistry
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. I Semester Pharmaceutical Chemistry Session 2021-22

Practical-I : (PRPC-11)
Time : 6 Hrs.

Credit 3
Max. Marks: 75
Min. Marks: 30

i)	Organic Preparation	12 Marks
ii)	Pharmaceutical Preparation	12 Marks
iii)	Extraction	16 Marks
iv)	Interpretation	18 Marks
iv)	Practical Record	07 Marks
v)	Viva	10 Marks

(A) Organic Preparations — **12 Marks**

(a) p-Amino Phenol from Phenyl Hydroxylamine.
(b) 2,4-Di nitrophenyl hydrazine from 2,4-Di nitrochlorobenzene
(c) Phenyl Urea from Aniline
(d) Picric Acid From Phenol
(e) Dibenzalacetone from Benzaldehyde (Condensation reaction) i.e. Claisen-Schmidt Reaction.
(f) Phenyl benzoate from phenol
(g) Phenyl Azo beta Naphthol from aniline
(h) Aspirin from Salicylic acid.

(B) Pharmaceutical Preparations — **12 Marks**

(a) Aluminium Acetate Ear Drop
(b) Ammoniated Camphor Ointment. .
(c) Electrolyte Maintenance IV Fluid (for Pediatrics Use)
(d) Salicylic Acid Compound dusting Powder
(e) Compound Sodium Chloride and Dextrose oral Powder
(f) Strong Iodine Solution
(g) Zinc Sulphate Eye/Ear Drop
(h) Effervescent Granules
(i) Simple Elixir.
(j) $KMnO_4$ Gargle.

(II) Extraction — **16 Marks**

(a) To isolate caffeine from Tea Leaves.
(b) To Isolate Casein and Lactose from Milk
(c) To Isolate Piperine from Black Pepper..
(d) To Isolate lycopene from Tomatoes.

(III) Identification and Interpretation of IR Spectra of Pharmaceutical Compounds. — **18 Marks**

(IV) **Practical Record** — **07 Marks**

(V) **Viva** — **10 Marks**

29/5/24

Department of Pharmaceutical Chemistry
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. I Semester Pharmaceutical Chemistry Session 2021-22

Practical-2 : (PRPC-11)
Time : 6 Hrs.

Credit 3
Max. Marks: 75
Min. Marks: 30

i)	Qualitative Analysis	**20 Marks**
ii)	Identification of Drugs	**20 Marks**
iii)	Volumetric Assay	**18 Marks**
iv)	Practical Record	**07 Marks**
v)	Viva	**10 Marks**

I) Qualitative Analysis **20 Marks**
Limit tests for Chloride, Sulphate, Lead, Arsenic and Heavy Metals.

II) (a) Identify the tablet powder by chemical analysis. **10 Marks**
Paracetamol, Ibuprofen, Metranidazole, Analgin, Aspirin, Chloroquine Phosphate, Ascorbic Acid

(b) Inorganic Preparations **10 Marks**
1. Ammonium hexa chloro stannate (IV)
2. Ammonium Copper (II) sulphate tetra hydrate
3. Ammonium ferric sulphate
4. Sodium Ferrioxylate.

(III) Volumetric Estimation **18 Marks**
(a) Sodium bicarbonate
(b) Citric Acid
(c) Benzoic Acid
(d) Zinc Sulphate
(e) Sodium nitrite
(f) Glucose

(iv) Practical Record **07 Marks**

(v) Viva **10 Marks**

29/8/14

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
3. Practical Physical Chemistry, R.S. Gaud and G. D. Gupta, CBS Publication
4. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
5. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
6. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
7. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
8. Practical Pharmaceutical Chemistry - I ,Backett, A.H. , CBS Publisher, Delhi
9. Practical Pharmaceutical Chemistry - II ,Backett, A.H. , CBS Publisher, Delhi

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

M.Sc. II Semester

Syllabus

2021-2022

Govt. Holkar (Model Autonomous) Science College, Indore
Name of Department - Pharmaceutical Chemistry
Syllabus Session 2021 -22
Programme : M.Sc. (Subject) Pharmaceutical Chemistry
Class : M.Sc. II Sem.

Sr. No	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Minimum)	External Assessment Max.	External Assessment mini	Total Max	Total Mini
1	Core 5	PRINCIPLES OF INORGANIC PHARMACEUTICAL CHEMISTRY –II	PC-21	4	25	9	75	26	100	35
2	Core 6	PRINCIPLES OF ORGANIC PHARMACEUTICAL CHEMISTRY- II	PC-22	4	25	9	75	26	100	35
3	Core 7	PRINCIPLES OF PHYSICAL PHARMACY-II	PC-23	4	25	9	75	26	100	35
4	Core 8	PHARMACEUTICAL ANALYSIS- II	PC-24	4	25	9	75	26	100	35
5	Practical 3	---	PRPC-21	3	---	---	75	---	75	26
6	Practical 4	---	PRPC-22	3	---	---	75	---	75	26
7	Seminar 3	---	---	1	---	---	25	---	25	9
8	Seminar 4	---	---	1	---	---	25	---	25	9
		---	---	**24**	**100**	---	**500**	---	**600**	---

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

lass : M.Sc. II Sem. Marks: 75 + (CCE) 25 = 100
ubject : Pharmaceutical Chemistry Credit : 4
aper: Core 5
itle of the paper - Principles of Inorganic Pharmaceutical Chemistry -II Code of the paper : PC-21

Part A : Introduction for Code PC (M.Sc. II Sem. I Paper)		
1	Pre- requisite (if any)	A student must pass M.Sc. I Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about impurities in pharmaceutical substances & their limit tests, inorganic compounds such as gastrointestinal agents & topical agents, radiopharmaceuticals and some inorganic pharmaceutical agents.
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-21-1 Explain about impurities and their tests in pharmaceutical substances.
		PC-21-2 Describe Synthesis, properties & uses of inorganic compounds such as gastrointestinal and topical agents.
		PC-21-3 Explain synthesis, properties & uses of inorganic compounds of pharmaceutical importance.
		PC-21-4 Describe Radiopharmaceuticals.
		PC-21-5 Explain calcium and iron compounds as pharmaceutical agents.

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. II Semester Pharmaceutical Chemistry Session 2021-22

Paper –1: Principles of Inorganic Pharmaceutical Chemistry -II (PC-21) M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Impurities in Pharmaceutical Substances and their tests-** **a)** Sources of Impurities in Pharmaceutical Chemicals **b)** Effects of Impurities **c)** Permissible Impurities in Pharmaceutical Substances **d)** Methods Used to Purify Inorganic Substances **e)** Tests of Purity **f)** Limit Test of Chloride ,Sulphate, Arsenic, Iron
Unit II	**Synthesis, Properties and Uses of the given Inorganic Compounds -** **(a) Gastrointestinal agents-** **(i)Antacids-** Sodium bicarbonate, Aluminium phosphate, Magnesium carbonate and Magnesium oxide. **(ii) Protective's and Adsorbents-** Bismuth sub carbonate, Kaolin, Activated charcoal. **(iii) Saline cathartics-** Sodium acid phosphate, Disodium hydrogen phosphate, Magnesium sulphate. **(b) Topical agents-** **(i) Dusting powders-**Talc, Zinc oxide, Zinc stearate.
Unit-III	**Synthesis, Properties and Uses of Inorganic Compounds of Pharmaceutical Importance-** **(a) Antioxidants-** Hypophosphorus acid & Sodium metabisulphite. **(b) Emetics-** Ammonium chloride, Ammonium carbonate & Potassium iodide **(c) Astringents-**Alum , Aluminium chloride & Zinc Chloride.
Unit-IV	**Radiopharmaceuticals** Introduction , Basic Properties, Half life of Radioelements ,Production of Radioisotopes, Measurement of Radioactivity, Applications of Radioisotopes used in Pharmacy, Radioactive pharmaceuticals preparations and uses- **(a) Ferric citrate Fe^{59}** **(b) Sodium phosphate P^{32}** **(c) Iodine ^{131} & Iodine ^{125}**
Unit-V	**Calcium and Iron Compounds as Pharmaceutical Agents** Role of Calcium in Body, Deficiency Disorder of Calcium, Preparation, Properties and Uses of Calcium Acetate, Calcium Chloride, Calcium Gluconate, Calcium Lactate. Importance of Iron in Human Body, Deficiency Disorder of Iron, Preparation, Properties and Uses of Ferric Ammonium Citrate, Ferrous Fumarate, Ferrous Gluconate and Ferrous Succinate.

Part C : Learning Resources -
Books Suggested 1.A Text Book of Inorganic Medicinal Chemistry , Surendra N Pandya, S.G. Publisher, Varanasi 2.Pharmaceutical Chemistry Inorganic II , G. R. Chatwal, Himalaya Publishing House 3. A Text Book of Inorganic Pharmaceutical Medicinal Chemistry, Quardy & Quardy 4. Text Book of Pharmaceutical Chemistry, Bentley & Driver, Oxford University Press, New Delhi.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. II Sem. | Marks: 75 + (CCE) 25 = 100
Subject : Pharmaceutical Chemistry | Credit : 4
Paper: Core 6
Title of the paper - Principles of Organic Pharmaceutical Chemistry-II | Code of the paper : PC-22

Part A : Introduction for Code PC (M.Sc. II Sem. II Paper)		
1	Pre- requisite (if any)	A student must have to pass M.Sc. I Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make understand about organic compounds as a drugs and their properties .
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-22-1 Explain classification of the drugs & drug receptors.
		PC-22-2 Explain physico- chemical properties in relation to biological action.
		PC-22-3 Explain preparation and uses of reagents used in organic synthesis.
		PC-22-4 Describe synthesis, reactivity and chemical properties of heterocyclic compounds of biological significance .
		PC-22-5 Explain addition to carbon hetero multiple bonds reactions.

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. II Semester Pharmaceutical Chemistry Session 2021-22

Paper – 2: Principles of Organic Pharmaceutical Chemistry-II (PC-22)M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**a) Classification of the Drugs on the Basis of :** (i) Chemical structure (ii) Therapeutic action (at least one examples of each class) **b) Drug Receptors:** (i) Classification of receptors (ii) Structure and nature of receptors (iii) Receptor theories (iv) Mechanism of receptors
Unit II	**Physico- Chemical Properties in Relation to Biological Action :** Study of properties like Ionization, Partition coefficient, Acid Base properties, Hydrogen bonding and stereochemistry. Factors affecting Drug Absorption , Distribution , Metabolism and Elimination. Pathways of Metabolism.
Unit-III	**Reagents in Organic Synthesis:** Preparation and uses of complex metal hydride – Lithium Aluminium Hydride, Lithium diisopropylamide, Osmium tetra oxide, Dicyclo hexyl carbodiisomide , 1-3 Dithiane , Raney Nickel , Lead Tetra Acetate , Periodic Acid , Diazomethane & Ozone.
Unit-IV	**Heterocyclic Compounds:** Synthesis, reactivity, chemical properties, applications and biological significance of following Heterocyclic Compounds : a) Mono hetero atoms systems : Indole, Quinoline, Isoquinoline. b) Multi hetero atoms systems : Pyrazole, Imidazole, Oxazole.
Unit-V	**Addition to Carbon Hetero Multiple Bonds** Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds , Acid Ester and Nitriles. Addition reactions of Grignard eagents, Organozinc and Organolithium reagent to carbonyl and unsaturated carbonyl compounds. Mechanism of condensation reactions Aldol , Knoevenagel , Perkin , Reimer Tiemann, Friedel Craft's and Cannizaro's Reactions .

Part C : Learning Resources -

Books Suggested

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
6. Modern Organic Reactions, H.O. House, Benjamin.
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic &* Professionals.
8. Pericyclic Reactions, S.M. Mukherji, Macmillan, India
9. Medicinal Chemistry, Wilson & Gisvold.
10. An introduction to Medicinal Chemistry Patrick, Graham.
11. Text Book of Organic Medicinal & Pharmaceutical Chemistry, Wilson & Grisvold, Lippincott Williams & Wilkins.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

lass : M.Sc. II Sem. Marks: 75 + (CCE) 25 = 100
ubject : Pharmaceutical Chemistry Credit : 4
aper: Core-7
itle of the paper - Principles of Physical Pharmacy – II Code of the paper: PC-23

Part A : Introduction for Code PC (M.Sc. II Sem. III Paper)		
1	Pre- requisite (if any)	A student must have to pass M.Sc. I Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about principles of physical pharmacy, drug product designing and polymer science.
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-23-1 Explain concept of rheology, properties and applications to pharmacy.
		PC-23-2 Describe coarse dispersions systems.
		PC-23-3 Explain prodrug, drug carriers and routes of drug administration.
		PC-23-4 Describe polymer on the basis of source and structure.
		PC-23-5 Explain important features of bioactive polymers and their uses.

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. II Semester Pharmaceutical Chemistry Session 2021-22

Paper – 3: Principles of Physical Pharmacy – II(PC-23) M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Rheology:** Concept of viscosity, factors influencing the viscosity, Introduction of rheology, Newtonian Systems, Non-Newtonian Systems, Thixotropy, Determination of Rheological Properties, Viscoelasticity, Psychorheology, Applications to Pharmacy.
Unit II	**Coarse Dispersions:** Suspensions, Interfacial Properties of Suspended Particles, Formulation of Suspensions & Emulsions, Theories of Emulsification, Physical Stability of Emulsions, Preservation of Emulsions, Rheological Properties of Emulsions, Micro emulsions, Semisolids, Drug Kinetics in Coarse Disperse Systems, Drug Diffusion in Coarse Disperse Systems.
Unit-III	**Drug Product Design:** **(A) Prodrug and Drug Carriers:** Prodrug , Liposomes, Monolithic and reservoir devices microcapsules, Nano capsules and nanoparticles **(B) Routes of administration:** Ocular administration, Nasal administration, Buccal administration, pulmonary administration, Gastrointestinal administration, Rectal administration, Transdermal administration.
Unit-IV	**Polymer Science** Introduction, classification of polymer on the basis of source and structure, polymerization in homogenous and heterogeneous system, molecular weight determination from solution viscosity, polymers as thickening agents, Pharmaceutical applications of polymers.
Unit-V	Configuration of polymer chains, Glass transition temperature, determination of Glass transition temperature and its importance. Synthetic Polymers: Plastics, elastomers , fibers, Biomedical polymers, Important features of bioactive polymers and their uses.

Part C : Learning Resources -

Books Suggested

1. Physical Chemistry, P.W. Atkins, ELBS Publication.
2. Physical Pharmacy: Physical Chemical Principles in the Pharmaceutical science Martin, Pilar Bustamante, A.H.C. Chun , Lippincott Williams & Wilkins
3. Micelles, Theoretical and Applied Aspects, V. Moraoi, Plenum Publication.
4. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
5. Essentials of Physical Pharmacy, Sanjiv Aggarwal, Anmol Publication
6. Physical Pharmacy , David Attwood, Alexander T. Florence, Pharmaceutical Press

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

Class : M.Sc. II Sem. Marks: 75 + (CCE) 25 = 100

Subject : Pharmaceutical Chemistry Credit : 4

Paper: Core 8

Title of the paper – Pharmaceutical Analysis – II Code of the paper : PC-24

Part A : Introduction for Code PC (M.Sc. II Sem. IV Paper)		
1	Pre- requisite (if any)	A student must have to pass M.Sc. I Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about various pharmaceutical analytical methods like chromatography solvent extraction, titrimetry, gravimetry, Nephelometry and turbidimetry.
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-24-1 Explain TLC, Paper and Gas-liquid chromatography in pharmaceutical analysis.
		PC-24-2 Explain HPLC, Ion exchange & Gel chromatography.
		PC-24-3 Describe solvent extraction, types and applications.
		PC-24-4 Describe titrimetric and gravimetric methods of analysis.
		PC-24-5 Explain principle instrumentation & applications of Nephelometry, turbidimetry & flame photometry.

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. II Semester Pharmaceutical Chemistry Session 2021-22

Paper – 4: Pharmaceutical Analysis – II (PC-24)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Chromatographic Methods:-** Introduction of Chromatography ,Classification of chromatography. Principles, technique and Applications of Thin Layer Chromatography, Column Chromatography ,Paper Chromatography, Gas-Liquid Chromatography in Pharmaceutical Analysis.
Unit II	**High Performance Liquid Chromatography** (HPLC)-Introduction, Principle, Instrumentation and applications. **Ion Exchange Chromatography**- Introduction, Principle, cation & anion exchangers and applications. **Gel Chromatography**- Introduction, Principle, Gel preparation, column packing and applications.
Unit-III	**Solvent Extraction:-** Principle of Liquid-Liquid Extraction and Solid-Liquid Extraction, Distribution Law, Factors favouring Solvent Extraction, Sequences of the Extraction Process, Extraction Techniques- Batch Extraction, Stripping Extraction, Continuous Extraction and Soxhlet Extraction, Important Applications of Liquid-Liquid Extraction.
Unit-IV	**Titrimetry and Gravimetry:-** Introduction , Apparatus and experimental technique of gravimetric analysis, Introduction of titrimetric method ,Determination of Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD). Arsenic, Cadmium, Calcium and Magnesium by Titrimetric and Gravimetric Methods.
Unit-V	**Nephelometry and Turbidimetry**-Introduction, Principle, Instrumentation and applications. Flame photometry- Introduction, Principle, Instrumentation and applications.

Part C : Learning Resources -

Books Suggested

1. Pharmaceutical analysis Parimoo, CBS Publisher.
2. Pharmaceutical Analysis theory and practice Kamboj,P.C., Vallabh Publication.
3. A T.B. of Pharmaceutical Analysis I Rao, G. Devala, Birla Publication .
4. A T.B. of Pharmaceutical Analysis II Rao, G. Devala, Birla Publication
5. Pharmaceutical Analysis, Ashutosh Kar, CBS Publisher
6. Pharmaceutical Analysis Practical Sheorey, Sonal, Hanrao, Career Publications
7. Environmental Chemistry,A.K. De, wiley Eastern.
8. Instrumental Methods of Chemical Analysis, G.W. Ewing, McGraw Hill Book Company
9. Fundamental of Analytical Chemistry, Douglas A. Skoog, Donald M. West, F. James Holler Ceneage Learning India Pvt Ltd.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

Department of Pharmaceutical Chemistry
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. II Semester Pharmaceutical Chemistry Session 2021-22

Practical-3 : (PRPC-21)
Time : 6 Hrs.

Credit-3
Max. Marks: 75
Min. Marks: 30

(i)	Volumetric Assay	**20 Marks**
(i)	Gravimetric Analysis	**20 Marks**
(ii)	Chromatography	**18 Marks**
(iv)	Practical Record	**07 Marks**
(v)	Viva	**10 Marks**

(I) Volumetric Assay — **20 Marks**

(a) Ampicillin
(b) Aspirin
(c) Aluminium Hydroxide
(d) Magnesium Sulphate
(e) Chlorpheniramine.
(f) Borax

(II) Gravimetric Analysis — **20 Marks**

(a) Barium as Barium Sulphate.
(b) Iron as Ferric Oxide.
(c) Zinc as Zinc Oxide.

(III) Chromatography — **18 Marks**

(a) Separation of Vitamins by TLC.
(b) Separation of Amino acids by Paper Chromatography
(c) Separation of Dyes by TLC.
(d) Separation of Analgesics by TLC.

(iv) Practical Record — **07 Marks**

(v) Viva — **10 Marks**

Department of Pharmaceutical Chemistry
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. II Semester Pharmaceutical Chemistry Session 2021-22

Practical-4 : (PRPC-22)
Time : 6 Hrs.

Credit-3
Max. Marks: 75
Min. Marks: 30

(i)	Quantitative Analysis	**20 Marks**
(ii)	Investigation / Determination	**20 Marks**
(iii)	Physical parameters of Tablets	**18 Marks**
(iv)	Practical Record	**07 Marks**
(v)	Viva	**10 Marks**

(I) Quantitative Analysis **20 Marks**

(a) Potentiometric Analysis of Sulphanilamide by titration with $NaNO_2$
(b) Conductometric Analysis of Chlorides in Drugs.
(c) Determination of COD (Chemical Oxygen Demand) of Water sample.
(d) Estimation of Phenols using bromate bromide solution/ or Acetylation Method.
(e) Conductometric Analysis of basicity of Sodium potassium Tartrate.

(II) Investigation / Determination **20 Marks**

(a) Determination of Heat of Ionization of Acetic Acid.
(b) Investigation of auto Catalytic reaction between $KMnO_4$ and Oxalic Acid.
(c) Investigation of adsorption of oxalic acid by activated charcoal and test validity of Freundlich and Langmuir, isotherms.
(d) To construct phase diagram for three component system (eg: Chloroform-Acetic Acid-Water).
(e) Determination of Partition Coefficient of Iodine in CCl_4 and water.

(III) Physical parameters of Tablets **18 Marks**

(a) Hardness (b) Friability
(c) Disintegration Test of Coated and Uncoated Tablets and Capsules.
(d) Dissolution Test of Coated and Uncoated Tablets and Capsules.

(iv) Practical Record **07 Marks**

(v) Viva **10 Marks**

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
3. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
4. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
5. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
6. Text Book of Quantitative Chemical Analysis, Vogel, Pearson Education.
7. Practical Pharmaceutical Chemistry, Beckett & Stenlake Vol.-II, CBS Publishers & Distribution.

23/10/2021

Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

M.Sc. III Semester

Syllabus

2021-2022

Govt. Holkar (Model Autonomous) Science College, Indore
Name of Department - Pharmaceutical Chemistry
Syllabus Session 2021 -22
Programme : M.Sc. (Subject) Pharmaceutical Chemistry
Class : M.Sc. III Sem.

Sr. No	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Minimum)	External Assessment Max.	External Assessment mini	Total Max	Total Mini
1	Core 9	MEDICINAL CHEMISTRY	PC-31	4	25	9	75	26	100	35
2	Core 10	CHEMISTRY OF NATURAL PRODUCTS	PC-32	4	25	9	75	26	100	35
3	Elective 1/1	TOXICOLOGY	PC-33-A	4	25	9	75	26	100	35
	Elective 1/2	PHARMACEUTICAL BIOTECHNOLOGY	PC-33-B							
4	Elective 2/1	PHARMACOGNOSY	PC-34-A	4	25	9	75	26	100	35
	Elective 2/2	APPLIED PHARMACEUTICS - I	PC-34-B							
5	Open Elective (Inter disciplinary)	OUT OF ANY GROUP EXCEPT HEALTH CHEMISTRY	OE-35	4	25	9	75	---	100	35
6	Practical - 5	---	PRPC-31	3	---	---	75	---	75	26
7	Practical - 6	---	PRPC-32	3	---	---	75	---	75	26
	---	---	---	**26**	**125**	---	**525**	---	**650**	---

(Dr. V.R. Chourey 29-10-21)

29/10/2021

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. III Sem.
Subject : Pharmaceutical Chemistry
Paper: Core 9
Title of the paper - Medicinal Chemistry

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : PC-31

Part A : Introduction for Code PC (M.Sc. III Sem. I Paper)

1	Pre- requisite (if any)	A student must have to pass M.Sc. II Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand various categories of drugs their classification SAR uses & adverse effects.
	Course Learning outcomes	After successful completion of the course students should be able to
		PC-31-1 Explain classification SAR, therapeutic uses and adverse effects of NSAID's
		PC-31-2 Explain classification, SAR, MOA, synthesis, therapeutic uses and adverse effects of local & general anesthetics.
		PC-31-3 Describe classification synthesis, uses and adverse effects of antihypertensive & diuretic drugs .
		PC-31-4 Explain classification, SAR synthesis, therapeutic uses and adverse effects of anti histaminics, antimalarials, and anti tubercular agents.
		PC-31-5 Explain SAR synthesis, uses, and side effects of sulphonamides and antineoplastic agents.

29/7/14

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. III Semester Pharmaceutical Chemistry Session 2021-22

Paper – 1: Medicinal Chemistry (PC-31)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Non Steroidal Anti-inflammatory drugs (NSAIDs)** Classification and SAR of Heteroaryl acetic acid analogues, Aryl Propionic acid analogues, Salicylic acid analogues. Synthesis, Mode of action, Therapeutic uses and Adverse effects of Indomethacin, Tolmetin Sodium, Ibuprofen, Naproxen, Aspirin, Paracetamol.
Unit II	**A) Local Anesthetics:** Classification, SAR of Local Anesthetics, Mechanism & Site of action of local anesthetics, Synthesis, MOA, Uses and Adverse effects of Benzocaine, Procaine, Lignocaine, Diperodon. **B) General Anesthetics:** Definition, Classification, theories of General anesthetics, Synthesis, Uses, Adverse effects of Cyclopropane , Halothane, Chloroform, Thiopental sodium, Tribromoethanol.
Unit-III	**a) Antihypertensive drugs :** Hypertension-Types and Causes, Classification of Antihypertensives. Synthesis, uses, adverse effects of Metraminol, Naphazoline, Hexamethonium bromide, Methyl Dopa. **b) Diuretics :** Physiology of urine formation, Classification of Diuretics, SAR of Mercurials, Thiazides, Xanthines. Mechanism of action of Mercurials, Carbonic anhydrase Inhibitors, Thiazides and Loop Diuretics. Synthesis, Mode of action, Therapeutic uses and adverse effect of Ethacrynic acid, Furosemide, Chlorothiazide, Acetazolamide.
Unit-IV	**a) Anti-Histaminics:** Introduction , classification and SAR of Anti-Histamines, Mode of action of H_1 and H_2 receptor antagonists. Synthesis, therapeutic uses and adverse effect of Diphenhydramine Hydrochloride, Promethazine HCl, Chlorcyclizine HCl, Antazoline HCl. **b) Antimalarials:** Etiology of Malaria, classification of Anti-malarials, SAR of 4-aminoquinolines and 8-aminoquinolines. Synthesis, Mode of action, therapeutic uses and adverse effects of Chloroquine Phosphate, Amodiaquine Hydrochloride, Primaquine Phosphate, Proguanil Hydrochloride. **c) Anti Tubercular Agents:** Introduction, synthesis, uses and adverse effects of Ethambutol, Isonicotinic acid.
Unit-V	a) **Sulphonamides:** SAR of sulphanilamide. synthesis, uses and side effects of Sulfanilamide, Sulfapyridine, sulfadiazine, b) **Antineoplastic Agents :** Introduction, role of Alkylating Agents, synthesis ,uses, Properties & Side Effect of Mechloroethamine, Cyclophosphamide, Melphalan Uracil.

Part C : Learning Resources -

Books Suggested

1. Principles of Medicinal Chemistry Foye, W.O. Varghese Publication
2. Medicinal Chemistry Kar, Ashitosh.New Age Publication.
3. Burger's Medicinal Chemistry and Drug discovery , Jone-Wiley puplication.
4. Medicinal and Pharmaceutical Chemistry, Harikishan Singh,V. K. Kapoor, Vallabh Prakashan, Delhi.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

29/X/21

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. III Sem.
Subject : Pharmaceutical Chemistry
Paper: Core 10
Title of the paper - Chemistry of Natural Products

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : PC-32

Part A : Introduction for Code PC (M.Sc. III Sem. II Paper)

1	Pre- requisite (if any)	A student must have to pass M.Sc. II Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about chemistry of natural products which can be used as a pharmaceutical agent.
	Course Learning outcomes	After successful completion of the course students should be able to
		PC-32-1 Explain classification occurrence and methods of structure determination of terpenoids & carotenoids.
		PC-32-2 Describe nomenclature, occurrence isolation & methods of structure elucidation of alkaloids.
		PC-32-3 Describe occurrence nomenclature and synthesis, of cholesterol.
		PC-32-4 Explain occurrence, nomenclature, isolation and methods of structure determination of plant pigments and biosynthesis of flavonoids.
		PC-32-5 Explain occurrence classification of prostaglandins, pyrethroids and rotenones.

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. III Semester Pharmaceutical Chemistry Session 2021-22

Paper – 2: Chemistry of Natural Products (PC-32)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Terpenoids and Carotenoids** Classification, nomenclature, occurrence, general methods of structure determination, isoprene rule. Structural determination and synthesis of the following representative compounds: - Citral, Geraniol, α-Terpineol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, and β-Carotene.
Unit II	**Alkaloids** Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, Emde's degradation of alkaloids, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structural determination and synthesis of the following compounds: - Ephedrine, Coniine, Nicotine, Atropine, Quinine and Morphine.
Unit-III	**Steroids** Occurrence, nomenclature, basic skeleton, Isolation, Diels' hydrocarbon. Structural determination and synthesis of Cholesterol, Androsterone , Testosterone, Estrone, Progesterone, Aldosterone.
Unit-IV	**Plant Pigments** Occurrence, nomenclature and general methods of structure determination, Isolation and synthesis of Apigenin, Luteolin, Quercetin, Myricetin, Quercetin 3-glucoside, Daidzein, Cyanidin-7-arabinoside, Hirsutidin chloride, structure determination of Hemoglobin. **Biosynthesis of flavonoids**:- Acetate pathway and Shikimic acid pathway.
Unit-V	a) **Prostaglandin:** Occurrence, classification, biogenesis and physiological effects and Synthesis of PGE2 and PGF2α. b) **Pyrethroids and Rotenones:** Structure, physical and chemical properties and Synthesis of Pyrethroids and Rotenones.

29/4/21

Part C : Learning Resources -

Books Suggested

1. Chemistry of Natural Products, V. K. Ahluwalia, Anne Books Pvt. Ltd.
2. Chemistry of Natural Products, N.R. Krishnaswamy, Universities Press.
3. Organic chemistry of Organic Natural Products I & II Chatwal G.R., Himalaya Publishing House

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time : 3 hours	75	75
		100

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. III Sem.
Subject : Pharmaceutical Chemistry
Paper: Elective 1/1
Title of the paper - Toxicology

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : PC-33-A

Part A : Introduction for Code PC (M.Sc. III Sem. III Paper)

1	Pre- requisite (if any)	A student must have to pass M.Sc. II Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about poisoning, treatment of poisoning & drug dependence.
	Course Learning outcomes	After successful completion of the course students should be able to
		PC-33 (A)-1 Describe toxicants, classification and importance of toxicology and carcinogenicity
		PC-33 (A)-2 Explain drugs of abuse their classification, tolerance and dependence.
		PC-33 (A)-3 Describe poisons, their types and causes of poisoning .
		PC-33 (A)-4 Explain detailed treatment of poisoning of substances like, morphine, alcohol & metals.
		PC-33 (A)-5 Describe drugs & pregnancy and drug interactions.

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. III Semester Pharmaceutical Chemistry Session 2021-22

Paper – 3: Toxicology (PC-33-A)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	a) Definition, Types of Toxicology, Toxicants and its classification, scope and importance of Toxicology b) Carcinogenicity-Introduction to carcinogens, types of carcinogens, Mutagencity, Teratogenicity, Acute, Sub-acute and Chronic Toxicity.
Unit II	**Drug Dependence** a) Definition, Drugs of Abuse, Classification of Drugs of Abuse, Drug Addiction. b) Tolerance and Dependence - Physical Dependence, Psychological Dependence, Mechanism of Tolerance and Dependence.
Unit-III	**Poisoning** Definition, Classification of Poisons, Factors Modifying the action of Poison, Types of Poisoning, Causes of Poisoning, General Treatment and Management of Poisoning.
Unit-IV	**Detailed Treatment of Poisoning of the Following Substance** a) Metals such as – As, Hg, Pb, Zn b) Morphine, L.S.D. c) Alcohol, Barbiturates, Chloroform. d) Salicylates and Paracetamol. e) Digitalis, Nicotine and Cocaine.
Unit-V	a) Environmental Pollution: Types of Pollution, Methods of Control of Pollution. b) Drugs and Pregnancy: Effects of drugs on pregnancy, Teratogenic Drugs, Drugs Contraindicated in Pregnancy. c) Drug Interaction: Definitions, Factors Predisposing to Drug Interactions, Classification and Mechanism of Drugs Interaction, Adverse Drugs Interactions.

29/X/21

Part C : Learning Resources -

Books Suggested

1. Pharmacology and Toxicology, Siddiquie, Anees Ahmad ; Krishna,N. Rama;Jain,S.K.Supernova Pubplishers and Dishtributors.
2. Biochemistry, Kuchel, Philip W.;Ralston,Gregory B., Mcgraw Hill Publ.
3. Essentials of Phrmacotherapeutics, F. S. K. Barar, S. Chand & Co. ,Delhi.
4. Pharmacology and Toxicology , V.N.Raje, CBS Publishers and Dishtributors.
5. fundamentals of Toxicology, Dr. Kamleshwar Pandey, Dr. J.P. Shukla and Dr. S.P. Trivedi

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

29/9/14

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. III Sem.
Subject : Pharmaceutical Chemistry
Paper: Elective 1/2
Title of the paper - Pharmaceutical Biotechnology

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : PC-33-B

Part A : Introduction for Code PC (M.Sc. III Sem. III Paper)

1	Pre- requisite (if any)	A student must have to pass M.Sc. II Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about pharmaceutical biotechnology like vaccinology , genetics immunology & gene therapy.
	Course Learning outcomes	After successful completion of the course students should be able to .
		PC-33 (B)-1 Explain basics of immunology and hypersensitivity .
		PC-33 (B)-2 Describe vaccinology as per pharmaceutical considerations .
		PC-33 (B)-3 Explain genetics and genetics code.
		PC-33 (B)-4 Explain gene cloning monoclonal antibodies and hybridoma technology.
		PC-33 (B)-5 Explain various approaches of gene therapy.

29/9/21

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. III Semester Pharmaceutical Chemistry Session 2021-22

Paper – 3: Pharmaceutical Biotechnology (PC-33-B)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Basics of Immunology:-** Immunity, Cells, Tissues and organs of Immune System. Antigen; Characteristics and types. Antibodies: structure and types; Types of Antigen-Antibody Reactions and its Applications, Hypersensitivity.
Unit II	**Vaccinology:-** Vaccinology- Introduction and Types of Vaccines, Conventional vaccines, Modern Vaccine technologies:- Genetically improved livc vaccines and Genetically improved subunit vaccines as per Pharmaceutical considerations, Recent development in Covid-19 Vaccine.
Unit-III	**Genetics:-** DNA -Structure & Function, Types, Replication & Repair, Expression of Genetic Information, RNA-Structure & Function, Types, Transcription and Reverse Transcription, Translation, Post translational modification, Genetic code.
Unit-IV	**Recombinant DNA Technology:-** Gene Cloning, Restriction enzymes, Types of Vectors, Genomic libraries, Polymerase Chain reaction.(PCR) - Principle and Types, Methodology for Production of Biopharmaceutical by Recombinant DNA Technology: Hormones, Interferons, t-Plasminogen Activator. Monoclonal Antibodies and Hybridoma Technology.
Unit-V	**Gene Therapy:-** General Introduction and approaches for Gene Therapy, Potential target diseases for Gene Therapy. Gene transfer methods, Molecular Principles of Drug Targeting, Drug Delivery System in Gene Therapy and Types, Clinical studies with respect to Gene Therapy.

29/X/21

Part C : Learning Resources -

Books Suggested

1. Industrial Microbiology – A.H.Patel, Mac Millan, India Ltd.
2. Pharmaceutical Biotechnology,P.Vyas and V. K. Dixit , CBS Pulishere and distributors
3. Pharmaceutical Biotechnology , Manoj Kumar, Anmol Publishers
4. Pharmaceutical Biotechnology , M. Sharma and N. Tripathi, Campus International Publication.
5. Industrial Microbiology – L.E.Casida, JR, New Age International (P) Ltd.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

29/11/21

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. III Sem.
Subject : Pharmaceutical Chemistry
Paper: Elective 2/1
Title of the paper - Pharmacognosy

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : PC-34-A

Part A : Introduction for Code PC (M.Sc. III Sem. IV Paper)

1	Pre- requisite (if any)	A student must have to pass M.Sc. II Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about cultivation of medicinal plants and plant tissue culture.
	Course Learning outcomes	After successful completion of the course students should be able to
		PC-34 (A)-1 Explain introduction and classification of drugs from natural origin.
		PC-34 (A)-2 Explain cultivation factors affecting cultivation and plant growth hormones.
		PC-34 (A)-3 Describe classification of carbohydrates.
		PC-34 (A)-4 Describe classification of glycosides .
		PC-34 (A)-5 Explain biomedicinals from plant tissue culture secondary metabolites and phytopharmaceuticals .

Vachoury

29/8/24

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. III Semester Pharmaceutical Chemistry Session 2021-22

Paper – 4: Pharmacognosy (PC-34-A)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Introduction and Classification** History, scope and development of Pharmacognosy. Natural Sources of Drugs: Higher Plants, Microbes, Animals, Marine Organisms. Classifications of Drugs from Natural Origin: Morphological, Taxonomical, organized and unorganized, Pharmacological (Therapeutical), Chemical Classification.
Unit II	**Cultivation and Collection** Cultivation, Factors Affecting Cultivation, Collection, Harvesting, Drying. Plant Growth Hormones-Auxins, Gibberllins, Cytokinins, Abscisic acid, Ethylene. Pest and Pest Control Methods- Mechanical method, Agricultural method, Biological and Chemical control method
Unit-III	**Carbohydrates** Introduction , Classification and Identification tests. Preparation, Chemical constituents and uses of – Honey, Starch, Dextran, Cellulose, Ispaghula, Acacia, Tragacanth,Tamarind , Bael & Agar.
Unit-IV	**Glycosides** Glycosides- Introduction, Classification and Identification tests. Collection and preparation, Chemical Constituents and uses of-Senna, Aloes, Digitalis, Brahmi and Bitter almond. **Resins:** Introduction, Classification. Collection and preparation, Chemical Constituents and uses of-Ginger,Turmeric, Capsicum, Tolu Balsam and Asafoetida.
Unit-V	**Plant tissue culture** Biomedicinals from plant tissue culture- Introduction, types of cultures, composition of culture medium, surface sterilization of Explants. Preparation of Tissue culture from suspension culture, solid culture. Secondary metabolites, usefulness of secondary metabolites. Scope of tissue culture in production of phyto-pharmaceuticals.

29/7/21

Part C : Learning Resources -

Books Suggested

1. Pharmacognosy , C. K. Kokate, A.P. Purohit and S.B.Gokhale , Nirali Publication.
2. Pharmacognosy and Pharmacobiotechnology, Ashutosh kar, New age of Int. Publ.
3. Text Book of Pharmacognosy, S.S.Handa & V. K. Kapoor, Nirali Publication.
4. Text Book of Pharmacognosy , Shah & Quadry, CBS Publishers and Distributors.
5. Pharmacognosy & Phyto Chemistry Part 1 Rangari, V.D., Career Publication.
6. Pharmacognosy & Phyto Chemistry Part 2 Rangari, V.D. Career Publication.
7. Pharmacognosy , V. N. Raje, CBS Publishers and Distributors.
8. Text Book of Pharmacognosy , G. K. singh and Anil Bhandari, CBS Publishers and Distributors.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

29/X/24

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. III Sem.
Subject : Pharmaceutical Chemistry
Paper: Elective 2/2
Title of the paper - Applied Pharmaceutics - I

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : PC-34-B

Part A : Introduction for Code PC (M.Sc. III Sem. IV Paper)

1	Pre- requisite (if any)	A student must have to pass M.Sc. II Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about various topics of applied pharmaceutics.
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-34 (B)-1 Explain material handling systems & fluid flow.
		PC-34 (B)-2 Explain filtration and centrifugation methods for extraction of pharmaceutical compound
		PC-34 (B)-3 Explain surgical products and packaging of pharmaceutical product.
		PC-34 (B)-4 Explain cosmetic science, and cosmetic preparations.
		PC-34 (B)-5 Explain physical & chemical properties of drugs.

29/X/14

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. III Semester Pharmaceutical Chemistry Session 2021-22

Paper – 4: Applied Pharmaceutics - I (PC-34-B)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Fluid Flow:** Types of flow, Reynold's number, Viscosity, Concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure. **Material Handling Systems:** Liquid handling - Different types of pumps. Gas handling-Various types of fans, blowers and compressors. Solid handling-Bins, Bunkers, Conveyers, Air transport.
Unit II	**Filtration and Centrifugation** Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, and centrifugal sedimenters. Principle and method of extraction, preparation of infusion, tinctures, dry and soft liquid extracts.
Unit-III	**Surgical products** Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc., bandages, adhesive tape, protective cellulosic hemostastics, official dressings, absorbable and nonabsorbable sutures. Medical prosthetics and organ replacement materials. **Packaging of Pharmaceutical Products:** Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.
Unit-IV	**Cosmeticology and Cosmetic Preparations:** Fundamentals of cosmetic science, structure and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin, hair, dentifrice and manicure preparations like nail polish, Lipsticks, eye lashes, baby care products.
Unit-V	**Preformulation studies** Study of physical properties of drug like physical form, particle size, shape, density, wetting dielectric constant. Solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability. Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc., and their influence on formulation and stability of products.

29/1/14

Part C : Learning Resources -

Books Suggested:

1.Introduction to Pharmaceutical Dosage, Ansel H C, Forms, K M Varghese & Co., Bombay.
2.Pharmaceutical Dosage Forms; Parenteral Medications, Vols. 1& 2 Avis K E, Lachman L and Licberman H A, Marcel Dekker Inc., NY.
3.Modem Pharmaceutics, Banker G S and Rhode C T Marcel Dekker Inc., NY.
4. Advances in Pharmaceutical Sciences, Vol 1-4, Bean H S, Beckett A H, and Carless A H, Academic Press, London.
5.Dispensing for Pharmaceutical Students, Carter S. 1. Cooper and Gunn's, CBS Publishers, Delhi.
6.Chemical Stability of Pharmaceuticals, Connores KA, Amiden GLand Stella V J, John Wiley & Sons, NY.
7.Remington's The science and Practice of Pharmacy; Mack Publishing Co. Easton, Pernsybrania.
8. "Pharmaceutical Dosage Forms; Dispense Systems; Vols. 1 &2, Liberman H A. Rieger M M and Banker G 8, Marcel Dekker Inc., NY.
9. Handbook of Basic Pharmacokinetics; Ritschel W A, Drug Intelligence Publications, Hamilton.
10. The Theory and Practice of Industrial Pharmacy; Lachmen L, Lieberman HA and Kanig J L, Lea & Febiger, Philadelphia.
11. Text Book of Hospital Pharmacy; Merchant H.S and Qadry J. S, B.S. Shah Prakashan, Ahmedabad.
12. A Text Book of Forsenic Pharmacy; Mittal B.M., National Book Depot, Calcutta
13. Physical Pharmacy; Martin A N, Arthur Cammarata, James Swarbrick, K M Varghese & Co., Bombay.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	**25**
External Assessment: External Exam : 75 Time : 3 hours	**75**	**75**
		100

29/X/14

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. III Sem.
Subject : Pharmaceutical Chemistry
Paper: Open Elective OE-35
Title of the paper - Health Chemistry

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : OE-35

Part A : Introduction for Code PC (M.Sc. III Sem. V Paper)

1	Pre- requisite (if any)	A student must have to pass M.Sc. II Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about types of drugs body fluids enzymes, hormones, and common diseases.
	Course Learning outcomes	After successful completion of this course students should be able to
		OE-35-1 Explain biological functions of carbohydrates proteins & vitamins.
		OE -35-2 Explain drugs & their types .
		OE -35-3 Explain body fluids.
		OE -35-4 Explain types of enzymes & hormones.
		OE -35-5 Explain some common diseases.

Vachoury

29/7/21

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. III Semester Pharmaceutical Chemistry Session 2021-22

Paper – 5: Health Chemistry (OE-35)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Health** Definition:- Food, Food Pyramid, Health, Hygiene, mal , under and over nutrition , their causes and remedies, sanitation, Carbohydrates :- Classification, Biological functions. Proteins :- Classification, Biological functions. Vitamins- Classification, Biological functions. **Drugs** Drugs:- Types of drugs, depressant, anticonvulsant, narcotics, antipyretics, antibiotics, antiseptics, analgesics, muscle relaxants and cardiovascular and vasodepressants, Steroids.
Unit II	**Drugs** Drugs:- Types of drugs, depressant, anticonvulsant, narcotics, antipyretics, antibiotics, antiseptics, analgesics, muscle relaxants and cardiovascular and vasodepressants, Steroids.
Unit-III	**Body fluids** Blood volume, groups, coagulation, blood pressure, anemia, blood sugar, heamoglobin ,chemistry of respiration, urine, electrolyte balance.
Unit-IV	**Enzymes, Hormones, Digestion** Types of enzymes and enzyme action, Characters of hormones action, examples of essential hormones, digestion in mouth, stomach, intestine and pancreas, mineral metabolism.
Unit-V	**Common Diseases** Toxicants in food cancer,types and causes, common diseases:- Jaundice, vomiting, fever, rickets, scurvy, beriberi, pellagra, night blindness, ulcer, gout, goiter, diabetes, anemia and their causes,

29/4/14

Part C : Learning Resources -

Books Recommended

1. Jayashree Ghosh, A Text book of Pharmaceutical Chemistry, S. Chand and Co. Ltd, 1999. UNITS II and V
2. Alex V Ramani, Food Chemistry, MJP Publishers, Chennai, 2009 UNIT I
3. Deb A C, Fundamentals of Biochemistry, New Central Book Agency, Calcutta, 1994. UNIT III
4. Satake M and Mido Y, Chemistry for Health Science, Discovery Publishing House, New Delhi, 2003 UNIT I and III
5. Ashutosh Kar, Medicinal Chemistry, Wiley Easterns Limited, New Delhi, 1993 UNIT II & IV

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

Department of Pharmaceutical Chemistry
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. III Semester Pharmaceutical Chemistry Session 2021-22

Practical-5 : (PRPC-31)
Time : 6 Hrs.

Credit-3
Max. Marks: 75
Min. Marks: 30

(i)	**Titrimetric Method**	
(ii)	**Spectrophotometric (UV Visible) Determination**	**20 Marks**
(iii)	**Chromatography**	**20 Marks**
(iv)	**Practical Record**	**18 Marks**
(v)	**Viva**	**07 Marks**
		10 Marks

(I) **Titrimetric Method** 20 **Marks**

(a) Determination of Solubility of Benzoic Acid in Water at different temperature and hence its heat of solution.
(b) Estimation of available Chlorine in Bleaching Powder by Iodometric Methods.
(c) Estimation of available Oxygen in Hydrogen Peroxide by $KMnO_4$ Method.
(d) Determination of Heat of Neutralization of Strong acid and Strong base.

(II) **Spectrophotometric (UV Visible) Determination** 20 **Marks**

(a) Determination of the wavelength of maximum absorbance and molar extinction coefficient of given sample.
(b) Determination of Paracetamol and Ibuprofen in the given Tablets.
(c) Determination of Phosphate Concentration in a Soft Drink.
(d) UV Visible determination of Following groups of Compounds
(i) Amino Acids (ii) Proteins (iii) Cholesterol (iv) Ascorbic Acid
(v) Aspirin (vi) Riboflavin

(III) **Chromatography** **18 Marks**

(i)Separation and Identification of Sugar Present in the given Mixture of Glucose, Fructose and Sucrose by Paper Chromatography.
TLC - (i) Separation of Zn and Mg.(ii) Separation of Cd and Zn
(iii) Ni and Mn. (iv) Co and Zn.
(v)Separation of Anthracene and Picric Acid from Anthracene Picrate by Column Chromatography.
(vi) Column Chromatography of Plant pigments.

(iv) **Practical Record** **07 Marks**

(v) **Viva** **10 Marks**

29/X/14

Department of Pharmaceutical Chemistry
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. III Semester Pharmaceutical Chemistry Session 2021-22

Practical-6: (PRPC-32)
Time : 6 Hrs.

Credit-3
Max. Marks: 75
Min. Marks: 30

(i) Optical Method of Analysis	20 Marks
(ii) Flame Photometric Determination	18 Marks
(iii) Assay of Drugs	20 Marks
(iv) Practical Record	07 Marks
(v) Viva	10 Marks

(I) Optical Methods of Analysis **20 Marks**

Polarimeter-

(a) Determine the relationship between Optical Activity and Concentration.
(b) Study the Influence of Solvent on Optical Rotation of Camphor.
(c) Determine the percentage of optically active substances in the given solution.
(d) Determine the Optical Rotation of Carbohydrates.
(e) Determine the Optical Rotation of Amino acids.

(II) Flame Photometric Determination **18 Marks**

(a) Determination of Sodium in Pharmaceutical compound.
(b) Determination of Potassium in Pharmaceutical compound.

(III) Assay of Drugs(Volumetrically) **20 Marks**

(a) Ibuprofen.
(b) Analgin.
(c) Ascorbic acid.
(d) Calcium ions in Calcium gluconate injection.

(IV) Practical Record **07 Marks**

(V) Viva **10 Marks**

29/X/14

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Books Suggested

1. Practical Pharmaceutical Chemistry - I Backett, A.H., CBS Publishers and Dishtributors.
2. Principles of Pharmaceutical Organic Chemistry R.R. Nadenla, New Age International
3. Practical Pharmacognosy Rakesh Gupta , Macmillon Publ.
4. Vogel's Text Book of Quantitative Chemical Analysis , J. Mendham, D.J. Barnes and R.C. Denney,
5. Pearson Publication.

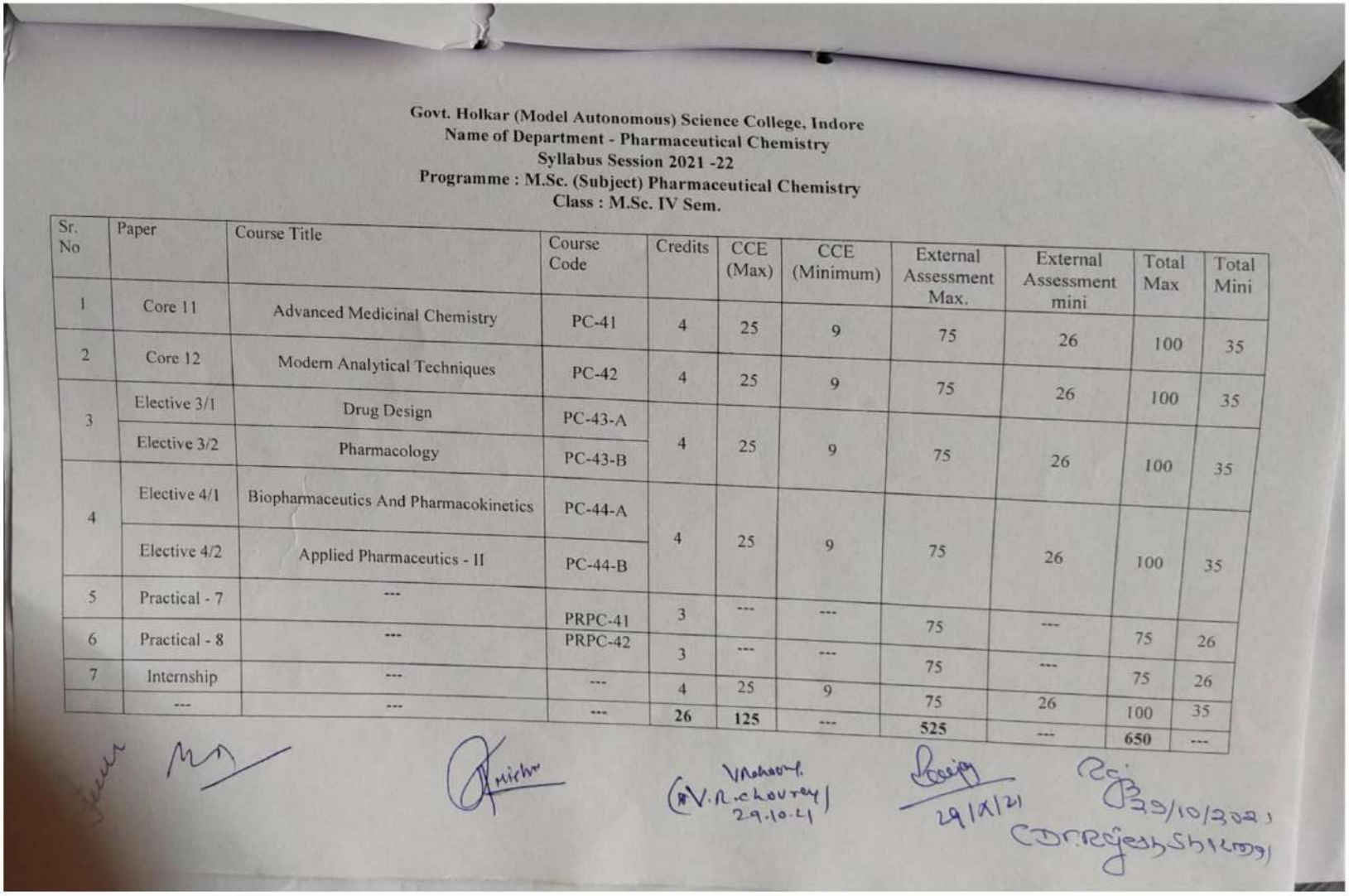
Govt. Holkar (Model, Autonomous) Science College, Indore

Department of Pharmaceutical Chemistry

M.Sc. IV Semester

Syllabus

2021-2022



Govt. Holkar (Model Autonomous) Science College, Indore
Name of Department - Pharmaceutical Chemistry
Syllabus Session 2021 -22
Programme : M.Sc. (Subject) Pharmaceutical Chemistry
Class : M.Sc. IV Sem.

Sr. No	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Minimum)	External Assessment Max.	External Assessment mini	Total Max	Total Mini
1	Core 11	Advanced Medicinal Chemistry	PC-41	4	25	9	75	26	100	35
2	Core 12	Modern Analytical Techniques	PC-42	4	25	9	75	26	100	35
3	Elective 3/1	Drug Design	PC-43-A	4	25	9	75	26	100	35
	Elective 3/2	Pharmacology	PC-43-B							
4	Elective 4/1	Biopharmaceutics And Pharmacokinetics	PC-44-A	4	25	9	75	26	100	35
	Elective 4/2	Applied Pharmaceutics - II	PC-44-B							
5	Practical - 7	---	PRPC-41	3	---	---	75	---	75	26
6	Practical - 8	---	PRPC-42	3	---	---	75	---	75	26
7	Internship	---	---	4	25	9	75	26	100	35
	---	---	---	26	125	---	525	---	650	---

V.R. Chourey 29.10.21

29/12/21

29/10/2021

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. IV Sem.
Subject : Pharmaceutical Chemistry
Paper: Core 11
Title of the paper - Advanced Medicinal Chemistry

Marks: 75 + (CCE) 25 = 10
Credit : 4

Code of the paper : PC-41

Part A : Introduction for Code PC (M.Sc. IV Sem. I Paper)		
1	Pre- requisite (if any)	Students must pass M.Sc. III Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand advanced medicinal chemistry and pharmacodynamics of some categories of drugs.
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-41-1 Explain types of diabetes, physiology of insulin and therapy of hyperthyroidism
		PC-41-2 Explain significance of drugs metabolism in medicinal chemistry
		PC-41-3 Explain skeletal muscle relaxants, narcotic analyzers and anti cholinergic drugs.
		PC-41-4 Explain classification MOA, SAR, therapeutic uses and side effects of immunosuppressant, anticoagulants and antiplatelet drugs.
		PC-41-5 Explain antiparkinsonism, antihyperlipdemic, antifungal and antiulcer drugs.

29/X/21

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. IV Semester Pharmaceutical Chemistry Session 2021-22

Paper – 1: Advanced Medicinal Chemistry (PC-41)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Insulin** – types of diabetes, physiological functions of insulin, insulin preparations, insulin deficiency and adverse effects. b) Hormones- Introduction, thyroid hormones, SAR, diseases of thyroid gland, drugs used in therapy of hyperthyroidism.
Unit II	**Pharmacodynamics** Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, membrane active drugs, drug metabolism, xenobiotics, significance of drug metabolism in medicinal chemistry.
Unit-III	a) **Skeletal muscle Relaxants-** Introduction, classification, synthesis, properties & uses of Mephenesin, Succinyl choline chloride, Metaxalone. b) **Narcotic Analgesics** -Introduction, classification, SAR of Meperidine Analogues & Diphenyl heptanone. c) **Anticholinergic Drugs-** Introduction, SAR of Atropine & Muscarinic antagonists.
Unit-IV	Classification, mode of action, SAR, side effects, & Therapeutic uses of the following category of drugs. a) Anticoagulants and Anti Platelets Drugs b) Immunosupressants c) Antiviral and anti HIV agents d) Antiprotozoal agents
Unit-V	a) **Antiparkinsonism agents-** Introduction, MOA, Synthesis, Properties & uses of Biperiden HCL,Carbidopa. b) **Antihyperlipdemic agents** - Introduction, classification, synthesis, properties & uses of Ciprofibrate, Nicotinic acid. c) **Antifungal drugs-** Classification, mode of action, SAR, side effects & therapeutic uses. d) **Antiulcer drugs-** Classification, mode of action, SAR, side effects & therapeutic uses.

Vachowry 29/8/14

Part C : Learning Resources -

Books Suggested

1. Medicinal Chemistry, V. K. Ahluwalia and M. Chopra, CRC Press.
2. Medicinal Chemistry Kar, Ashutosh., New Age International Publication.
3. An introduction to Medicinal Chemistry Patrick, Graham, Oxford Publication.
4. Medicinal Chemistry : An introduction, Thomas Gareth, Wiley India Pvt. Ltd.
5. Principles of Medicinal Chemistry Foye, W.O. Varghese Publication
6. Burger's Medicinal Chemistry and Drug discovery , Jone-Wiley publication.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. IV Sem.
Subject : Pharmaceutical Chemistry
Paper: Core 12
Title of the paper - Modern Analytical Techniques

Marks: 75 + (CCE) 25 = 10
Credit : 4

Code of the paper : PC-42

Part A : Introduction for Code PC (M.Sc. IV Sem. II Paper)		
1	Pre- requisite (if any)	A students must have to pass M.Sc. III Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about various modern analytical techniques.
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-42-1 Explain instrumentation, theory of FTIR and c^{13} NMR spectroscopy.
		PC-42-2 Explain theory, instrumentation & applications of mass spectroscopy.
		PC-42-3 Explain theory, instrumentation and applications of Fluorimetry and Phosphorimetry
		PC-42-4 Explain immunoassay techniques.
		PC-42-5 Explain thermal methods & polarimetry.

29/7/21

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. IV Semester Pharmaceutical Chemistry Session 2021-22

Paper – 2: Modern Analytical Techniques (PC-42)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**FT-IR:-** Theory, Instrumentation, sample preparation, working, Advantages, Limitations and its applications. C^{13} NMR: Introduction, Chemical shifts, Factors affecting chemical shift, Coupling and Decoupling , Splitting and applications of C^{13} NMR
Unit II	**Mass Spectroscopy :-** Theory, Instrumentation , Fragmentation pattern, Types of Ions produced in Mass Spectrometer and Applications for Structural elucidation. Applications of GC-Mass, HPLC-Mass for complex mixtures.
Unit-III	Theory, Instrumentation and application of the following: (a) Ultra centrifugation (b) Liquid Scintillation counting (c) Auto radiography **Fluorimetry and Phosphorimetry:-** Introduction, Theory, Factors affecting Fluorescence and Phosphorescence, Instrumentation, Relation between Fluorescence intensity and Concentration ,Comparison of Fluorimetry and Phosphorimetry. Applications of Fluorimetry and Phosphorimetry.
Unit-IV	**Immunoassay Techniques:-** (a)ELISA -Introduction, Principle, Types , Procedure and Applications of ELISA. (b) Radioimmunoassay -Introduction, Theory, Methods and Applications.
Unit-V	**Thermal methods:-** (a)Thermo Gravimetry (TG) – Introduction, Factors Affecting Thermogravimetric curves , Instrumentation and Applications. (b)Differential Scanning Calorimetry (DSC) - Introduction, Factors Affecting DSC curves , Instrumentation and Applications. (c)Differential Thermal Analysis (DTA)-Introduction, Factors affecting DTA curve, Instrumentration and Applications. Polarimetry :- Introduction, Theory , Optical Activity , Factors affecting Optical Activity, Instrumentation and Applications.

29/8/21

Part C : Learning Resources -

Books suggested

1. Modern Spectroscopy, J.M. Hollas, John Viley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V.Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
6. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
7. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, Harper & Row.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

29/X/21

Department of Pharmaceutical Chemistry

Class : M.Sc. IV Sem.
Subject : Pharmaceutical Chemistry
Paper: Elective 3/1
Title of the paper - Drug Design

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : PC-43-A

	Part A : Introduction for Code PC (M.Sc. IV Sem. III Paper)	
1	Pre- requisite (if any)	A students must pass M.Sc. III Sem. in Pharmaceutical Chemistry.
	Course Objectives	To make students understand about various perspectives of drug design .
2	Course Learning outcomes	After successful completion of this course students should be able to
		PC-43 (A)-1 Explain historical perspective, introduction to drug design & discovery.
		PC-43 (A)-2 Describe prodrug, soft drug and structure based drug design
		PC-43 (A)-3 Explain pharmacophoric approach for drug designing
		PC-43 (A)-4 Explain fundamentals of QSAR
		PC-43 (A)-5 Describe significance of computers in medicinal chemistry

29/8/21

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. IV Semester Pharmaceutical Chemistry Session 2021-22

Paper – 3: Drug Design (PC-43-A)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Introduction to Drug Design & Discovery** Historical Development, factors affecting drug development , Generation of Lead Compound & Lead Optimization with example, Cell Biology & Genomics as a Source of Drugs, molecular modification of lead compouds.
Unit II	**I) Prodrugs and Soft drugs –** a) Prodrugs-Introduction ,prodrug formation of compounds containing various chemical groups,multiple prodrug formation. b) Soft drugs-introduction and advantages ,uses of soft drugs principle. **II) Structure based drug design-** Process of Structure based drug design and methods of design of enzyme inhibitors.
Unit-III	**Pharmacophoric Approach** Pharmacophore Based Ligand Design, Pharmacophore Concept, Pharmacophore Elements and Representation, Active Conformation, Molecular Superimposition, Receptor Excluded and Receptor Essential Volumes, Solvation Effects, Examples of 3D Pharmacophore Models and their Use.
Unit-IV	**Quantitative Structure Activity Relationships (QSAR)** Fundamentals of QSAR, Biological Data, the additivity of Group Contribution Hansch Analysis and related approaches, physicochemical properties, Statistical methods in QSAR, application of Hansch and related approaches, 3D QSAR approach.
Unit-V	**Computers in Medicinal Chemistry** Generation of 3D coordinates, Sketch approach, conversion of 2D structure in 3D form, force field, geometry optimization, energy minimizing procedures, Quantum mechanical methods, conformational analysis, pharmacophore identification, molecular modeling in 3D QSAR – CoMFA and related methods.

29/1/21

Part C : Learning Resources -

Books Suggested

1. An introduction to drug design S.N. Pandeya, J.R. Dimmock
2. An introduction to Medicinal Chemistry Patrick, Graham, Oxford Publ.
3. Instant Notes: Medicinal Chemistry Patrick, Graham, Taylor Frncis Publ.
4. Medicinal Chemistry Kar, Ashutosh. New Age International Publ.
5. Principles of Medicinal Chemistry Foye, W.O. Varghese Publication
6. Drug Design, S. Morris, Sarup Book Publ.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

29/X/21

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class : M.Sc. IV Sem.
Subject : Pharmaceutical Chemistry
Paper: Elective 3/2
Title of the paper - Pharmacology

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : PC-43-B

Part A : Introduction for Code PC (M.Sc. IV Sem. III Paper)		
1	Pre- requisite (if any)	A students must have to pass M.Sc. III Sem. in Pharmaceutical Chemistry
2	Course Objectives	To make students understand about general pharmacological and psychopharmacological agents.
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-43 (B)-1 Describe neurohumoral transmission in CNS
		PC-43 (B)-2 Explain psychopharmacological agents.
		PC-43 (B)-3 Describe drugs acting in the gastrointestinal track.
		PC-43 (B)-4 Describe drugs acting on the hematopoietic system.
		PC-43 (B)-5 Explain autacoids.

29/X/21

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. IV Semester Pharmaceutical Chemistry Session 2021-22

Paper – 3: Pharmacology (PC-43-B)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**General Pharmacology:** Dosage forms , Routes of Administration, Tolerance, Dependence and ADME of Drugs. A)**Neurohumoral Transmission in CNS** i) Steps involved in Neurohumoral Transmission in CNS. ii) Detailed study about neurotransmitters a) Acetyl choline b) Serotonin c) Dopamine d) GABA **B) General Anesthetics**
Unit II	**Psychopharmacological Agents** a) Antipsychotics b) Antidepressants c) Antimanics d) Hallucinogens e) Anti-anxiety agents
Unit-III	**Drugs Acting on the Gastrointestinal Tract** a) Antacids, Anti-ulcer Drugs b) Laxatives and Anti-diarrheal Drugs c) Emetics and Anti-emetics
Unit-IV	**Drugs Acting on the Haematopoietic System** a) Hematinics. b) Anti-coagulants and Hemostatic Agents. c) Fibrinolytic and Anti-platelet Drugs. d) Blood and Plasma Volume Expanders.
Unit-V	**Autocoids-** a) Histamine and Antihistaminics. b) Euiconosoids- Prostaglandins, Leukotrienes, Thromboxanes. c) Nonsteroidal Anti-inflammatory drugs, Antipyretic and Analgesics.

29/X/21

Part C : Learning Resources -

Books Suggested

1. Essentials of Medical Pharmacology, K.D.Tripathi, Jaypee Bro.Med. Pupl.
2. Pharmacology & Pharmacotherapeutics I Satoshakar , Popular Prakashan Pvt. Ltd.
3. Pharmacology & Pharmacotherapeutics II Satoshakar , Popular Prakashan Pvt. Ltd.
4. Essential of Pharmacology , S. singh, New Age International Publ.
5. Essential of Pharmacology , D.K. Basu, CBS Publishers and Dishtributors.
6. Pharmaceutical Pharmacology, S. C. Mehta and Ashutosh Kar, New Age International Publ.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

29/7/24

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class: M.Sc. IV Sem.
Subject: Pharmaceutical Chemistry
Paper: Elective 4/1
Title of the paper - Biopharmaceutics and Pharmacokinetics

Marks: 75 + (CCE) 25 = 100
Credit: 4

Code of the paper: PC-44-A

Part A : Introduction for Code PC (M.Sc. IV Sem. IV Paper)		
1	Pre- requisite (if any)	A students must have to pass M.Sc. III Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand about various topics like biopharmaceutics, pharmacokinetics, bioavailability and bioequivalence of the drugs.
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-44 (A)-1 Explain biopharmaceutics and methods of studying gastrointestinal absorption.
		PC-44 (A)-2 Describe pharmacokinetics of the drugs.
		PC-44 (A)-3 Explain compartment models of pharmacokinetic drug interactions.
		PC-44 (A)-4 Explain clinical pharmacokinetics and their applications.
		PC-44 (A)-5 Describe bioavailability & bioequivalence.

29/8/21

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. IV Semester Pharmaceutical Chemistry Session 2021-22

Paper – 4: Biopharmaceutics And Pharmacokinetics (PC-44-A)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks: 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Biopharmaceutics** Definition, passage of drugs across biological barrier, cell membrane- structure and physiology with reference to gastrointestinal absorption of drugs and mechanisms of drug absorption. **Methods of Studying Gastrointestinal Absorption** – In vitro and in vivo Method Factors influencing drug absorption and bio-availability from its dosage form. (a) Physicochemical factors (b) dosage form characteristics and pharmaceutic ingredients (c) Patient related factors.
Unit II	**Pharmacokinetics** Distribution of drugs, Tissue permeability and physiologic barriers to distribution of drugs, protein binding and its significance, Biotransformation of drugs (phase I & Phase II reactions), excretion of drugs.
Unit-III	**Compartment Models** Pharmacokinetic drug interactions and their significance in combination therapy , plasma drug concentration , pharmacokinetic models, zero order, first order and mixed order kinetics, non-compartmental analysis, concept of prodrugs.
Unit-IV	**Clinical Pharmacokinetics** Pharmacokinetic parameters with reference to one compartment model, Apparent volume of distribution, clearance, curve fitting method of absorption rate constant, urinary excretion data criteria for obtaining valid urinary excretion data rate, applications of pharmacokinetic principles.
Unit-V	**Bioavailability and Bioequivalence** Studies of bioavailability and bio-equivalence, measurement of bioavailability methods for enhancement of bioavailability, Federal requirements.

29/8/21

Part C : Learning Resources -

Books Suggested

Biopharmaceutics and Pharmacokinetics Chatwal, G.R., Himalaya Publishing House.
Principles & applications of Biopharmaceutics & Pharmacokinetics Tipnis & Bajaj, Career Publ.
Biopharmaceutics & Pharmacokinetics, Kulkarni, CBS Publishers and Distributors.
Essentials of Biopharmaceutics & Pharmacokinetics, Ashutosh Kar, New Age International Publ.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods: By Presentation, PPT, By Test, By written Exam
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time : 3 hours	75	75
		100

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Pharmaceutical Chemistry

Class: M.Sc. IV Sem.
Subject: Pharmaceutical Chemistry
Paper: Elective 4/2
Title of the paper - Applied Pharmaceutics – II

Marks: 75 + (CCE) 25 = 100
Credit: 4

Code of the paper: PC-44-B

Part A : Introduction for Code PC (M.Sc. IV Sem. IV Paper)		
1	Pre- requisite (if any)	A students must have to pass M.Sc. III Sem. in Pharmaceutical Chemistry.
2	Course Objectives	To make students understand various pharmaceutical dosage forms like tablets, capsules, liquids semisolids, parenteral & ophthalmic preparations.
	Course Learning outcomes	After successful completion of this course students should be able to
		PC-44 (B)-1 Explain manufacturing & types of tablets
		PC-44 (B)-2 Describe capsule dosage forms.
		PC-44 (B)-3 Explain liquid & semisolid dosage forms
		PC-44 (B)-4 Explain parenteral products and ophthalmic preparations
		PC-44 (B)-5 Describe micro capsulation.

29/8/14

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Part B : Content of the Course

Department of Pharmaceutical Chemistry
Govt. Holkar (Model Autonomous) Science College, Indore
M.Sc. IV Semester Pharmaceutical Chemistry Session 2021-22

Paper – 4: Applied Pharmaceutics – II (PC-44-B)

M. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	**Tablets** Formulation of different types of tablets, granulation, technology on large-scale by various techniques, different types of tablet compression machinery and the equipment's employed, evaluation of tablets. Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipment's for coating, coating process, evaluation of coated tablets. Stability and quality assurance.
Unit II	**Capsules** Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, method of capsule filling, soft gelatin, capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.
Unit-III	**Liquid and Semisolid Dosages Forms** **Liquid Dosage Forms:** Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizer, colors, flavors and others, manufacturing packaging and evaluation of clear liquids. **Semisolid Dosage Forms**: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging.
Unit-IV	**Parenteral Products** Preformulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment Formulation details, containers and closures. Prefilling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophillization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products. **Ophthalmic Preparations:** Requirements, formulation, methods of preparation, containers, evaluation.
Unit-V	**Micro-encapsulation** Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, coacervation, multi orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.

29/X/21

Part C : Learning Resources -

Books Suggested

1.Introduction to Pharmaceutical Dosage Ansel H.C., Forms, K M Varghese & Co., Bombay.
2.Pharmaceutical Dosage Forms; Parenteral Medications, Vols. 1& 2 Avis K E, Lachman L. and Lieberman H. A., Marcel Dekker Inc., NY.
3.Modem Pharmaceutics Banker G S and Rhode C T Marcel Dekker Inc., NY.
4. Advances in Pharmaceutical Sciences, Vol. 1-4 Bean H S, Beckett A H, and Carless A.H., Academic Press, London.
5.Dispensing for Pharmaceutical Students, Carter S. 1. Cooper and Gunn's CBS Publishers, Delhi.
6.Chemical Stability of Pharmaceuticals, Connors KA, Amiden G. Land Stella V J, John Wiley & Sons NY.
7.Remington's The science and Practice of Pharmacy, Mack Publishing Co. Easton, Pernsybrania.
8. "Pharmaceutical Dosage Forms; Dispense Systems, Vols. 1 &2, Lieberman H.A., M. Rieger and Banker G., Marcel Dekker Inc., NY.
9. Handbook of Basic Pharmacokinetics, Ritschel W A, Drug Intelligence Publications, Hamilton.
10. The Theory and Practice of Industrial Pharmacy, Lachman L., Lieberman H.A., CBS publication.
11. Text Book of Hospital Pharmacy, Merchant H.S and Qadry J. S, B.S. Shah Prakashan, Ahmedabad.
12. A Text Book of Forensic Pharmacy, Mittal B.M. National Book Depot, Calcutta
13. Physical Pharmacy, Martin A N, Arthur Cammarata, James Swarbrick, K M Varghese & Co., Bombay.

Part D – Assessment and Evaluation

Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75

Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

Department of Pharmaceutical Chemistry
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. IV Semester Pharmaceutical Chemistry Session 2021-22

Practical-7 : (PRPC-41)
Time : 6 Hrs.

Credit-3
Max. Marks: 75
Min. Marks: 30

(i)	**Instrumental Analysis**	**20 Marks**
(ii)	**Synthesis of Drugs**	**20 Marks**
(iii)	**Spectrophotometric estimation**	**18 Marks**
(iv)	**Practical Record**	**07 Marks**
(v)	**Viva**	**10 Marks**

(I) (a) Instrumental Analysis **20 Marks**

(a) Determination of Sulphate by Nephelometric Method.
(b) Conductometric Titration of:
(i) Strong acid Vs strong base (ii) Strong acid Vs weak base
(iii) Weak acid Vs strong base (iv) Weak acid Vs weak base
(c) To prepare buffer of pH 4 and 7 and determine their pH using pH meter.
(d) Karl Fisher Method for Determination of Water in Pharmaceutical Analysis.
(e) Determination of Concentration of Permanganate by using Ferrous ion Potentiometrically.

(II) Synthesis of Drugs **20 Marks**

(a) 6-Methyl uracil.
(b) Chlorbutol.
(c) Benzocaine.
(d) Phenytoin.

(III) Spectrophotometric estimation **18 Marks**

(i) Estimation of Paracetamol by using Spectrophotometer.
(ii) Estimation of Chlorophyll by using Spectrophotometer.
(iii) Estimation of iron in Tablets by Isothiocynate method.
(iv) Estimation of Ammonium Chloride using Nessler's reagent
(v) Estimation of amount of Copper (II) with EDTA by using Spectrophotometer.
(vi) Determination of pK value of methyl red indicator at room temperature by using Spectrophotometer.

(iv) Practical Record **07 Marks**

(v) Viva **10 Marks**

Vacancy

29/8/24

Department of Pharmaceutical Chemistry
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. IV Semester Pharmaceutical Chemistry Session 2021-22

Practical-8 : (PRPC-42)
Time : 6 Hrs.

Credit-3
Max. Marks: 75
Min. Marks: 30

(i)	**Solvent Extraction**	**20 Marks**
(ii)	**Water Analysis**	**20 Marks**
(iii)	**Pharmaceutical and Cosmetic Preparations**	**18 Marks**
(iv)	**Practical Record**	**07 Marks**
(v)	**Viva**	**10 Marks**

Solvent Extraction **20 Marks**

Separate and estimate Mg (II) and Fe (III) by Solvent Extraction Method.
Separation and identification of aspirin and caffeine from given analgesic tablet.

(II) Water Analysis **20 Marks**

Determination of Following Parameters in the given water sample-
Colour, Odour, Turbidity, pH, Electrical Conductivity, Acidity, Alkalinity, Hardness, Total Solids, Total Dissolved Solids, Total Suspended Solids and some other detectable parameters.

(III) Pharmaceutical and Cosmetic Preparation **18 Marks**

(a) Camphor Liniment.
(b) After Shave Lotion.
(c) Simple Shampoo.
(d) Compact Powder.
(e) Cleansing Cream.
(f) Calamine Lotion.
(g) Iodine containing ointment.
(h) Benzyl Benzoate Emulsion.
(i) Crystal violet paint.

(iv) Practical Record **07 Marks**

(v) Viva **10 Marks**

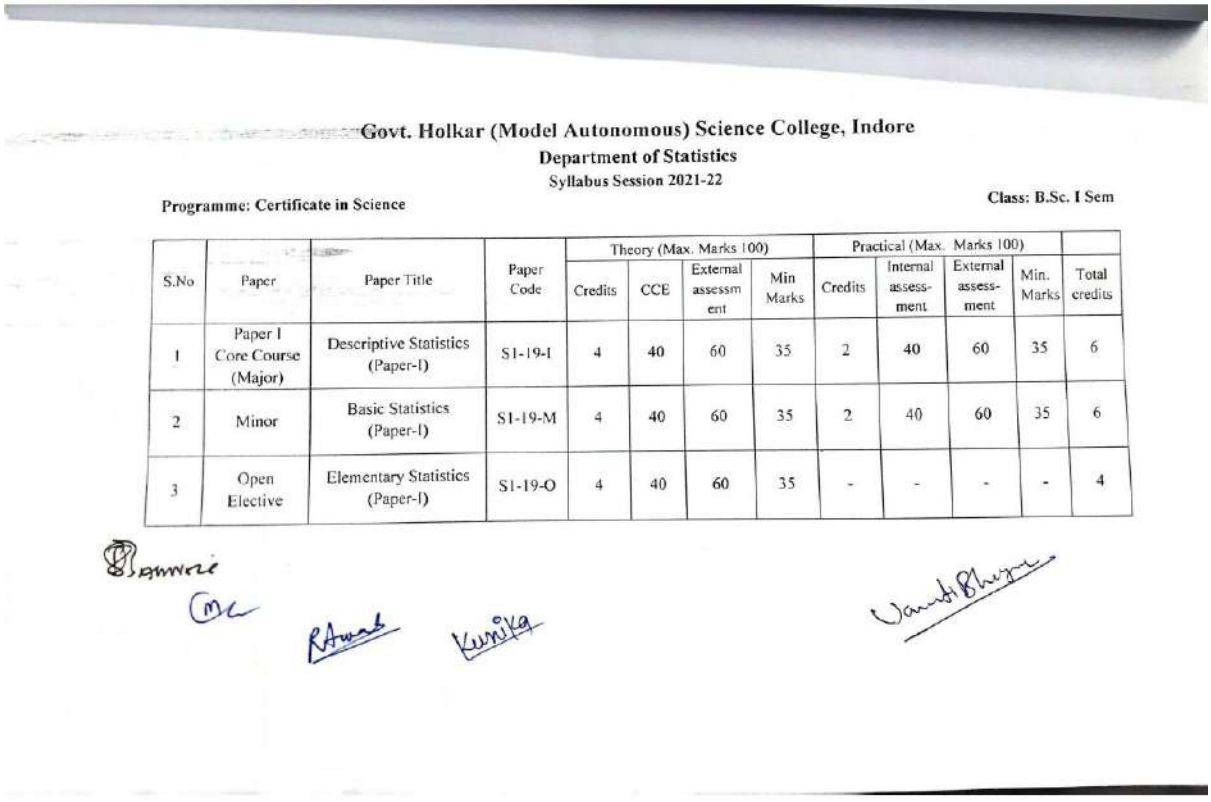
29/11/21

DEPARTMENT OF PHARMACEUTICAL CHEMISTRY 2021-22

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Statistics

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development



Govt. Holkar (Model Autonomous) Science College, Indore

Department of Statistics

Syllabus Session 2021-22

Programme: Certificate in Science **Class: B.Sc. I Sem**

S.No	Paper	Paper Title	Paper Code	Theory (Max. Marks 100)				Practical (Max. Marks 100)				
				Credits	CCE	External assessment	Min Marks	Credits	Internal assess-ment	External assess-ment	Min. Marks	Total credits
1	Paper I Core Course (Major)	Descriptive Statistics (Paper-I)	S1-19-I	4	40	60	35	2	40	60	35	6
2	Minor	Basic Statistics (Paper-I)	S1-19-M	4	40	60	35	2	40	60	35	6
3	Open Elective	Elementary Statistics (Paper-I)	S1-19-O	4	40	60	35	-	-	-	-	4

DEPARTMENT OF STATISTICS

Part A Introduction				
Program: UG/Certificate		Class: B.Sc.	Semester: I	Session: 2021- 2022
Subject: STATISTICS				
1	Course Code	S1-19-I		
2	Course Title	Descriptive Statistics		
3	Course Type (CoreCourse /Open Elective/Generic Elective/Vocational)	Core Course		
4	Pre-requisite (if any)	To study this course, a student must have had the subject mathematics in the class 12th.		
5	Course Objectives	The main objective of this course is to acquaint students with basic concepts in Statistics. They will be introduced to some elementary statistical methods of analysis of data.		
6	Course Learning outcomes (CLO)	At the end of this course students will gain knowledge related to,		
		1. Compile and present data in tabular and graphical forms and analyse, interpret and compute different measures of central tendency.		
		2. Compute elementary measures to characterize the data.		
		3. Study bivariate data and compute correlation coefficient between random variables.		
		4. Obtain regression lines and curves for bivariate and trivariate data.		
		5. Analyse and interpret qualitative data (attributes).		
7	Credit Value	4 Credits		
8	Total Marks	Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P: 4-0-0

Paragraph	Topics	No. of Lectures

I	**1. Introduction to Statistics** 1.1 Historical background of Statistics development in India 1.2 Definition, scope importance and limitations of Statistics. 1.3 Population: Finite, infinite, homogeneous and heterogeneous 1.4 Concept of sample, random sample and non-random sample 1.5 Brief description of census and sample surveys. **2. Data** 2.1 Primary and secondary data. Methods of collection of Primary data and sources of secondary data 2.2 Qualitative and quantitative data, cross sectional and time-series data, discrete and continuous data 2.3 Preparation and characteristics of a good questionnaire 2.4 Outliers **3. Frequency Distributions** 3.1 Discrete frequency distributions 3.2 Continuous frequency distributions 3.3 Inclusive and exclusive frequency distributions **4. Classification of data** 4.1 Meaning and definition of classification 4.2 Types of classification 4.3 Criteria for ideal classification **5. Presentation of data** 5.1 Tabulation: Parts of a table, Rules for construction of tables, types of tables 5.2 Diagrammatic presentation: Line diagram, Bar diagram. Multiple and sub divided bar diagram, Pie diagram, Area diagram and Pictograph 5.3 Stem and leaf diagram 5.4 Graphical presentation: Histogram, Frequency polygon, Frequency curve and cumulative frequency curve (ogive) **6. Scales of measurement**: nominal, ordinal, interval and ratio	12
	1 सांख्यिकी का परिचय 1.1 सांख्यिकी की ऐतिहासिक पृष्टभूमि और भारत में इसका विकास 1.2 सांख्यिकी की परिभाषा, क्षेत्र , महत्व तथा सीमाए 1.3 समग्र : परिमित, अपरिमित, समांग तथा असमांग	

	1.4 प्रतिदर्श, यादृच्छिक प्रतिदर्श और अयादृच्छिक प्रतिदर्शकी अवधारणा 1.5 सम्पूर्ण गणना और प्रतिदर्श सर्वेक्षण का सक्षिप्त वर्णन **2** समंक 2.1.प्राथमिक और द्वितीयक समंक, प्राथमिक समंको के सकलन की विधियां और द्वितीयक समंको के स्रोत 2.2. गुणात्मक और संख्यात्मक समंक, वज्र विभाजित, काल श्रेणी समंक, असतत और सतत समंक 2.3. एक अच्छी प्रश्नावली के रचना और उसकी विशेषताएं 2.4 बहिर्वासी(Outlier) **3.** आवृति बंटन 3.1 असतत आवृति बंटन 3.2 सतत आवृति बंटन 3.3 समावेशी और अपवर्जी आवृति बंटन **4.** समंको का वर्गीकरण 4.1 वर्गीकरणका अर्थ और परिभाषा 4.2 वर्गीकरण केप्रकार 4.3 आदर्श वर्गीकरण के लिये मापदंड **5.** समंको का प्रस्तुतीकरण 5.1 सारणीयन: सारणी के भाग, सारणियो की रचना नियम, सारणी के प्रकार 5.2 चित्र रेखीय प्रदर्शन: रेखा चित्र, दण्ड चित्र, बहु और उपविभाजित दण्ड चित्र, पाई चित्र, क्षेत्र चित्र और चित्रालेख 5.3 स्टेम एंड लीफ चित्र 5.4 बिंदुरेखीय; प्रदर्शन: आयत चित्र, आवृति बहुभुज, आवृतिवक्र, संचयी आवृति वक्र (तोरण) **6.** माप के पैमाने: नामित, क्रमिक, अंतराल और अनुपात	
II	**Measures of Location & Dispersion** **1. Measures of Central Tendency/Location** 1.1 Average: Arithmetic Mean, Median, Mode, Geometric mean, harmonic mean, their merits and demerits 1.2 Relation between mean, median and mode 1.3 Relationship between Arithmetic mean, Geometric mean and harmonic mean 1.4 Determination of median and mode by graphical method 1.5 Weighted arithmetic mean	12

	2. Partition values 2.1 Quartiles,Quantiles, Deciles and Percentiles 2.2 Diagrammatic representation through Box plot and ogive **3. Measures of Dispersion** 3.1 Range Mean deviation, Quartile deviation, standard deviation 3.2 Root mean square deviation and its relation with Standard deviation 3.3 Variance, Variance of composite series Coefficient of variation	
	अवस्थिति एवं विचरण के माप : **1.** केंद्रीय प्रवत्ति/ अवस्तिथि के माप 1.1. औसत : समांतर माध्य, मध्यिका, बहुलक, गुणोत्तर माध्य, हरात्मक माध्य, उनके गुण और दोष 1.2. माध्य, मध्यिका तथा बहुलक के मध्य सम्बन्ध 1.3. समांतर माध्य, गुणोत्तर माध्य तथा हरात्मक माध्य के मध्य सम्बन्ध 1.4. बिंदुरेखीय विधि द्वारा मध्यिका तथा बहुलक का निर्धारण 1.5. भारित समांतर माध्य **2.** विभाजक मूल्य 2.1 चतुर्थक, विभाजक, दशमक तथा शतमक 2.2 बॉक्स प्लॉट तथा तोरण के द्वारा चित्ररेखीय प्रदर्शन **3.** अपकिरण के माप 3.1. विस्तार (परास), माध्य विचलन, चतुर्थक विचलन तथा मानक विचलन 3.2. मूल माध्य वर्ग विचलन तथा इसका मानक विचलन से सम्बन्ध 3.3. प्रसरण,संयुक्त श्रेणी का प्रसरण , विचरण गुणांक	
III	**1. Moments** 1.1 Moments- about origin, about any point and central moments (about mean) 1.2 Moments about mean in terms of moments about any point and vice versa 1.3 Sheppard's Correction 1.4 Skewness, Kurtosis and their measures, Karl Pearson's Beta and Gamma coefficients	12

	2. Bivariate Data 2.1 Covariance 2.2 Concept of correlation between two variables, positive correlation, negative correlation, zero correlation 2.3 Scatter diagram, Karl Pearson's coefficient of correlation, properties of correlation coefficient 2.4 Determination of correlation coefficient for bivariate frequency distribution, Coefficient of determination 2.5 Concept of rank correlation, Spearman's rank correlation coefficient (including repeated ranks) 2.6 Concept of Intra-class correlation	
	1. आघूर्ण 1.1. केंद्र तथा किसी बिंदु के सापेक्ष आघूर्ण एवं केंद्रीय आघूर्ण (माध्य के सापेक्ष) 1.2. माध्य के सापेक्ष आघूर्ण किसी बिंदु के सापेक्ष आघूर्ण के पदों में एवं इसके विपरीत रूप से भी 1.3. शेपर्ड का संशोधन 1.4. विषमता, ककुदता एवं उनके माप, कार्ल पियर्सन के बीटा तथा गामा गुणांक 2. द्विचरसमंक 2.1. सहप्रसरण 2.2. दो चरों के मध्य सहसंबंध की अवधारणा, धनात्मक सहसम्बन्ध,ऋणात्मक सहसम्बन्ध, शून्य सहसम्बन्ध 2.3. प्रकीर्ण आरेख, कार्ल पियर्सन का सहसम्बन्ध गुणांक सहसम्बन्ध गुणांक के गुण 2.4. द्विचर आवृति बंटन के लिए सहसम्बन्ध गुणांक का निर्धारण,निर्धारक गुणांक 2.5. कोटि सहसम्बन्ध की अवधारणा, स्पीयरमैन का कोटि सहसम्बन्ध गुणांक (पुनरावृत कोटियों सहित) 2.6. आन्तरवर्ग सहसम्बन्ध की अवधारणा	
IV	**1. Curve Fitting** 1.1 Legendre's principle of least squares 1.2 Fitting of straight line 1.3 Fitting of parabola 1.4 Fitting of power curve and exponential curves **2. Regression** 2.1 Lines of Regression 2.2 Properties of regression coefficients 2.3 Angle between two lines of regression	12

	2.4 Obtaining lines of regression for given data 2.5 Difference between correlation and regression	
	1. वक्र आसंजन 1.1. लिजेंडर का न्यूनतम वर्ग सिद्धांत 1.2. सरल रेखा का आसंजन 1.3. परवलय का आसंजन 1.4. शक्ति (पॉवर) वक्र तथा चर घातांकी वक्र के आसंजन 2. समाश्रयण 2.1. समाश्रयणरेखाएं 2.2. समाश्रयण गुणांकों के गुण 2.3. दो समाश्रयण रेखाओ के मध्य कोण 2.4. दिए गए समंको के लिए समाश्रयण रेखाओ को प्राप्त करना 2.5. सहसम्बन्ध तथा समाश्रयण के बीच अंतर	
V	1. **Multiple and Partial correlation** 1.1 Plane of regression 1.2 Properties of residuals (without derivation) 1.3 Multiple and partial correlation coefficients (for three variables) and their properties 2. **Theory of Attributes** 2.1 Class, Class Frequencies. Order of classes 2.2 Consistency of data, conditions for consistency of data 2.3 Independence of attributes, criteria for independence of attributes 2.4 Pearson's and Yule's coefficients of association, coefficient of colligation	12
	1. बहुगुणी एवं आंशिक सहसम्बन्ध 1.1. समाश्रयण तल 1.2. अवशेष के गुण (व्युत्पत्ति रहित) 1.3. बहुगुण एवं आंशिक सहसम्बन्ध गुणांक (तीन चरो के लिए) तथा उनके गुण 2. गुण सम्बन्ध सिद्धांत 2.1. वर्ग , वर्ग आवृतियो, वर्गों के क्रम 2.2. समंको के संगति, समंको की संगति के लिए शर्ते 2.3. गुणों में स्वातंत्र्यता, गुणों में स्वातंत्र्यताके मापदंड 2.4. पियर्सन तथा यूल के साहचर्य गुणांक, संबंधन गुणांक	

Key Words/ Tags: Statistics, data, Frequency distribution, Presentation of data, Central tendency, Dispersion, Moments, Skewness, Kurtosis, Bivariate data. Correlation, Rank correlation, Partial correlation, Multiple correlation, Regression, Attributes.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books:

1. Agrawal, B.L. "सांख्यिकीय के सिद्धांत एवं अनुप्रयोग" Rajasthan Hindi Granth Academy, 1st edition, 1977,revised 1983
2. Goon, A.M., Gupta, M. K. and Dasgupta, B, "Fundamentals of Statistics" Vol. –I, World Press, India, 8th Edition (2005) Reprint (2008)
3. Gupta, S.C., and kapoor, V.K. "Fundamentals of Mathemetical Statistics" Sultan Chand & Sons, New Delhi, India 11th edition(2002), Reprint 2015
4. Medhi, J. Statistical Methods, Wiley Eastern Ltd. 3rd Edition (2006)
5. Mukhopadhyay, P. "Mathematical Statistics", New Central Book Agency. Pvt. Ltd. Kolkata. 2nd edition (2005)
6. Gupta S.P. "Statistical Methods", Sultan Chand and Sons.31st Edition(2002)
7. Shastri,V., Pathak, A. and Shastri, R. "उच्च सांख्यिकी विश्लेषण", Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
8. Shukla, S.M. and Sahay. S.P. "सांख्यिकी के सिद्धांत" Sahitya Bhawan Publications. 31st edition,(2008)
9. Singh, S.P. "सांख्यिकी के सिद्धांत एवं व्यवहार", S. Chand Company, New Delhi, 1st Revised Edition (1978), Reprint(2018)

Reference Books:-

1. Agrawal, B.L. "Programmed Statistics", New Age International Pvt. Ltd., India, 2nd Edition(2003), Reprint(2010)
2. Holcomb, Z.C. "Fundamentals of Descriptive Statistics",Routledge. 1st Edition (1998), Reprint (2016)

Platform

1. https://mathworld.wolfram.com/topics/DescriptiveStatistics.html
2. https://stattrek.com/statistics/charts/histogram.aspx?tutorial=AP

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests. The division of marks are as follows:**	**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks Time : 02.00 Hours

A. Submission of Assignment followed by Presentation			**Section(A)** : 05 MCQ Questions	05 x 01 = 05
B. Class Test	**Best two test marks** **20 Marks**	**Best two test marks** **40 Marks**	**Section (B) :** Five Short Questions (200 Words Each)	05 x 05 = 25
Test I (Written Test)	**20 Marks**		**Section (C) :** Two Long Questions (500 Words Each)	**02 x 15 = 30**
Test II (Written Test)	**20 Marks**			
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

DEPARTMENT OF STATISTICS

Part A Introduction			
Program: UG/ Certificate	Class: B. Sc.	Semester I	Session:2021-2022
Subject: Statistics Practical			

1	Course Code	S1-19-I-P	
2	Course Title	Hands on fitting of Standard Probability Distributions	
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Core Course	
4	Pre-requisite (if any)	This Practical course is based on theory paper "Descriptive Statistics"	
5	Course Learning outcomes (CLO)	The practical undertaken will empower them to:	
		1. Collect data for real life situations	
		2. Compile and present data in tabular and graphical forms	
		3. Compute averages, measures of dispersion, skewness, kurtosis, correlation and regression	
		4. Fit lines/curves	
		5. Study multiple attributes.	
6	Credit Value	2 Credits	
7	Total Marks	Max. Marks: 40+60	Min. Passing Marks:35

Part B- Content of the Course	
Total No. of Lectures-Tutorials-Practical (in hours per week):L-T-P: 0-0-2	
Total numbers of lab hours: 30 Hrs. (2 hours per week)	
Lab Assignments	No. of Lab Hrs.

Descriptive Statistics 1. Preparation of a questionnaire for a survey 2. Construction of frequency distributions, Cumulative frequency distribution from raw data 3. Diagrammatic representation of data 4. Graphical representation of data 5. Computation of median and mode respectively from ogive and histogram 6. Numerical problem based on measure of central tendency 7. Numerical problem based on measure of dispersion 8. Numerical Problems based on combined mean combined variance and coefficient of variation 9. Numerical problem based on weighted mean 10. Numerical Problem based on moments, skewness and kurtosis 11. Computation of measures based on partition value (quantiles), construction of box plot **Fitting, bivariate measures and data related student activity** 1. Numerical Problems based on fitting of straight line and parabola 2. Numerical Problems based on fitting of polynomial and exponential curves 3. Numerical Problems based on correlation including correlation for bivariate data. 4. Numerical Problems based on lines of regression and regression coefficients 5. Numerical problems based on rank correlation coefficient 6. Numerical problems based on multiple and partial correlation coefficient 7. Numerical problems based on finding class frequencies for three attributes. 8. Numerical problems based on association and independence of attributes. 9. Data related student activity: Collection of data by each student individually and application of all statistical techniques by the student depending upon the data e.g. classification tabulation, measures of central tendency, Dispersion, moments, beta, gamma coefficients, correlation, regression, fitting of curves.	30

Key Words/ Tags: Questionnaire, Data representation, Measures of location, Dispersion, Skewness and Kurtosis, Fitting of regression line and Curves, Correlation, Regression, Attributes, Data related student activity.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books

1. **DeCoursey, W.J. "** Statistics and Probability for Engineering Applications With Microsoft® Excel **", Newnes Publications**, London, UK, (2013).
2. **Gupta, S. C., and Kapoor, V. K.** " Fundamentals of Mathematical Statistics **". Sultan Chand**

&Sons, New Delhi, India, 11th edition (2002), Reprint 2015
3. **Gupta, S. P.:** " Statistical Methods ", Sultan Chand and Sons. 31 * Edition (2002
4. **Moore, D.S., Notz, W.I. and Fligner M.A.** " The Basic Practice of Statistics ", W. H. Freeman and Company, USA, 8th Edition (2017)
5. **Quirk, T. J., Quirk M. H. and Horton, H. F.:** " Excel for Physical Sciences Statistics ", Springer International Publishing Switzerland. 1 Edition (2016)
6. **Shastri, V., Pathak, A. and Shastri, R.** " उच्च सांख्यिकीय विश्लेषण ", Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
7. **Shukla, S.M. and Sahay, S.P.** "सांख्यिकी के सिद्धांत" , Sahitya Bhawan Publications . 31st edition, 2008.
8. **Siegel, A. F.**"Practical Business Statistics", Academic Press publications, USA, 7th Edition (2016)
9. **Singh, S.P.:** "सांख्यिकी के सिद्धांत एवं व्यवहार" , S. Chand and Company New Delhi , 14 Revised Edition (1978). Reprint (2018).

Suggestive digital platforms

1. https://mathworld.wolfram.com/topics/DescriptiveStatistics.html
2. https://stattrek.com/statistics/charts/histogram.aspx?tutorial-AP

Web Links

1.https://www.youtube.com/watch?v690JWOHKOOk&list=RDCMUCLI511-QwKqQn0Cf4nzdGKeQ&startradio=1&rv=69oJW0HkOOk&t=24nWh68Y
2. https://onlinecourses.swayam2.ac.in/cec21_ma01/preview

Part D-Assessment and Evaluation	
Internal Assessment (A):	**40 Marks**
Lab Record/Class Interaction/Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours)/ Mini Project (Project Demo + Report))	20 Marks
End Sem External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Table Work/ Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

DEPARTMENT OF STATISTICS

Part A Introduction				
Program: UG/Certificate		Class: B.Sc.	Semester: I	Session: 2021- 2022
Subject: STATISTICS				
1	Course Code	S1-19-M		
2	Course Title	Basic Statistics		
3	Course Type (CoreCourse /Open Elective/Generic Elective/Vocational)	Core Course		
4	Pre-requisite (if any)	To study this course, a student must have had the subject mathematics in the class 12th.		
5	Course Objectives	The main objective of this course is to acquaint students with basic concepts in Statistics. They will be introduced to some elementary statistical methods of analysis of data.		
6	Course Learning outcomes (CLO)	At the end of this course students will gain knowledge related to,		
		1. Compile and present data in tabular and graphical forms and analyse, interpret and compute different measures of central tendency.		
		2. Compute elementary measures to characterize the data.		
		3. Study bivariate data and compute correlation coefficient between random variables.		
		4. Obtain regression lines and curves for bivariate and trivariate data.		
		5. Analyse and interpret qualitative data (attributes).		
7	Credit Value	4 Credits		
8	Total Marks	Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P: 4-0-0

Paragraph	Topics	No. of Lectures

I	**1. Introduction to Statistics** 1.1 Historical background of Statistics development in India 1.2 Definition, scope importance and limitations of Statistics. 1.3 Population: Finite, infinite, homogeneous and heterogeneous 1.4 Concept of sample, random sample and non-random sample 1.5 Brief description of census and sample surveys. **2. Data** 2.1 Primary and secondary data. Methods of collection of Primary data and sources of secondary data 2.2 Qualitative and quantitative data, cross sectional and time-series data, discrete and continuous data 2.3 Preparation and characteristics of a good questionnaire 2.4 Outliers **3. Frequency Distributions** 3.1 Discrete frequency distributions 3.2 Continuous frequency distributions 3.3 Inclusive and exclusive frequency distributions **4. Classification of data** 4.1 Meaning and definition of classification 4.2 Types of classification 4.3 Criteria for ideal classification **5. Presentation of data** 5.1 Tabulation: Parts of a table, Rules for construction of tables, types of tables 5.2 Diagrammatic presentation: Line diagram. Bar diagram. Multiple and sub divided bar diagram, Pie diagram, Area diagram and Pictograph 5.3 Stem and leaf diagram 5.4 Graphical presentation: Histogram, Frequency polygon, Frequency curve and cumulative frequency curve (ogive) **6. Scales of measurement**: nominal, ordinal, interval and ratio	12
	1 सांख्यिकी का परिचय 1.1 सांख्यिकी की ऐतिहासिक पृष्टभूमि और भारत में इसका विकास 1.2 सांख्यिकी की परिभाषा, क्षेत्र , महत्त्व तथा सीमाए 1.3 समग्र : परिमित, अपरिमित, समांग तथा असमांग	

Jaya Bhagat

	1.4 प्रतिदर्श, यादृच्छिक प्रतिदर्श और अयादृच्छिक प्रतिदर्शकी अवधारणा 1.5 सम्पूर्ण गणना और प्रतिदर्श सर्वेक्षण का सक्षिप्त वर्णन **2 समंक** 2.1.प्राथमिक और द्वितीयक समंक, प्राथमिक समंको के सकलन की विधियां और द्वितीयक समंको के स्रोत 2.2. गुणात्मक और संख्यात्मक समंक, वज्र विभाजित, काल श्रेणी समंक, असतत और सतत समंक 2.3. एक अच्छी प्रश्नावली के रचना और उसकी विशेषताएं 2.4 बहिर्वासी(Outlier) **3. आवृति** बंटन 3.1 असतत आवृति बंटन 3.2 सतत आवृति बंटन 3.3 समावेशी और अपवर्जी आवृति बंटन **4. समंको** का वर्गीकरण 4.1 वर्गीकरणका अर्थ और परिभाषा 4.2 वर्गीकरण केप्रकार 4.3 आदर्श वर्गीकरण के लिये मापदंड **5. समंको** का प्रस्तुतीकरण 5.1 सारणीयन: सारणी के भाग, सारणियो की रचना नियम, सारणी के प्रकार 5.2 चित्र रेखीय प्रदर्शन: रेखा चित्र, दण्ड चित्र, बहु और उपविभाजित दण्ड चित्र, पाई चित्र, क्षेत्र चित्र और चित्रालेख 5.3 स्टेम एंड लीफ चित्र 5.4 बिंदुरेखीय; प्रदर्शन: आयत चित्र, आवृति बहुभुज, आवृतिवक्र, संचयी आवृति वक्र (तोरण) **6. माप** के पैमाने: नामित, क्रमिक, अंतराल और अनुपात	
II	**Measures of Location & Dispersion** **1. Measures of Central Tendency/Location** 1.1 Average: Arithmetic Mean, Median, Mode, Geometric mean, harmonic mean, their merits and demerits 1.2 Relation between mean, median and mode 1.3 Relationship between Arithmetic mean, Geometric mean and harmonic mean 1.4 Determination of median and mode by graphical method 1.5 Weighted arithmetic mean	12

	2. Partition values 2.1 Quartiles,Quantiles, Deciles and Percentiles 2.2 Diagrammatic representation through Box plot and ogive **3. Measures of Dispersion** 3.1 Range Mean deviation, Quartile deviation, standard deviation 3.2 Root mean square deviation and its relation with Standard deviation 3.3 Variance, Variance of composite series Coefficient of variation	
	अवस्थिति एवं विचरण के माप : 1. केंद्रीय प्रवत्ति/ अवस्तिथि के माप 1.1. औसत : समांतर माध्य, मध्यिका, बहुलक, गुणोत्तर माध्य, हरात्मक माध्य, उनके गुण और दोष 1.2. माध्य, मध्यिका तथा बहुलक के मध्य सम्बन्ध 1.3. समांतर माध्य, गुणोत्तर माध्य तथा हरात्मक माध्य के मध्य सम्बन्ध 1.4. बिंदुरेखीय विधि द्वारा मध्यिका तथा बहुलक का निर्धारण 1.5. भारित समांतर माध्य 2. विभाजक मूल्य 2.1 चतुर्थक, विभाजक, दशमक तथा शतमक 2.2 बॉक्स प्लॉट तथा तोरण के द्वारा चित्ररेखीय प्रदर्शन 3. अपकिरण के माप 3.1. विस्तार (परास), माध्य विचलन, चतुर्थक विचलन तथा मानक विचलन 3.2. मूल माध्य वर्ग विचलन तथा इसका मानक विचलन से सम्बन्ध 3.3. प्रसरण,संयुक्त श्रेणी का प्रसरण , विचरण गुणांक	
III	**1. Moments** 1.1 Moments- about origin, about any point and central moments (about mean) 1.2 Moments about mean in terms of moments about any point and vice versa 1.3 Sheppard's Correction 1.4 Skewness, Kurtosis and their measures, Karl Pearson's Beta and Gamma coefficients	12

	2. Bivariate Data 2.1 Covariance 2.2 Concept of correlation between two variables, positive correlation, negative correlation, zero correlation 2.3 Scatter diagram, Karl Pearson's coefficient of correlation, properties of correlation coefficient 2.4 Determination of correlation coefficient for bivariate frequency distribution, Coefficient of determination 2.5 Concept of rank correlation, Spearman's rank correlation coefficient (including repeated ranks) 2.6 Concept of Intra-class correlation	
	1. आघूर्ण 1.1. केंद्र तथा किसी बिंदु के सापेक्ष आघूर्ण एवं केंद्रीय आघूर्ण (माध्य के सापेक्ष) 1.2. माध्य के सापेक्ष आघूर्ण किसी बिंदु के सापेक्ष आघूर्ण के पदों में एवं इसके विपरीत रूप से भी 1.3. शेपर्ड का संशोधन 1.4. विषमता, ककुदता एवं उनके माप, कार्ल पियर्सन के बीटा तथा गामा गुणांक 2. द्विचरसमंक 2.1. सहप्रसरण 2.2. दो चरों के मध्य सहसंबंध की अवधारणा, धनात्मक सहसम्बन्ध,ऋणात्मक सहसम्बन्ध, शून्य सहसम्बन्ध 2.3. प्रकीर्ण आरेख, कार्ल पियर्सन का सहसम्बन्ध गुणांक सहसम्बन्ध गुणांक के गुण 2.4. द्विचर आवृति बंटन के लिए सहसम्बन्ध गुणांक का निर्धारण,निर्धारक गुणांक 2.5. कोटि सहसम्बन्ध की अवधारणा, स्पीयरमैन का कोटि सहसम्बन्ध गुणांक (पुनरावृत कोटियों सहित) 2.6. आन्तरवर्ग सहसम्बन्ध की अवधारणा	
IV	**1. Curve Fitting** 1.1 Legendre's principle of least squares 1.2 Fitting of straight line 1.3 Fitting of parabola 1.4 Fitting of power curve and exponential curves **2. Regression** 2.1 Lines of Regression 2.2 Properties of regression coefficients 2.3 Angle between two lines of regression	12

	2.4 Obtaining lines of regression for given data 2.5 Difference between correlation and regression	
	1. वक्र आसंजन 1.1. लिजेंडर का न्यूनतम वर्ग सिद्धांत 1.2. सरल रेखा का आसंजन 1.3. परवलय का आसंजन 1.4. शक्ति (पॉवर) वक्र तथा चर घातांकी वक्र के आसंजन 2. समाश्रयण 2.1. समाश्रयणरेखाएं 2.2. समाश्रयण गुणांकों के गुण 2.3. दो समाश्रयण रेखाओ के मध्य कोण 2.4. दिए गए समंको के लिए समाश्रयण रेखाओ को प्राप्त करना 2.5. सहसम्बन्ध तथा समाश्रयण के बीच अंतर	
V	1. **Multiple and Partial correlation** 1.1 Plane of regression 1.2 Properties of residuals (without derivation) 1.3 Multiple and partial correlation coefficients (for three variables) and their properties 2. **Theory of Attributes** 2.1 Class, Class Frequencies. Order of classes 2.2 Consistency of data, conditions for consistency of data 2.3 Independence of attributes, criteria for independence of attributes 2.4 Pearson's and Yule's coefficients of association, coefficient of colligation	12
	1. बहुगुणी एवं आंशिक सहसम्बन्ध 1.1. समाश्रयण तल 1.2. अवशेष के गुण (व्युत्पत्ति रहित) 1.3. बहुगुण एवं आंशिक सहसम्बन्ध गुणांक (तीन चरो के लिए) तथा उनके गुण 2. गुण सम्बन्ध सिद्धांत 2.1. वर्ग , वर्ग आवृतियो, वर्गों के क्रम 2.2. समंको के संगति, समंको की संगति के लिए शर्तें 2.3. गुणों में स्वातंत्र्यता, गुणों में स्वातंत्र्यताके मापदंड 2.4. पियर्सन तथा यूल के साहचर्य गुणांक, संबंधन गुणांक	

Key Words/ Tags: Statistics, data, Frequency distribution, Presentation of data, Central tendency, Dispersion, Moments, Skewness, Kurtosis, Bivariate data. Correlation, Rank correlation, Partial correlation, Multiple correlation, Regression, Attributes.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books:

1. Agrawal, B.L. "सांख्यिकीय के सिद्धांत एवं अनुप्रयोग" Rajasthan Hindi Granth Academy, 1st edition, 1977,revised 1983
2. Goon, A.M., Gupta, M. K. and Dasgupta, B, "Fundamentals of Statistics" Vol. –I, World Press, India, 8th Edition (2005) Reprint (2008)
3. Gupta, S.C., and kapoor, V.K. "Fundamentals of Mathemetical Statistics" Sultan Chand & Sons, New Delhi, India 11th edition(2002), Reprint 2015
4. Medhi, J. Statistical Methods, Wiley Eastern Ltd. 3rd Edition (2006)
5. Mukhopadhyay. P. "Mathematical Statistics", New Central Book Agency. Pvt. Ltd. Kolkata. 2nd edition (2005)
6. Gupta S.P. "Statistical Methods", Sultan Chand and Sons.31st Edition(2002)
7. Shastri,V., Pathak. A. and Shastri, R. "उच्च सांख्यिकी विश्लेषण", Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
8. Shukla, S.M. and Sahay. S.P. "सांख्यिकी के सिद्धांत" Sahitya Bhawan Publications. 31st edition,(2008)
9. Singh, S.P, "सांख्यिकी के सिद्धांत एवं व्यवहार", S. Chand Company, New Delhi, 1st Revised Edition (1978), Reprint(2018)

Reference Books:-

1. Agrawal, B.L. "Programmed Statistics", New Age International Pvt. Ltd., India, 2nd Edition(2003), Reprint(2010)
2. Holcomb, Z.C. "Fundamentals of Descriptive Statistics",Routledge. 1st Edition (1998), Reprint (2016)

Platform

1. https://mathworld.wolfram.com/topics/DescriptiveStatistics.html
2. https://stattrek.com/statistics/charts/histogram.aspx?tutorial=AP

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests. The division of marks are as follows:**	**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours

A. Submission of Assignment followed by Presentation			**Section(A) : 05 MCQ Questions**	05 x 01 = 05
B. Class Test	**Best two test marks 20 Marks**	**Best two test marks 40 Marks**	**Section (B) : Five Short Questions (200 Words Each)**	05 x 05 = 25
Test I (Written Test)	**20 Marks**		**Section (C) : Two Long Questions (500 Words Each)**	02 x 15 = 30
Test II (Written Test)	**20 Marks**			
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

DEPARTMENT OF STATISTICS

Part A Introduction			
Program: UG/ Certificate	Class: B. Sc.	Semester I	Session:2021-2022
Subject: Statistics Practical			

1	Course Code	S1-19-M-P	
2	Course Title	Hands on fitting of Standard Probability Distributions	
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Core Course	
4	Pre-requisite (if any)	This Practical course is based on theory paper "Basic Statistics"	
5	Course Learning outcomes (CLO)	The practical undertaken will empower them to:	
		1. Collect data for real life situations	
		2. Compile and present data in tabular and graphical forms	
		3. Compute averages, measures of dispersion, skewness, kurtosis, correlation and regression	
		4. Fit lines/curves	
		5. Study multiple attributes.	
6	Credit Value	2 Credits	
7	Total Marks	Max. Marks: 40+60	Min. Passing Marks:35

Part B- Content of the Course
Total No. of Lectures-Tutorials-Practical (in hours per week):L-T-P: 0-0-2
Total numbers of lab hours: 30 Hrs. (2 hours per week)

Lab Assignments	No. of Lab Hrs.
Descriptive Statistics 1. Preparation of a questionnaire for a survey 2. Construction of frequency distributions, Cumulative frequency distribution from raw data 3. Diagrammatic representation of data 4. Graphical representation of data 5. Computation of median and mode respectively from ogive and histogram 6. Numerical problem based on measure of central tendency 7. Numerical problem based on measure of dispersion 8. Numerical Problems based on combined mean combined variance and coefficient of variation 9. Numerical problem based on weighted mean 10. Numerical Problem based on moments, skewness and kurtosis 11. Computation of measures based on partition value (quantiles), construction of box plot **Fitting, bivariate measures and data related student activity** 1. Numerical Problems based on fitting of straight line and parabola 2. Numerical Problems based on fitting of polynomial and exponential curves 3. Numerical Problems based on correlation including correlation for bivariate data. 4. Numerical Problems based on lines of regression and regression coefficients 5. Numerical problems based on rank correlation coefficient 6. Numerical problems based on multiple and partial correlation coefficient 7. Numerical problems based on finding class frequencies for three attributes. 8. Numerical problems based on association and independence of attributes. 9. Data related student activity: Collection of data by each student individually and application of all statistical techniques by the student depending upon the data e.g. classification tabulation, measures of central tendency, Dispersion, moments, beta, gamma coefficients, correlation, regression, fitting of curves.	30

Key Words/ Tags: Questionnaire, Data representation, Measures of location, Dispersion, Skewness and Kurtosis, Fitting of regression line and Curves, Correlation, Regression, Attributes, Data related student activity.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books

1. **DeCoursey, W.J.** " Statistics and Probability for Engineering Applications With Microsoft® Excel ", Newnes Publications, London, UK, (2013).

2. **Gupta, S. C., and Kapoor, V. K.** " Fundamentals of Mathematical Statistics ". Sultan Chand &Sons, New Delhi, India, 11th edition (2002), Reprint 2015
3. **Gupta, S. P.:** " Statistical Methods ", Sultan Chand and Sons. 31 * Edition (2002
4. **Moore, D.S., Notz, W.I. and Fligner M.A.** " The Basic Practice of Statistics ", W. H. Freeman and Company, **USA**, 8th Edition (2017)
5. **Quirk, T. J., Quirk M. H. and Horton, H. F.:** " Excel for Physical Sciences Statistics ", Springer International Publishing Switzerland. 1 Edition (2016)
6. **Shastri, V., Pathak, A. and Shastri, R.** " उच्च सांख्यिकीय विश्लेषण ", Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
7. **Shukla, S.M. and Sahay, S.P.** "सांख्यिकी के सिद्धांत" , Sahitya Bhawan **Publications** . 31st edition, 2008.
8. **Siegel, A. F.**"Practical Business Statistics", Academic Press publications, **USA**, 7th Edition (2016)
9. **Singh, S.P.**: "सांख्यिकी के सिद्धांत एवं व्यवहार" , S. Chand and Company New **Delhi** , 14 Revised Edition (**1978**). Reprint (2018).

Suggestive digital platforms

1. https://mathworld.wolfram.com/topics/DescriptiveStatistics.html
2. https://stattrek.com/statistics/charts/histogram.aspx?tutorial-AP

Web Links

1.https://www.youtube.com/watch?v690JWOHKOOk&list=RDCMUCLI511-QwKqQn0Cf4nzdGKeQ&startradio=1&rv=69oJW0HkOOk&t=24nWh68Y
2. https://onlinecourses.swayam2.ac.in/cec21_ma01/preview

Part D-Assessment and Evaluation	
Internal Assessment (A):	**40 Marks**
Lab Record/Class Interaction/Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours)/ Mini Project (Project Demo + Report))	20 Marks
End Sem External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Table Work/ Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

DEPARTMENT OF STATISTICS

Part A Introduction				
Program: UG/Certificate		Class: B.Sc.	Semester: I	Session: 2021- 2022
Subject: STATISTICS				
1	Course Code	S1-19-O		
2	Course Title	Elementary Statistics		
3	Course Type (CoreCourse /Open Elective/Generic Elective/Vocational)	Core Course		
4	Pre-requisite (if any)	To study this course, a student must have had the subject mathematics in the class 12th.		
5	Course Objectives	The main objective of this course is to acquaint students with basic concepts in Statistics. They will be introduced to some elementary statistical methods of analysis of data.		
6	Course Learning outcomes (CLO)	At the end of this course students will gain knowledge related to,		
		1. Compile and present data in tabular and graphical forms and analyse, interpret and compute different measures of central tendency.		
		2. Compute elementary measures to characterize the data.		
		3. Study bivariate data and compute correlation coefficient between random variables.		
		4. Obtain regression lines and curves for bivariate and trivariate data.		
		5. Analyse and interpret qualitative data (attributes).		
7	Credit Value	4 Credits		
8	Total Marks	Max. Marks: 40 (CCE) + 60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P: 4-0-0

Paragraph	Topics	No. of Lectures

I	**1. Introduction to Statistics** 1.1 Historical background of Statistics development in India 1.2 Definition, scope importance and limitations of Statistics. 1.3 Population: Finite, infinite, homogeneous and heterogeneous 1.4 Concept of sample, random sample and non-random sample 1.5 Brief description of census and sample surveys. **2. Data** 2.1 Primary and secondary data. Methods of collection of Primary data and sources of secondary data 2.2 Qualitative and quantitative data, cross sectional and time-series data, discrete and continuous data 2.3 Preparation and characteristics of a good questionnaire 2.4 Outliers **3. Frequency Distributions** 3.1 Discrete frequency distributions 3.2 Continuous frequency distributions 3.3 Inclusive and exclusive frequency distributions **4. Classification of data** 4.1 Meaning and definition of classification 4.2 Types of classification 4.3 Criteria for ideal classification **5. Presentation of data** 5.1 Tabulation: Parts of a table, Rules for construction of tables, types of tables 5.2 Diagrammatic presentation: Line diagram, Bar diagram. Multiple and sub divided bar diagram, Pie diagram, Area diagram and Pictograph 5.3 Stem and leaf diagram 5.4 Graphical presentation: Histogram, Frequency polygon, Frequency curve and cumulative frequency curve (ogive) **6. Scales of measurement**: nominal, ordinal, interval and ratio	12
	1 सांख्यिकी का परिचय 1.1 सांख्यिकी की ऐतिहासिक पृष्टभूमि और भारत में इसका विकास 1.2 सांख्यिकी की परिभाषा, क्षेत्र , महत्त्व तथा सीमाए 1.3 समग्र : परिमित, अपरिमित, समांग तथा असमांग	

Kumika

Shanti Bhagat

	1.4 प्रतिदर्श, याद्दच्छिक प्रतिदर्श और अयाद्दच्छिक प्रतिदर्शकी अवधारणा 1.5 सम्पूर्ण गणना और प्रतिदर्श सर्वेक्षण का सक्षिप्त वर्णन **2** समंक 2.1.प्राथमिक और द्वितीयक समंक, प्राथमिक समंको के सकलन की विधियां और द्वितीयक समंको के स्रोत 2.2. गुणात्मक और संख्यात्मक समंक, वर्ग विभाजित, काल श्रेणी समंक, असतत और सतत समंक 2.3. एक अच्छी प्रश्नावली के रचना और उसकी विशेषताएं 2.4 बहिर्वासी(Outlier) **3.** आवृति बंटन 3.1 असतत आवृति बंटन 3.2 सतत आवृति बंटन 3.3 समावेशी और अपवर्जी आवृति बंटन **4.** समंको का वर्गीकरण 4.1 वर्गीकरणका अर्थ और परिभाषा 4.2 वर्गीकरण केप्रकार 4.3 आदर्श वर्गीकरण के लिये मापदंड **5.** समंको का प्रस्तुतीकरण 5.1 सारणीयन: सारणी के भाग, सारणियो की रचना नियम, सारणी के प्रकार 5.2 चित्र रेखीय प्रदर्शन: रेखा चित्र, दण्ड चित्र, बहु और उपविभाजित दण्ड चित्र, पाई चित्र, क्षेत्र चित्र और चित्रालेख 5.3 स्टेम एंड लीफ चित्र 5.4 बिंदुरेखीय; प्रदर्शन: आयत चित्र, आवृति बहुभुज, आवृतिवक्र, संचयी आवृति वक्र (तोरण) **6.** माप के पैमाने: नामित, क्रमिक, अंतराल और अनुपात	
II	**Measures of Location & Dispersion** **1. Measures of Central Tendency/Location** 1.1 Average: Arithmetic Mean, Median, Mode, Geometric mean, harmonic mean, their merits and demerits 1.2 Relation between mean, median and mode 1.3 Relationship between Arithmetic mean, Geometric mean and harmonic mean 1.4 Determination of median and mode by graphical method 1.5 Weighted arithmetic mean	12

Kumika

Vanati Bhagat

	2. Partition values 2.1 Quartiles,Quantiles, Deciles and Percentiles 2.2 Diagrammatic representation through Box plot and ogive **3. Measures of Dispersion** 3.1 Range Mean deviation, Quartile deviation, standard deviation 3.2 Root mean square deviation and its relation with Standard deviation 3.3 Variance, Variance of composite series Coefficient of variation	
	अवस्थिति एवं विचरण के माप : 1. केंद्रीय प्रवति/ अवस्तिथि के माप 1.1. औसत : समांतर माध्य, मध्यिका, बहुलक, गुणोतर माध्य, हरात्मक माध्य, उनके गुण और दोष 1.2. माध्य, मध्यिका तथा बहुलक के मध्य सम्बन्ध 1.3. समांतर माध्य, गुणोतर माध्य तथा हरात्मक माध्य के मध्य सम्बन्ध 1.4. बिंदुरेखीय विधि द्वारा मध्यिका तथा बहुलक का निर्धारण 1.5. भारित समांतर माध्य 2. विभाजक मूल्य 2.1 चतुर्थक, विभाजक, दशमक तथा शतमक 2.2 बॉक्स प्लॉट तथा तोरण के द्वारा चित्ररेखीय प्रदर्शन 3. अपकिरण के माप 3.1. विस्तार (परास), माध्य विचलन, चतुर्थक विचलन तथा मानक विचलन 3.2. मूल माध्य वर्ग विचलन तथा इसका मानक विचलन से सम्बन्ध 3.3. प्रसरण,संयुक्त श्रेणी का प्रसरण , विचरण गुणांक	
III	**1. Moments** 1.1 Moments- about origin, about any point and central moments (about mean) 1.2 Moments about mean in terms of moments about any point and vice versa 1.3 Sheppard's Correction 1.4 Skewness, Kurtosis and their measures, Karl Pearson's Beta and Gamma coefficients	12

	2. Bivariate Data 2.1 Covariance 2.2 Concept of correlation between two variables, positive correlation, negative correlation, zero correlation 2.3 Scatter diagram, Karl Pearson's coefficient of correlation, properties of correlation coefficient 2.4 Determination of correlation coefficient for bivariate frequency distribution, Coefficient of determination 2.5 Concept of rank correlation, Spearman's rank correlation coefficient (including repeated ranks) 2.6 Concept of Intra-class correlation	
	1. आघूर्ण 1.1. कैंद्र तथा किसी बिंदु के सापेक्ष आघूर्ण एवं कैंद्रीय आघूर्ण (माध्य के सापेक्ष) 1.2. माध्य के सापेक्ष आघूर्ण किसी बिंदु के सापेक्ष आघूर्ण के पदों में एवं इसके विपरीत रूप से भी 1.3. शेपर्ड का संशोधन 1.4. विषमता, ककुदता एवं उनके माप, कार्ल पियर्सन के बीटा तथा गामा गुणांक **2. द्विचरसमंक** 2.1. सहप्रसरण 2.2. दो चरों के मध्य सहसंबंध की अवधारणा, धनात्मक सहसम्बन्ध,ऋणात्मक सहसम्बन्ध, शून्य सहसम्बन्ध 2.3. प्रकीर्ण आरेख, कार्ल पियर्सन का सहसम्बन्ध गुणांक सहसम्बन्ध गुणांक के गुण 2.4. द्विचर आवृति बंटन के लिए सहसम्बन्ध गुणांक का निर्धारण,निर्धारक गुणांक 2.5. कोटि सहसम्बन्ध की अवधारणा, स्पीयरमैन का कोटि सहसम्बन्ध गुणांक (पुनरावृत कोटियों सहित) 2.6. आन्तरवर्ग सहसम्बन्ध की अवधारणा	
IV	**1. Curve Fitting** 1.1 Legendre's principle of least squares 1.2 Fitting of straight line 1.3 Fitting of parabola 1.4 Fitting of power curve and exponential curves **2. Regression** 2.1 Lines of Regression 2.2 Properties of regression coefficients 2.3 Angle between two lines of regression	12

	2.4 Obtaining lines of regression for given data 2.5 Difference between correlation and regression	
	1. वक्र आसंजन 1.1. लिजेंडर का न्यूनतम वर्ग सिद्धांत 1.2. सरल रेखा का आसंजन 1.3. परवलय का आसंजन 1.4. शक्ति (पॉवर) वक्र तथा चर घातांकी वक्र के आसंजन 2. समाश्रयण 2.1. समाश्रयणरेखाएं 2.2. समाश्रयण गुणांकों के गुण 2.3. दो समाश्रयण रेखाओ के मध्य कोण 2.4. दिए गए समंको के लिए समाश्रयण रेखाओ को प्राप्त करना 2.5. सहसम्बन्ध तथा समाश्रयण के बीच अंतर	
V	1. **Multiple and Partial correlation** 1.1 Plane of regression 1.2 Properties of residuals (without derivation) 1.3 Multiple and partial correlation coefficients (for three variables) and their properties 2. **Theory of Attributes** 2.1 Class, Class Frequencies. Order of classes 2.2 Consistency of data, conditions for consistency of data 2.3 Independence of attributes, criteria for independence of attributes 2.4 Pearson's and Yule's coefficients of association, coefficient of colligation	12
	1. बहुगुणी एवं आंशिक सहसम्बन्ध 1.1. समाश्रयण तल 1.2. अवशेष के गुण (व्युत्पत्ति रहित) 1.3. बहुगुण एवं आंशिक सहसम्बन्ध गुणांक (तीन चरो के लिए) तथा उनके गुण 2. गुण सम्बन्ध सिद्धांत 2.1. वर्ग , वर्ग आवृतियो, वर्गों के क्रम 2.2. समंको के संगति, समंको की संगति के लिए शर्ते 2.3. गुणों में स्वातंत्र्यता, गुणों में स्वातंत्र्यताके मापदंड 2.4. पियर्सन तथा यूल के साहचर्य गुणांक, संबंधन गुणांक	

Key Words/ Tags: Statistics, data, Frequency distribution, Presentation of data, Central tendency, Dispersion, Moments, Skewness, Kurtosis, Bivariate data. Correlation, Rank correlation, Partial correlation, Multiple correlation, Regression, Attributes.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books:

1. Agrawal, B.L, "सांख्यिकीय के सिद्धांत एवं अनुप्रयोग" Rajasthan Hindi Granth Academy, 1st edition, 1977,revised 1983
2. Goon, A.M., Gupta, M. K. and Dasgupta, B, "Fundamentals of Statistics" Vol. –I, World Press, India, 8th Edition (2005) Reprint (2008)
3. Gupta, S.C., and kapoor, V.K. "Fundamentals of Mathemetical Statistics" Sultan Chand & Sons, New Delhi, India 11th edition(2002), Reprint 2015
4. Medhi, J. Statistical Methods, Wiley Eastern Ltd. 3rd Edition (2006)
5. Mukhopadhyay. P. "Mathematical Statistics", New Central Book Agency. Pvt. Ltd. Kolkata. 2nd editlon (2005)
6. Gupta S.P. "Statistical Methods", Sultan Chand and Sons.31st Edition(2002)
7. Shastri,V., Pathak. A. and Shastri, R. "उच्च सांख्यिकी विश्लेषण', Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
8. Shukla, S.M. and Sahay. S.P. "सांख्यिकी के सिद्धांत" Sahitya Bhawan Publlcations. 31st edition,(2008)
9. Singh, S.P. "सांख्यिकी के सिद्धांत एवं व्यवहार", S. Chand Company, New Delhi, 1st Revised Edition (1978), Reprint(2018)

Reference Books:-

1. Agrawal, B.L. "Programmed Statistics", New Age International Pvt. Ltd., India, 2nd Edition(2003), Reprint(2010)
2. Holcomb, Z.C. "Fundamentals of Descriptive Statistics",Routledge. 1st Edition (1998), Reprint (2016)

Platform

1. https://mathworld.wolfram.com/topics/DescriptiveStatistics.html
2. https://stattrek.com/statistics/charts/histogram.aspx?tutorial=AP

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests. The division of marks are as follows:**	**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours

A. Submission of Assignment followed by Presentation			**Section(A) : 05 MCQ Questions**	05 x 01 = 05
B. Class Test	**Best two test marks 20 Marks**	**Best two test marks 40 Marks**	**Section (B) : Five Short Questions (200 Words Each)**	05 x 05 = 25
Test I (Written Test)	**20 Marks**		**Section (C) : Two Long Questions (500 Words Each)**	02 x 15 = 30
Test II (Written Test)	**20 Marks**			
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

Govt. Holkar (Model Autonomous) Science College, Indore

Department of Statistics

Syllabus Session 2021-22

Programme: Certificate in Science **Class: B.Sc. II Sem**

S.No	Paper	Paper Title	Paper Code	Theory (Max. Marks 100)				Practical (Max. Marks 100)				
				Credits	CCE	External assessment	Min Marks	Credits	Internal assess-ment	External assess-ment	Min. Marks	Total credits
1	Paper II Core Course (Major)	Probability and Probability Distribution (Paper-II)	S2-19-I	4	40	60	35	2	40	60	35	6
2	Minor	Theory of Probability and Probability Distribution (Paper-II)	S2-19-M	4	40	60	35	2	40	60	35	6
3	Open Elective	Introduction to Probability Theory (Paper-II)	S2-19-O	4	40	60	35	-	-	-	-	4

DEPARTMENT OF STATISTICS

Part A Introduction				
Program: UG/Certificate		Class: B. Sc.	Semester: II	Session: 2021- 2022
Subject: STATISTICS				
1	Course Code	S2-19-I		
2	Course Title	Probability and Probability Distribution		
3	Course Type (Core Course/ Open Elective/ Generic Elective/ Vocational)	Core Course		
4	Pre-requisite (if any)	To study this course, a student must have had the subject mathematics in the class 12th.		
5	Course Objectives	The main objective of this course is to acquaint students with basic concepts and applications of probability and probability distributions. This will enable the student to develop and analyse probabilistic models in real life situations.		
6	Course Learning outcomes (CLO)	At the end of this course students will gain knowledge related to,		
		1. Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.		
		2. Derive the probability density function of transformation of random variables and Calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.		
		3. Use discrete and continuous probability distributions, including requirements, mean and variance, and making decisions.		
		4. Identify the type of statistical situation to which different distributions can be applied. Also use different distributions to solve simple practical problems.		
		5. Translate real-world problems into probability models.		
7	Credit Value	4 Credits		
8	Total Marks	Max. Marks: 40 (CCE)+60 (End Semester or Theory Exam) External Evaluation = 100 Marks		Min. Passing Marks:35

Part B- Content of the Course		
Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P: 4-0-0		
Paragraph	Topics	No. of Lectures
I	**Probability and its applications** **1.Elements of probability** 1.1 History of Probability and Indian context 1.2 Random experiment, trials, outcomes, sample points, sample space. 1.3 Events, exhaustive events, favorable events, equally likely events, mutually exclusive events, independent events. 1.4 Mathematical and Statistical definitions of probability with their limitations. 1.5 Axiomatic approach to probability **2. Laws of Probability** 2.1Addition law of probability 2.2 Conditional probability 2.3 Multiplication law of probability 2.4 Total probability theorem 2.5 Bayes theorem	12
	प्रायिकता एवं उसके अनुप्रयोग 1- प्रायिकता के अवयव 1-1 प्रायिकताका इतिहास एवं भारतीय संदर्भ में विकास 1-2 यादृच्छिक प्रयोग, अभिप्रयोग, आगत, परिणाम, प्रतिदर्श बिंदु, समष्टि प्रतिदर्श 1-3 घटनायें, संपूर्ण, निःशेष घटनायें, अनुकूल घटनायें, समसम्भावी घटनायें, परस्पर अपवर्जी घटनायें, स्वतंत्र घटनायें 1-4 प्रायिकता की गणितीय एवं सांख्यिकीय परिभाषायें एवं उनकी सीमाएं 1-5 प्रायिकता का अभिगृहितीय अनुगमन 2- प्रायिकता के नियम 2-1 प्रायिकता का योग नियम	

	2-2 सप्रतिबंध प्रायिकता 2-3 प्रायिकता का गुणन नियम 2-4 कुल प्रायिकता प्रमेय 2-5 वेज़ प्रमेय	
II	**Random variables and related functions with properties** **1. Random variables** 1.1 Definition with examples 1.2 Discrete and continuous random variables 1.3 Distribution function 1.4 Probability mass function, probability density function and their properties. 1.5 Joint, marginal and conditional probability distribution functions 1.6 Independence of random variables **2. Mathematical expectations** 2.1 Definition and its properties 2.2 Addition theorem of expectations 2.3 Multiplication theorem of expectations 2.4 Mean and variance of linear combinations of random variables.	**12**
	यादृच्छिक चर तथा संबंधित फलन उनके गुण सहित 1- यादृच्छिक चर 1.1 परिभाषा उदाहरण सहित 1.2 असतत एवं सतत् यादृच्छिक चर 1.3 बंटन फलन 1.4 प्रायिकता मात्रा फलनप्रायिकता घनत्व फलन 1.5 संयुक्त उपांत / सीमांत तथा सप्रतिबंध प्रायिकताफलन 1.6 यादृच्छिक चरों की स्वातंत्रयता 2- गणितीय प्रत्याशा 2–1परिभाषा एवं उसके गुण 2-2 प्रत्याशा का योग प्रमेय 2-3 प्रत्याशा का गुणन प्रमेय	

	2-4 यादृच्छिक चरों के रेखीय संचय का माध्य तथा प्रसरण	
III	**Generating functions and Theoretical discrete distributions, their properties and applications** 1. **Generating functions** 1.1 Moment generating function 1.2 Cumulant generating function 1.3 Probability generating function 1.4 Characteristics function (concept only) 2. **Theoretical discrete distributions** 2.1 Uniform distribution 2.2 Bernoulli distribution 2.3 Binomial distribution 2.4 Poisson distribution 2.4.1 Poisson distribution (as limiting form of binomial distribution)	12
	जनक फलन तथा सैद्धांतिक असतत बंटन ,उनके गुण तथा अनुप्रयोग 1. जनक फलन 1.1 आघूर्ण जनक फलन 1.2 संचयी जनक फलन 1.3 प्रायिकता जनक फलन 1.4 अभिलाक्षणिक फलन 2. सैद्धांतिक असतत बंटन ,उनके गुण तथा अनुप्रयोग 2.1 एक समान बंटन 2.2 बर्नौली बंटन 2.3 द्विपद बंटन 2.4 प्वासों बंटन 2.4.1 प्वासों बंटन द्विपद बंटन के सीमान्त रूप में	
IV	**Theoretical discrete distributions, their properties and applications** 1. Negative binomial distribution 2. Geometric distribution	12

	2.1 Lack of memory property of geometric distribution 3. Hyper- geometric distribution **Theoretical continuous distributions, their properties and applications** 1. Rectangular or uniform distribution 2. Normal distribution	
	सैद्धांतिक असतत बंटन ,उनके गुण तथा अनुप्रयोग 1. ऋणात्मक द्विपद बंटन 2. गुणोत्तर बंटन 2.1 गुणोत्तर बंटन की स्मृति लोप विशेषता 3. अतिगुणोत्तर बंटन सैद्धांतिक सतत् बंटन, उनके गुण तथा अनुप्रयोग 1. आयताकार या एक समान बंटन 2. प्रसामान्य बंटन	
V	**Theoretical continuous distributions, their properties and applications** 1. Gamma distribution 2. Beta distribution 2.1 First kind 2.2 Second kind 3. Exponential distribution 3.1 Lack of memory property of exponential distribution.	12
	सैद्धांतिक सतत् बंटन, उनके गुण तथा अनुप्रयोग 1. गामा बंटन 2. बीटा बंटन 2.1 प्रथम प्रकार 2.2 द्वितीय प्रकार 3. चरघातांकी बंटन 3.1 चरघातांकी बंटन की स्मृतिलोप विशेषता	
Keywords: Probability, Bayes theorem, Random variables, Generating functions. Mathematical expectations, Binomial distribution, Poisson distribution, Geometric distribution, Negative binomial distribution, Hyper-geometric distribution, Normal, Gamma, Beta, Exponential distribution.		

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books:

1. **Goon A. M., Gupta, M.K. and Dasgupta, B.:** "Fundamentals of Statistics". Vol.-1, World Press, India, 8th Edition (2005), Reprint (2008).
2. **Gupta, S. C., and V. K. Kapoor:** "Fundamentals of Mathematical Statistics". Sultan Chand & Sons, New Delhi, India, 11th edition (2002), Reprint 2015
3. **Gupta, S.P.** "Statistical Methods", Sultan Chand and Sons. 31st Edition (2002)
4. **Medhi, J.** "Statistical methods", Wiley Eastern Ltd. 3rd Edition (2006)
5. **Mukhopadhya, P.** "Mathematical Statistics", New Central Book Agency. Pvt. Ltd. Kolkata. 2nd edition (2005)
6. **Shastri,V, Pathak. A. and Shastri, R.** "उच्च सांख्यिकीय विश्लेशण", Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
7. **Shukla, S.M. and Sahay**, S.P. "साख्यिकी के सिद्धात" Sahitya Bhawan Publications. 31stEdition (2008)
8. **Singh, S.P.** "सांख्यिकी के सिद्धांत एवंव्यवहार", S. Chand and Company, New Delhi, 1st Revised Edition (1978), Reprint (2018)

Reference Books:

1. **Bhat, B.R.:** Elements of Modern Probability Theory", New Academic Science Ltd. 4th Edition (2018)
2. **Hogg, R. V. and Craig, A.T.:** "Introduction to Mathematical Statistics", Macmillan Publication Co. Inc. New York. (1978)
3. **Mood, A.M., Graybill, F.A. and Boes, D.C.:** "Introduction to the Theory of Statistics", McGraw-Hill Education (India) Pvt. Ltd. 3rd Edition (2001)
4. **Ross, S.:** "A first course in Probability, Pearson Education Publishers", Delhi .6th Edition (2003)

Suggestive digital platforms

1. https://mathworld.wolfram.com/topic/Probability.html
2. https://stattrek.com/probability/probability-rules.aspx?tutorial=AP

Weblink

1. https://www.youtube.com/watch?v=mrCrjeqJv6U&list=PLbMVogVj5nJQWowhOG0-K-ylbwRRmm3C
2. https://onlinecourses.swayam2.ac.in/cec21_ma02/preview

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks Shall be based on allotted assignments and Class Tests. The division of marks are as follows:			External Evaluation (Theory Exam) End Semester Exam: 60 Marks Time : 02.00 Hours	
A. Submission of Assignment followed by Presentation			Section(A) : 05 MCQ Questions	05 x 01 = 05
B. Class Test	Best two test marks 20 Marks	Best two test marks 40 Marks	Section (B) : Five Short Questions (200 Words Each)	05 x 05 = 25
Test I (Written Test)	20 Marks		Section (C) : Two Long Questions (500 Words Each)	02 x 15 = 30
Test II (Written Test)	20 Marks			
Test III (Quiz/Seminar/Assignment)	20 Marks			
Total Internal Assessment (Theory) Marks (A+B)		40 Marks	Total External Evaluation (Theory) Marks (A+B+C)	60 Marks

DEPARTMENT OF STATISTICS

Part A Introduction			
Program: UG/ Certificate	Class: B. Sc.	Semester II	Session: 2021-2022
Subject: Statistics Practical			

1	Course Code	S2-19-I	
2	Course Title	Hands on fitting of Standard Probability Distributions	
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Core Course	
4	Pre-requisite (if any)	This Practical course is based on theory paper "Probability and Probability Distribution"	
5	Course Learning outcomes (CLO)	On completion of this course, learners will be able to:	
		1. Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.	
		2. Calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.	
		3. Use discrete and continuous probability distributions to solve statistical problems.	
		4. Use the normal probability distribution including standard normal curve calculations of appropriate areas.	
		5. Use different distributions to solve simple practical problems.	
6	Credit Value	2 Credits	
7	Total Marks	Max. Marks: 40+60	Min. Passing Marks:35

Part B- Content of the Course	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-2	
Total numbers of lab hours: 30 Hrs. (2 hours per week)	
Lab Assignments	No. of Lab Hrs.

Fitting of discrete probability distributions 1. Fitting of binomial distribution for given n and p 2. Fitting of binomial distribution for unknown parameters 3. Fitting of Poisson distribution for given value of parameters 4. Fitting of Poisson distribution for unknown parameter 5. Fitting of negative binomial distribution 6. Fitting of hyper-geometric distribution **Fitting of normal Distribution** 1 To identify nature of different discrete and continuous probability distributions from their probability distribution curves with change in parameter values from their graphs 2 Fitting of normal distribution using area property when parameters are known 3 Fitting of normal distribution using area property when parameters are unknown 4 Fitting of normal distribution using ordinates when parameters are known. 5 Fitting of normal distribution using ordinates when parameters are unknown	**30**

Keywords/Tags: Binomial distribution, Poisson distribution, negative binomial distribution, hyper-geometric distribution, fitting of distributions, Normal distribution, fitting of normal distribution

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books:

1. **DeCoursey, W.J.** "Statistics and Probability for Engineering Applications with Microsoft® Excel", Newnes Publications, London, UK, (2013)
2. **Gupta, S.C., and Kapoor, V.K.** "Fundamentals of Mathematical Statistics". Sultan Chand & Sons, New Delhi, India, 11th edition (2002), Reprint 2015
3. **Gupta, S.P.:** "Statistical Methods", Sultan Chand & Sons. 31st Edition (2002)
4. **Moore, D.S., Notz, W.I. and Fligner, M.A.** "The Basic practice of Statistics", W.H. Freeman and Company, USA, 8th Edition (2017)
5. **Quirk,T.J., Quirk M.H. and Horton, H.F. :** "Excel for Physical Sciences Statistics", Springer International Publishing Switzerland. 1st Edition (2016)
6. **Shastri, V, Pathak, A. and Shastri, R.:** "उच्च सांख्यिकीय विश्लेशण", Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
7. **Shukla, S.M. and Sahay, S.P.:** "सांख्यिकी के सिद्धांत ", Sahitya Bhawan Publications. 31st edition, 2008
8. **Siegel, A.F.:** "Practical Business Statistics", Academic Press publications, USA. 7th Edition (2016)
9. **Singh, S.P.:** "सांख्यिकी के सिद्धात एव व्यवहार", S. Chand and Company, New Delhi, 1st Revised Edition (1978), Reprint (2018).

Suggestive digital platforms web links:

Platform

1. https://mathworld.wolfram.com/topics/Probability.html
2. https://stattrek.com/probability/probability-rules.aspx?tutorial=AP

Weblinks

1. https://www.youtube.com/watch?v=mrCrjeqJv6U&list=PLbMVogVj5nJQWowhOG0-K-yl-bwRRmm3C
2. https://onlinecourses.swayam2.ac.in/cec21_ma02/preview

Part D-Assessment and Evaluation	
Internal Assessment (A):	**40 Marks**
Lab Record/Class Interaction/Quiz	15 Marks
Attendance in the Lab	05 Marks
Assignments (Industrial Training (10 hours)/ Mini Project (Project Demo + Report))	20 Marks
End Sem External Evaluation (B):	**60 Marks**
Viva Voce on Practical	10 Marks
Practical Record File	10 Marks
Table Work/ Experiments	40 Marks
Total Marks (A+B)	**100 Marks**

DEPARTMENT OF STATISTICS

Part A Introduction

Program: UG/Certificate	Class: B. Sc.	Semester: II	Session: 2021- 2022

Subject: STATISTICS

1	Course Code	S2-19-M	
2	Course Title	Theory of Probability and Probability Distribution	
3	Course Type (Core Course/ Open Elective/ Generic Elective/ Vocational)	Core Course	
4	Pre-requisite (if any)	To study this course, a student must have had the subject mathematics in the class 12th.	
5	Course Objectives	The main objective of this course is to acquaint students with basic concepts and applications of probability and probability distributions. This will enable the student to develop and analyse probabilistic models in real life situations.	
6	Course Learning outcomes (CLO)	At the end of this course students will gain knowledge related to,	
		1. Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.	
		2. Derive the probability density function of transformation of random variables and Calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.	
		3. Use discrete and continuous probability distributions, including requirements, mean and variance, and making decisions.	
		4. Identify the type of statistical situation to which different distributions can be applied. Also use different distributions to solve simple practical problems.	
		5. Translate real-world problems into probability models.	
7	Credit Value	4 Credits	
8	Total Marks	Max. Marks: 40 (CCE)+60 (End Semester or Theory Exam) External Evaluation = 100 Marks	Min. Passing Marks:35

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P: 4-0-0

Paragraph	Topics	No. of Lectures
I	**Probability and its applications** **1.Elements of probability** 1.1 History of Probability and Indian context 1.2 Random experiment, trials, outcomes, sample points, sample space. 1.3 Events, exhaustive events, favourable events, equally likely events, mutually exclusive events, independent events. 1.4 Mathematical and Statistical definitions of probability with their limitations. 1.5 Axiomatic approach to probability **2. Laws of Probability** 2.1Addition law of probability 2.2 Conditional probability 2.3 Multiplication law of probability 2.4 Total probability theorem 2.5 Bayes theorem	12
	प्रायिकता एवं उसके अनुप्रयोग 1- प्रायिकता के अवयव 1-1 प्रायिकताका इतिहास एवं भारतीय संदर्भ में विकास 1-2 यादृच्छिक प्रयोग, अभिप्रयोग, आगत, परिणाम, प्रतिदर्श बिंदु, समष्टि प्रतिदर्श 1-3 घटनायें, संपूर्ण, निःशेष घटनायें, अनुकूल घटनायें, समसम्भावी घटनायें, परस्पर अपवर्जी घटनायें, स्वतंत्र घटनायें 1-4 प्रायिकता की गणितीय एवं सांख्यिकीय परिभाषायें एवं उनकी सीमाएं 1-5 प्रायिकता का अभिगृहितीय अनुगमन 2- प्रायिकता के नियम 2-1 प्रायिकता का योग नियम	

	2-2 सप्रतिबंध प्रायिकता 2-3 प्रायिकता का गुणन नियम 2-4 कुल प्रायिकता प्रमेय 2-5 वेज़ प्रमेय	
II	**Random variables and related functions with properties** **1. Random variables** 1.1 Definition with examples 1.2 Discrete and continuous random variables 1.3 Distribution function 1.4 Probability mass function, probability density function and their properties. 1.5 Joint, marginal and conditional probability distribution functions 1.6 Independence of random variables **2. Mathematical expectations** 2.1 Definition and its properties 2.2 Addition theorem of expectations 2.3 Multiplication theorem of expectations 2.4 Mean and variance of linear combinations of random variables.	**12**
	यादृच्छिक चर तथा संबंधित फलन उनके गुण सहित 1- यादृच्छिक चर 1.1 परिभाषा उदाहरण सहित 1.2 असतत एवं सतत् यादृच्छिक चर 1.3 बंटन फलन 1.4 प्रायिकता मात्रा फलनप्रायिकता घनत्व फलन 1.5 संयुक्त उपांत / सीमांत तथा सप्रतिबंध प्रायिकताफलन 1.6 यादृच्छिक चरों की स्वातंत्र्यता 2- गणितीय प्रत्याशा 2-1परिभाषा एवं उसके गुण 2-2 प्रत्याशा का योग प्रमेय 2-3 प्रत्याशा का गुणन प्रमेय	

	2-4 यादृच्छिक चरों के रेखीय संचय का माध्य तथा प्रसरण	
III	**Generating functions and Theoretical discrete distributions, their properties and applications** 1. **Generating functions** 1.1 Moment generating function 1.2 Cumulant generating function 1.3 Probability generating function 1.4 Characteristics function (concept only) 2. **Theoretical discrete distributions** 2.1 Uniform distribution 2.2 Bernoulli distribution 2.3 Binomial distribution 2.4 Poisson distribution 2.4.1 Poisson distribution (as limiting form of binomial distribution)	12
	जनक फलन तथा सैद्धांतिक असतत बंटन ,उनके गुण तथा अनुप्रयोग 1. जनक फलन 1.1 आघूर्ण जनक फलन 1.2 संचयी जनक फलन 1.3 प्रायिकता जनक फलन 1.4 अभिलाक्षणिक फलन 2. सैद्धांतिक असतत बंटन ,उनके गुण तथा अनुप्रयोग 2.1 एक समान बंटन 2.2 बर्नोली बंटन 2.3 द्विपद बंटन 2.4 प्वासों बंटन 2.4.1 प्वागों बंटन द्विपद बंटन के सीमान्त रूप में	
IV	**Theoretical discrete distributions, their properties and applications** 1. Negative binomial distribution 2. Geometric distribution	12

	2.1 Lack of memory property of geometric distribution 3. Hyper- geometric distribution **Theoretical continuous distributions, their properties and applications** 1. Rectangular or uniform distribution 2. Normal distribution	
	सैद्धांतिक असतत बंटन ,उनके गुण तथा अनुप्रयोग 1. ऋणात्मक द्विपद बंटन 2. गुणोत्तर बंटन 2.1 गुणोत्तर बंटन की स्मृति लोप विशेषता 3. अतिगुणोत्तर बंटन सैद्धांतिक सतत् बंटन, उनके गुण तथा अनुप्रयोग 1. आयताकार या एक समान बंटन 2. प्रसामान्य बंटन	
V	**Theoretical continuous distributions, their properties and applications** 1. Gamma distribution 2. Beta distribution 2.1 First kind 2.2 Second kind 3. Exponential distribution 3.1 Lack of memory property of exponential distribution.	**12**
	सैद्धांतिक सतत् बंटन, उनके गुण तथा अनुप्रयोग 1. गामा बंटन 2. बीटा बंटन 2.1 प्रथम प्रकार 2.2 द्वितीय प्रकार 3. चरघातांकी बंटन 3.1 चरघातांकी बंटन की स्मृतिलोप विशेषता	

Keywords: Probability, Bayes theorem, Random variables, Generating functions. Mathematical expectations, Binomial distribution, Poisson distribution, Geometric distribution, Negative binomial distribution, Hyper-geometric distribution, Normal, Gamma, Beta, Exponential distribution.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books:

1. **Goon A. M., Gupta, M.K. and Dasgupta, B.:** "Fundamentals of Statistics". Vol.-1, World Press, India, 8th Edition (2005), Reprint (2008).
2. **Gupta, S. C., and V. K. Kapoor:** "Fundamentals of Mathematical Statistics". Sultan Chand & Sons, New Delhi, India, 11th edition (2002), Reprint 2015
3. **Gupta, S.P.** "Statistical Methods", Sultan Chand and Sons. 31st Edition (2002)
4. **Medhi, J.** "Statistical methods", Wiley Eastern Ltd. 3rd Edition (2006)
5. **Mukhopadhya, P.** "Mathematical Statistics", New Central Book Agency. Pvt. Ltd. Kolkata. 2nd edition (2005)
6. **Shastri,V, Pathak. A. and Shastri, R.** "उच्च सांख्यिकीय विश्लेशण", Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
7. **Shukla, S.M. and Sahay**, S.P. "सांख्यिकी के सिद्धांत" Sahitya Bhawan Publications. 31stEdition (2008)
8. **Singh, S.P.** "सांख्यिकी के सिद्धांत एवंव्यवहार", S. Chand and Company, New Delhi, 1st Revised Edition (1978), Reprint (2018)

Reference Books:

1. **Bhat, B.R.:** Elements of Modern Probability Theory", New Academic Science Ltd. 4th Edition (2018)
2. **Hogg, R. V. and Craig, A.T.:** "Introduction to Mathematical Statistics", Macmillan Publication Co. Inc. New York. (1978)
3. **Mood, A.M., Graybill, F.A. and Boes, D.C.:** "Introduction to the Theory of Statistics", McGraw-Hill Education (India) Pvt. Ltd. 3rd Edition (2001)
4. **Ross, S.:** "A first course in Probability, Pearson Education Publishers", Delhi .6th Edition (2003)

Suggestive digital platforms

1. https://mathworld.wolfram.com/topic/Probability.html
2. https://stattrek.com/probability/probability-rules.aspx?tutorial=AP

Weblink

1. https://www.youtube.com/watch?v=mrCrjcqJv6U&list=PLbMVogVj5nJQWowhOG0-K-ylbwRRmm3C
2. https://onlinecourses.swayam2.ac.in/cec21_ma02/preview

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests.The division of marks are as follows:**			**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours	
A. **Submission of Assignment followed by Presentation**			**Section(A) :** 05 MCQ Questions	05 x 01 = 05
B. **Class Test**	**Best two test marks** **20 Marks**	**Best two test marks** **40 Marks**	**Section (B) :** Five Short Questions (200 Words Each)	05 x 05 = 25
Test I (Written Test)	**20 Marks**			
Test II (Written Test)	**20 Marks**		**Section (C) :** Two Long Questions (500 Words Each)	02 x 15 = 30
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

DEPARTMENT OF STATISTICS

Part A Introduction			
Program: UG/ Certificate	Class: B. Sc.	Semester II	Session: 2021-2022
Subject: Statistics Practical			

1	Course Code	S2-19-M	
2	Course Title	Hands on fitting of Standard Probability Distributions	
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Core Course	
4	Pre-requisite (if any)	This Practical course is based on theory paper "Probability and Probability Distribution"	
5	Course Learning outcomes (CLO)	On completion of this course, learners will be able to:	
		1. Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.	
		2. Calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.	
		3. Use discrete and continuous probability distributions to solve statistical problems.	
		4. Use the normal probability distribution including standard normal curve calculations of appropriate areas.	
		5. Use different distributions to solve simple practical problems.	
6	Credit Value	2 Credits	
7	Total Marks	Max. Marks: 40+60	Min. Passing Marks:35

Part B- Content of the Course	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-2	
Total numbers of lab hours: 30 Hrs. (2 hours per week)	
Lab Assignments	No. of Lab Hrs.

Fitting of discrete probability distributions 1. Fitting of binomial distribution for given n and p 2. Fitting of binomial distribution for unknown parameters 3. Fitting of Poisson distribution for given value of parameters 4. Fitting of Poisson distribution for unknown parameter 5. Fitting of negative binomial distribution 6. Fitting of hyper-geometric distribution **Fitting of normal Distribution** 1 To identify nature of different discrete and continuous probability distributions from their probability distribution curves with change in parameter values from their graphs 2 Fitting of normal distribution using area property when parameters are known 3 Fitting of normal distribution using area property when parameters are unknown 4 Fitting of normal distribution using ordinates when parameters are known. 5 Fitting of normal distribution using ordinates when parameters are unknown	**30**

Keywords/Tags: Binomial distribution, Poisson distribution, negative binomial distribution, hyper-geometric distribution, fitting of distributions, Normal distribution, fitting of normal distribution

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books:

1. **DeCoursey, W.J.** "Statistics and Probability for Engineering Applications with Microsoft® Excel", Newnes Publications, London, UK, (2013)
2. **Gupta, S.C., and Kapoor, V.K.** "Fundamentals of Mathematical Statistics". Sultan Chand & Sons, New Delhi, India, 11th edition (2002), Reprint 2015
3. **Gupta, S.P.:** "Statistical Methods", Sultan Chand & Sons. 31st Edition (2002)
4. **Moore, D.S., Notz, W.I. and Fligner, M.A.** "The Basic practice of Statistics", W.H. Freeman and Company, USA, 8th Edition (2017)
5. **Quirk,T.J., Quirk M.H. and Horton, H.F. :** "Excel for Physical Sciences Statistics", Springer International Publishing Switzerland. 1st Edition (2016)
6. **Shastri, V, Pathak, A. and Shastri, R.:** "उच्च सांख्यिकीय विश्लेशण", Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
7. **Shukla, S.M. and Sahay, S.P.:** "सांख्यिकी के सिद्धांत", Sahitya Bhawan Publications. 31st edition, 2008
8. **Siegel, A.F.:** "Practical Business Statistics", Academic Press publications, USA. 7th Edition (2016)
9. **Singh, S.P.:** "सांख्यिकी के सिद्धांत एवं व्यवहार", S. Chand and Company, New Delhi, 1st Revised Edition (1978), Reprint (2018).

Suggestive digital platforms web links:

Platform	1. https://mathworld.wolfram.com/topics/Probability.html 2. https://stattrek.com/probability/probability-rules.aspx?tutorial=AP
Weblinks	1. https://www.youtube.com/watch?v=mrCrjeqJv6U&list=PLbMVogVj5nJQWowhOG0-K-yl-bwRRmm3C 2. https://onlinecourses.swayam2.ac.in/cec21_ma02/preview

Part D-Assessment and Evaluation

Internal Assessment (A):	
Lab Record/Class Interaction/Quiz	**40 Marks**
Attendance in the Lab	15 Marks
Assignments (Industrial Training (10 hours)/ Mini Project (Project Demo + Report))	05 Marks
End Sem External Evaluation (B):	20 Marks
Viva Voce on Practical	**60 Marks**
Practical Record File	10 Marks
Table Work/ Experiments	10 Marks
Total Marks (A+B)	40 Marks
	100 Marks

DEPARTMENT OF STATISTICS

Part A Introduction

Program: UG/Certificate	Class: B. Sc.	Semester: II	Session: 2021- 2022

Subject: STATISTICS

1	Course Code	S2-19-O	
2	Course Title	Introduction to Probability Theory	
3	Course Type (Core Course/ Open Elective/ Generic Elective/ Vocational)	Open Elective	
4	Pre-requisite (if any)	To study this course, a student must have had the subject mathematics in the class 12th.	
5	Course Objectives	The main objective of this course is to acquaint students with basic concepts and applications of probability and probability distributions. This will enable the student to develop and analyse probabilistic models in real life situations.	
6	Course Learning outcomes (CLO)	At the end of this course students will gain knowledge related to,	
		1. Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events.	
		2. Derive the probability density function of transformation of random variables and Calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables.	
		3. Use discrete and continuous probability distributions, including requirements, mean and variance, and making decisions.	
		4. Identify the type of statistical situation to which different distributions can be applied. Also use different distributions to solve simple practical problems.	
		5. Translate real-world problems into probability models.	
7	Credit Value	4 Credits	
8	Total Marks	Max. Marks: 40 (CCE)+60 (End Semester or Theory Exam) External Evaluation = 100 Marks	Min. Passing Marks:35

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practicals (in hours per week): L-T-P: 4-0-0

Paragraph	Topics	No. of Lectures
I	**Probability and its applications** **1.Elements of probability** 1.1 History of Probability and Indian context 1.2 Random experiment, trials, outcomes, sample points, sample space. 1.3 Events, exhaustive events, favorable events, equally likely events, mutually exclusive events, independent events. 1.4 Mathematical and Statistical definitions of probability with their limitations. 1.5 Axiomatic approach to probability **2. Laws of Probability** 2.1Addition law of probability 2.2 Conditional probability 2.3 Multiplication law of probability 2.4 Total probability theorem 2.5 Bayes theorem	12
	प्रायिकता एवं उसके अनुप्रयोग 1- प्रायिकता के अवयव 1-1 प्रायिकताका इतिहास एवं भारतीय संदर्भ में विकास 1-2 यादृच्छिक प्रयोग, अभिप्रयोग, आगत, परिणाम, प्रतिदर्श बिंदु, समष्टि प्रतिदर्श 1-3 घटनायें, संपूर्ण, निःशेष घटनायें, अनुकूल घटनायें, समसम्भावी घटनायें, परस्पर अपवर्जी घटनायें, स्वतंत्र घटनायें 1-4 प्रायिकता की गणितीय एवं सांख्यिकीय परिभाषायें एवं उनकी सीमाएं 1-5 प्रायिकता का अभिगृहितीय अनुगमन 2- प्रायिकता के नियम 2-1 प्रायिकता का योग नियम	

	2-2 सप्रतिबंध प्रायिकता 2-3 प्रायिकता का गुणन नियम 2-4 कुल प्रायिकता प्रमेय 2-5 वेज़ प्रमेय	
II	**Random variables and related functions with properties** **1. Random variables** 1.1 Definition with examples 1.2 Discrete and continuous random variables 1.3 Distribution function 1.4 Probability mass function, probability density function and their properties. 1.5 Joint, marginal and conditional probability distribution functions 1.6 Independence of random variables **2. Mathematical expectations** 2.1 Definition and its properties 2.2 Addition theorem of expectations 2.3 Multiplication theorem of expectations 2.4 Mean and variance of linear combinations of random variables.	**12**
	यादृच्छिक चर तथा संबंधित फलन उनके गुण सहित 1- यादृच्छिक चर 1.1 परिभाषा उदाहरण सहित 1.2 असतत एवं सतत् यादृच्छिक चर 1.3 बंटन फलन 1.4 प्रायिकता मात्रा फलनप्रायिकता घनत्व फलन 1.5 संयुक्त उपांत / सीमांत तथा सप्रतिबंध प्रायिकताफलन 1.6 यादृच्छिक चरों की स्वातंत्र्यता 2- गणितीय प्रत्याशा 2-1परिभाषा एवं उसके गुण 2-2 प्रत्याशा का योग प्रमेय 2-3 प्रत्याशा का गुणन प्रमेय	

	2-4 यादृच्छिक चरों के रेखीय संचय का माध्य तथा प्रसरण	
III	**Generating functions and Theoretical discrete distributions, their properties and applications** 1. **Generating functions** 1.1 Moment generating function 1.2 Cumulant generating function 1.3 Probability generating function 1.4 Characteristics function (concept only) 2. **Theoretical discrete distributions** 2.1 Uniform distribution 2.2 Bernoulli distribution 2.3 Binomial distribution 2.4 Poisson distribution 2.4.1 Poisson distribution (as limiting form of binomial distribution)	12
	जनक फलन तथा सैद्धांतिक असतत बंटन ,उनके गुण तथा अनुप्रयोग 1. जनक फलन 1.1 आघूर्ण जनक फलन 1.2 संचयी जनक फलन 1.3 प्रायिकता जनक फलन 1.4 अभिलाक्षणिक फलन 2. सैद्धांतिक असतत बंटन ,उनके गुण तथा अनुप्रयोग 2.1 एक समान बंटन 2.2 बर्नोली बंटन 2.3 द्विपद बंटन 2.4 प्वासों बंटन 2.4.1 प्वासों बंटन द्विपद बंटन के सीमान्त रूप में	
IV	**Theoretical discrete distributions, their properties and applications** 1. Negative binomial distribution 2. Geometric distribution	12

	2.1 Lack of memory property of geometric distribution 3. Hyper- geometric distribution **Theoretical continuous distributions, their properties and applications** 1. Rectangular or uniform distribution 2. Normal distribution	
	सैद्धांतिक असतत बंटन ,उनके गुण तथा अनुप्रयोग 1. ऋणात्मक द्विपद बंटन 2. गुणोत्तर बंटन 2.1 गुणोत्तर बंटन की स्मृति लोप विशेषता 3. अतिगुणोत्तर बंटन सैद्धांतिक सतत् बंटन, उनके गुण तथा अनुप्रयोग 1. आयताकार या एक समान बंटन 2. प्रसामान्य बंटन	
V	**Theoretical continuous distributions, their properties and applications** 1. Gamma distribution 2. Beta distribution 2.1 First kind 2.2 Second kind 3. Exponential distribution 3.1 Lack of memory property of exponential distribution.	**12**
	सैद्धांतिक संतत् बंटन, उनके गुण तथा अनुप्रयोग 1. गामा बंटन 2. बीटा बंटन 2.1 प्रथम प्रकार 2.2 द्वितीय प्रकार 3. चरघातांकी बंटन 3.1 चरघातांकी बंटन की स्मृतिलोप विशेषता	

Keywords: Probability, Bayes theorem, Random variables, Generating functions, Mathematical expectations, Binomial distribution, Poisson distribution, Geometric distribution, Negative binomial distribution, Hyper-geometric distribution, Normal, Gamma, Beta, Exponential distribution.

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

Text Books:

1. **Goon A. M., Gupta, M.K. and Dasgupta, B.:** "Fundamentals of Statistics". Vol.-1, World Press, India, 8th Edition (2005), Reprint (2008).
2. **Gupta, S. C., and V. K. Kapoor:** "Fundamentals of Mathematical Statistics". Sultan Chand & Sons, New Delhi, India, 11th edition (2002), Reprint 2015
3. **Gupta, S.P.** "Statistical Methods", Sultan Chand and Sons. 31st Edition (2002)
4. **Medhi, J.** "Statistical methods", Wiley Eastern Ltd. 3rd Edition (2006)
5. **Mukhopadhya, P.** "Mathematical Statistics", New Central Book Agency. Pvt. Ltd. Kolkata. 2nd edition (2005)
6. **Shastri,V, Pathak. A. and Shastri, R.** "उच्च सांख्यिकीय विश्लेशण", Ram Prasad & Sons, Bhopal. 2nd Edition (2009)
7. **Shukla, S.M. and Sahay**, S.P. "साख्यिकी के सिद्धांत" Sahitya Bhawan Publications. 31stEdition (2008)
8. **Singh, S.P.** "सांख्यिकी के सिद्धात एवंव्यवहार", S. Chand and Company, New Delhi, 1st Revised Edition (1978), Reprint (2018)

Reference Books:

1. **Bhat, B.R.:** Elements of Modern Probability Theory", New Academic Science Ltd. 4th Edition (2018)
2. **Hogg, R. V. and Craig, A.T.:** "Introduction to Mathematical Statistics", Macmillan Publication Co. Inc. New York. (1978)
3. **Mood, A.M., Graybill, F.A. and Boes, D.C.:** "Introduction to the Theory of Statistics", McGraw-Hill Education (India) Pvt. Ltd. 3rd Edition (2001)
4. **Ross, S.: "A** first course in Probability, Pearson Education Publishers", Delhi .6th Edition (2003)

Suggestive digital platforms

1. https://mathworld.wolfram.com/topic/Probability.html
2. https://stattrek.com/probability/probability-rules.aspx?tutorial=AP

Weblink

1. https://www.youtube.com/watch?v=mrCrjcqJv6U&list=PLbMVogVj5nJQWowhOG0-K-ylbwRRmm3C
2. https://onlinecourses.swayam2.ac.in/cec21_ma02/preview

Part D-Assessment and Evaluation

Internal Assessment : Continuous Comprehensive Evaluation (CCE):40 Marks **Shall be based on allotted assignments and Class Tests.The division of marks are as follows:**			**External Evaluation (Theory Exam)** End Semester Exam: 60 Marks **Time :** 02.00 Hours	
A. **Submission of Assignment followed by Presentation**			**Section(A) :** 05 MCQ Questions	05 x 01 = 05
B. **Class Test**	**Best two test marks** **20 Marks**	**Best two test marks** **40 Marks**	**Section (B) :** Five Short Questions (200 Words Each)	05 x 05 = 25
Test I (Written Test)	**20 Marks**		**Section (C) :** Two Long Questions (500 Words Each)	02 x 15 = 30
Test II (Written Test)	**20 Marks**			
Test III (Quiz/Seminar/Assignment)	**20 Marks**			
Total Internal Assessment (Theory) Marks (A+B)		**40 Marks**	**Total External Evaluation (Theory) Marks (A+B+C)**	**60 Marks**

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Statistics
Syllabus Session 2021-22

Programme : B.Sc. II Year **Class: B. Sc. II YEAR**

Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -I	Statistical Inference	219-I	40	28	10	3	33	50	17
Paper -2	Sampling Techniques	219-II	40		10	3			

DEPARTMENT OF STATISTICS

Class: B. Sc. II Year
Subject: Statistics
Title of Paper: Statistical Inference

Marks: 40+ (CCE) 10 = 50
Paper: Theory -I
Code of the Paper: 219-I

Part A: Introduction for code-219-I	
Pre-requisite (if any)	-
Course Objectives	Drawing inference about the unknown population parameters based on random samples. Validating estimation about the population using hypothesis testing.
Course Learning Outcomes	1. Know the construction of point and interval estimators and evaluate the properties of estimators.
	2. Demonstrate understanding of the theory of maximum likelihood estimation.
	3. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-value.
	4. Learn to apply non-parametric tests in different real-life situations.
	5. Describe various sampling distributions.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	**Theory of Estimation:** Definition of a random sample, Parameter and Statistic, Concepts of point and interval estimation, Criterion of a good estimator: Unbiasedness, Consistency, Efficiency and Sufficiency, Mean square error of an estimate. Method of maximum likelihood estimation. Cramer – Rao inequality and its applications, confidence interval. Ancillary statistics, completeness, Rao-Blackwell theorem, different methods of estimation and their properties. Definition and concept – asymptotic efficiency, prior and posterior distributions, loss function, risk function and minimax estimator, Bayes estimator.
इकाई-I	**आकलन के सिद्धान्त:** एक यादृच्छिक प्रतिदर्ष की परिभाषा, प्राचल एवं प्रतिदर्शज, बिन्दु एवं अन्तराल आकलन की अवधारणाऐं, एक अच्छे आकलक के मापदण्ड :अनभिनतता, संगतता, दक्षता तथा पर्याप्तता।

	एक आकलक की माध्य वर्ग त्रुटि। अधिकतम संभाविता आकलन विधि, क्रेमर–राव असमयिका तथा विश्वास्यता अंतराल में इसके अनुप्रयोग। सहायक आकडे पूर्णतया राव ब्लेकवेल प्रमेय, आकलन की विभिन्न विधियों एवं उनके गुण। परिभाषाएँ एंव अवधारणा – अनन्त स्पर्शी दक्षता, पूर्ववर्ती एंव पश्चावर्ती बंटन हानि फलन, जोखिम फलन, न्यूनाधिक आकलक, बेज आकलक।
Unit-II	**Testing of Hypothesis:** Concept of Test of Significance, Null and alternative hypothesis, Simple and Composite hypothesis. Type-I and II errors, Critical region and level of significance, One and two tailed tests. Neymann Pearson lemma for construction of most powerful tests for simple null versus simple alternative for the parameters of Binomial, Poisson and Normal distributions. Likelihood ratio test: Likelihood ratio test for single mean. Definition- Random and non-Random tests, similar and unbiased test.
इकाई-II	**परिकल्पना परीक्षणः** सार्थकता परीक्षण की अवधाराणाएं, शून्य तथा वैकल्पिक परिकल्पना, सरल एवं संयुक्त परिकल्पना, प्रथम एवं द्वितीय प्रकार की त्रुटियां, क्रांतिक क्षेत्र तथा सार्थकता स्तर, एकल एवं द्विपुच्छ परीक्षण। द्विपद, प्वासॉ तथा प्रसामान्य बंटन के प्राचलों के लिये सरल शून्य परिकल्पना के विरूद्ध सरल वैकल्पिक परिकल्पना की सर्वाधिक दक्ष परीक्षणो की रचना हेतु नेमन पियरसन प्रमेयिका। संभावित अनुपात परीक्षण:एकल माध्य हेतु संभावित अनुपात परीक्षण । परिभाषाएँ –यादृच्छिक एंव अयादृच्छिक परीक्षण, समरूप तथा अनभिनत परीक्षण।
Unit-III	**Non-Parametric Tests:** Definition of order statistics, distributions of single, joint and marginal density functions. Non-parametric tests; advantages and disadvantages of non-parametric methods. Wald-Wolfwitz run test, Run test for randomness, sign test for univariate and bivariate distribution, Wilcoxon's signed ranked test for univariate and bivariate distribution, Mann-Whitney U-test, Median test (Application only) Kolmogrov- Smirnov- Two sample test, Wald's SPRT and its properties and their OC and ASN functions.
इकाई–III	**अप्राचलिक परीक्षणः** क्रमित प्रतिदर्शज की परिभाषा तथा उनके एकल, संयुक्त तथा उपांत घनत्व फलन। अप्राचलिक परीक्षण, अप्राचलिक विधियों के लिए लाभ और हानि। वाल्ड –वोल्फोविट्ज की परम्परा परीक्षण, यादृच्छिकरण के लिए परम्परा परीक्षण, एकल तथा द्वि–चर बंटन के लिये चिन्ह परीक्षण, एकल तथा द्वि–चर बंटन के लिये विल्काक्सन की कोटि चिन्ह परीक्षण, मान–व्हिटनी यू परीक्षण माध्यिका परीक्षण (केवल अनुप्रयोग)। कोलमोगोरोव – स्मिरनाव – द्वि प्रतिदर्श परिक्षण, वाल्ड्स एस.पी.आर.टी (SPRT) और इसके गुण तथा उनके OC तथा ASN फलन।
Unit-IV	**Sampling Distribution:** Sampling distribution of a statistic, definition of standard error and some examples. Sampling distribution of sum of Binomial and Poisson variates. Sampling distribution of

	mean of normal distribution. Derivation of student's t, Fisher's t, F and Chi-Square distribution with their properties. Relation between t, F and Chi-Square.
इकाई–IV	**प्रतिचयन बंटन:** एक प्रतिदर्शज का प्रतिचयन बंटन, प्रमापित त्रुटि की परिभाषा तथा कुछ उदाहरण, द्वि–पद तथा प्वासा चरो के योग का प्रतिचयन बंटन, प्रसामान्य बंटन के माध्य का प्रतिचयन बंटन, स्टूडेन्ट t, फिशर t, F तथा काई वर्ग बंटनो की व्युत्पति तथा उनके गुण । t, F तथा काई वर्ग के मध्य संबंध।
Unit-V	**Large Sample Tests:** Test of significance for single proportion, difference of proportions & z- test of significance for single mean and for difference of means. **Small Sample Tests:** t -test for single mean, t – test for difference of means, paired t-test, F-test for equality of two population variances. Conditions for the validity of Chi-square test, test for goodness of fit, test for independence of attributes (2x2 Contingency table). Fisher's z-transformation and their applications.
इकाई-V	**वृहत प्रतिदर्श परीक्षण** :एक अनुपात के लिये सार्थकता परीक्षण, माध्यों के अन्तर तथा एकल माध्य के लिए z सार्थकता परीक्षण। **लघु प्रतिदर्श परीक्षण** : एकल माध्य के लिये t-परीक्षण, माध्यों के अन्तर के लिये t-परीक्षण, युग्म t-परीक्षण, दो समष्टि प्रसरण की समानता के लिये F-परीक्षण। काई वर्ग परीक्षण की वैधता शर्तें, आसंजन सुष्ठता के लिये काई वर्ग परीक्षण, गुणों की स्वातन्त्रयता के लिये परीक्षण, (2x2 आसंगतता सारणी) फिशर का z-रूपान्तर तथा उनके अनुप्रयोग।

Part C: -Learning Resources

Text Book, Reference Books, Other resources

Part D: Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): 10
College Exam: 40

Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: 40 Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**

DEPARTMENT OF STATISTICS

Class: B. Sc. II Year
Subject: Statistics
Title of Paper: Sampling Techniques

Marks: 40+ (CCE) 10 = 50
Paper: Theory -II
Code of the Paper: 219-II

Part A : Introduction for code-219-II	
Pre-requisite (if any)	-
Course Objectives	Techniques for selecting a sample from a population keeping in mind the objectives to be fulfilled and obtain estimator of the population parameter from selected sample and study its properties.
Course Learning Outcomes	Students who successfully complete the course should
	1. Understand the Concepts of population and sample, concepts of survey, sampling error.
	2. Know the practical issues arising in sampling studies and understand the concepts of bias and sampling variability and strategies for reducing these.
	3. Understand the principles underlying sampling as a means of making inferences about a population.
	4. Understand the difference between randomization theory and model-based analysis,
	5. Be able to analyse data from different sampling schemes and have an appreciation of the practical issues arising in sampling studies.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	**Sample Survey:** Concept of population and sample, need for sampling, steps in a sample survey, principles of sample survey, sampling and non-sampling errors, requirements of a good sample, complete census v/s sample survey, Limitations of sampling.
इकाई-I	**प्रतिदर्श सर्वेक्षण:** समष्टि एवं प्रतिदर्श की अवधारणा, प्रतिचयन की आवश्यकताएँ, प्रतिदर्श सर्वेक्षण के चरण, प्रतिदर्श सर्वेक्षण के सिद्धान्त, प्रतिचयन एवं अप्रतिचयन त्रुटियाँ, एक अच्छे प्रतिदर्श के मापदण्ड, पूर्ण संगणना बनाम प्रतिदर्श सर्वेक्षण, प्रतिचयन की सीमाएँ ।
Unit-II	**Simple Random Sampling:** Definition of Simple random sampling, Simple random sampling with &without replacement. Unbiasedness of the sample mean, mean square error of the sample mean, merits, demerits and limitations of simple random sampling, confidence limit, size of sample for

	specified precision, simple random sampling for attributes. Probability proportional to size of sample with and without replacement, the Hansen-Hurwitz and the Hovitz – Thompson estimators.
इकाई-II	**सरल यादृच्छिक प्रतिचयनः** सरल यादृच्छिक प्रतिचयन की परिभाषा, प्रतिस्थापन सहित तथा प्रतिस्थापन रहित सरल यादृच्छिक प्रतिचयन, प्रतिदर्श माध्य की अनभिनतता, प्रतिदर्श माध्य की माध्य वर्ग की त्रुटि, सरल यादृच्छिक प्रतिदर्श के गुण, दोष तथा सीमाएँ, विश्वास्यता सीमा, विशिष्ट शुद्धता के लिये प्रतिदर्श का आकार, गुणों के लिये सरल यादृच्छिक प्रतिचयन । प्रतिस्थापन सहित तथा प्रतिस्थापन रहित प्रतिचयन उसके आकार के प्रायिकता अनुपात में। हेन्सेन हर्विट्ज तथा हार्विट्ज थाम्सन के आकलन।
Unit-III	**Stratified Random Sampling:** Definition and advantages of stratified random sampling, proportional allocation, optimum allocation, cost function. Comparison of stratified random sampling with simple random sampling without stratification, proportional allocation versus simple random sampling, Neyman allocation versus simple random sampling. Gain in precision due to stratification. Fixed effects model (Two–way classification), Random and mixed effect models (two ways classification with equal observation per cell.)
इकाई–III	**स्तरित यादृच्छिक प्रतिचयनः** स्तरित यादृच्छिक प्रतिचयन की परिभाषा एवं लाभ, आनुपातिक नियतन, अनुकूलतम नियतन, लागत फलन। बिना स्तरण के सरल यादृच्छिक प्रतिचयन की तुलना स्तरित यादृच्छिक प्रतिचयन से, आनुपातिक नियतन बनाम सरल यादृच्छिक प्रतिचयन, नेमन अनुकूलतम नियतन विरूद्ध आनुपातिक नियतन, नेमन अनुकूलतम नियतन विरूद्ध सरल यादृच्छिक प्रतियन। स्तरण के कारण शुद्धता में लाभ। नियत प्रभाव निदर्श (द्वि–मार्गी वर्गीकरण), यादृच्छिक एवं मिश्रित प्रभाव निदर्श (द्वि–मार्गी वर्गीकरण समान प्रेक्षण प्रति–कोष्ठिका)
Unit-IV	**Systematic Sampling:** Definition, linear systematic sampling, circular systematic sampling, mean and variance of a systematic sample mean, comparison of systematic sampling to simple random sampling, systematic sampling versus stratified random sampling, stratified random sampling versus simple random sampling for a population with linear trend, merits and demerit of systematic sampling. Concept of two-stage and multistage sampling.
इकाई–IV	**क्रमबद्ध प्रतिचयनः** परिभाषा, रेखीय क्रमबद्ध प्रतिचयन, वृत्तीय क्रमबद्ध प्रतिचयन, एक क्रमबद्ध प्रतिदर्श माध्य का माध्य एवं प्रसरण, क्रमबद्ध प्रतिचयन की तुलना सरल यादृच्छिक प्रतिचयन से, क्रमबद्ध प्रतिचयन विरूद्ध स्तरित यादृच्छिक प्रतिचयन, रेखीय प्रवृत्ति के साथ समष्टि के लिए स्तरित यादृच्छिक प्रतिचयन विरूद्ध सरल यादृच्छिक प्रतिचयन, क्रमबद्ध प्रतिचयन के गुण दोष। द्वि–चरण एवं बहु चरण प्रतिचयन की अवधारणाऐं।
Unit-V	**Ratio Method of Estimation:** Definition, bias of ratio estimate, expected value of ratio estimate for first order approximation under simple random sampling without replacement, variance of ratio estimate for first order approximation under simple random sampling without replacement.

	Regression Method of Estimation: Definition, simple regression estimate, Determination of beta, expected value of regression estimate for first order approximation under simple random sampling without replacement, variance of regression for first order approximation under simple random sampling without replacement. Concepts of orthogonality and balance, BIBD.
इकाई-V	**आकलन की अनुपात विधि:** परिभाषा, अनुपात आकलक की अभिनति, प्रथम क्रम के लिये सन्निकटन अनुपात आकलक का प्रत्याशित मान, प्रतिस्थापन रहित सरल यादृच्छिक प्रतिचयन के तहत प्रथम क्रम के लिये सन्निकटन अनुपात आकलक का प्रसरण प्रतिस्थापन रहित सरल यादृच्छिक प्रतिचयन के तहत। **आकलन की समाश्रयण विधि :**परिभाषा, सरल समाश्रयण आकलक, बीटा के मान का निर्धारण, प्रथम क्रम के लिये सन्निकटन समाश्रयण आकलक का प्रत्याशित मान प्रतिस्थापन रहित सरल यादृच्छिक प्रतिचयन के तहत। प्रथम क्रमके लिये सन्निकटन समाश्रयण आकलक का प्रसरण प्रतिस्थापन रहित सरल यादृच्छिक प्रतिचयन के तहत। लाम्बिक तथा संतुलित की अवधाराएँ, बी.आई.बी.डी. (BIBD)

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. P.V. Sukhatme and B.V. Sukhatme, S. Sukhatme and C.Ashok : Sampling theory of Survery with applications, ISAS Publications, New Delhi.
2. W.G. Cochran : Sampling Techniques, Wiley Publishing.
3. S.C. Gupta and V.K. Kapoor : Fundamentals of Applied Statistics Sultan Chand and Co.
4. D. Singh and F.S. Choudhary : Theory and Analysis of Sample survey and design, New Age Publishers.
5. A.M. Goon, M.K. Gupta and B.D. Das Gupta : Fundamentals of Statistics Vol. II. World Press, Calcutta.

Extra References :

1. Arijit Choudhary : Essential of Survery Sampling, PHI Learning.
2. P. Mukhupadhyaya : Theory and Method of Survey Sampling, PHI Learning.

Suggestive digital platforms and Web-links:

1. http://home.iitk.ac.in/~shalab/course1.htm.
2. https://nptel.ac.in/content/storage2/courses/111104073/Module5/Lecture14.pdf
3. https://nptel.ac.in/courses/111/104/111104073/.

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks: 50

Continuous Comprehensive Evaluation (CCE):	10	
College Exam:	40	
Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**

Govt. Holkar (Model Autonomous) Science College, Indore
Department of Statistics
Syllabus Session 2021-22

Programme : B.Sc. III Year **Class :B.Sc. III YEAR**

Paper	Title of the paper	Paper Code	Theory					Practical	
			External	Minimum	CCE	Minimum	Total Minimum	Maximum	Minimum
Paper -1	Applied Statistics	319-I	40	28	10	3	33	50	17
Paper -2	SQC and Design of Experiments	319-II	40		10	3			
Internship			Report	Viva	Maximum	Minimum			
			50	50	100	33			

DEPARTMENT OF STATISTICS

Class: B. Sc. III Year
Subject: Statistics
Title of Paper: Applied Statistics

Marks: 40+ (CCE) 10 = 50
Paper: Theory -I
Code of the Paper: 319-I

Part A: Introduction for code-319-I	
Pre-requisite (if any)	-
Course Objectives	The main objective of this course is to acquaint students with some basic concepts in applied statistics. They will be introduced to concept of handful knowledge demographic methods, index numbers, time series and demand analysis.
Course Learning Outcomes	1. Identify basic knowledge of demographic indicators.
	2. Recite and accomplish knowledge of measurement of fertility rates.
	3. Recognize and classify Index Numbers with complete illustration.
	4. Understand the concepts of time series data with their applications and conclude it.
	5. Develop and acquires ideas of Demand and Supply.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	**Vital Statistics:** Introduction, uses of Vital Statistics, methods of obtaining Vital Statistics: Registration method, census method. **Measurement of Mortality:** Crude death rate, Standardized death rates, Age specific death rates, with their relative merits and demerits. Infant mortality rate. Complete life table and its main components, uses of life table. Demographic data from census, registration, NSS other surveys, their limitations and uses.
इकाई-I	जनांकिकी संख्यिकी : प्रस्तावना, जनांकिकी के उपयोग, जनाकिंकी सांख्यिकी ज्ञात करने की विधियाँ पंजीकरण विधि, जनगणना विधि । मृत्युदरो की माप : अशोधितमृत्यु दर, प्रमापितमृत्युदर, आयु विशिष्ट मृत्युदर, उनके गुणदोषोंसहित ।शिशुमृत्युदर । संम्पूर्ण जीवन सारणी तथा उसके मुख्य घटक, जीवन सारणी के उपयोग। जनगणना के जनांकिकीय आकडें, पंजीयन, एन.एस.एस. (NSS) तथा अन्य सर्वेक्षण, उनकी सीमाएं एव उपयोगिताएं।

Unit-II	Stationary and Stable population, Lotka and Dublin's model for stable population. Central mortality rate, force of mortality. Measurement of Fertility rates: Crude birth rate, age specific birth rate, general fertility rate, total fertility rate, with their merits and demerits. Measurement of Population Growth rates: Crude rate of natural increase and Pearle's vital index, Gross reproduction rate (GRR), Net reproduction rate (NRR).
इकाई-II	स्थावर एव स्थित जनसंख्यां लोटका तथा डब्लीन का स्थिरजन संख्या माडल। केन्द्रीय मृत्युदर, मृत्युता बल।उर्वरता दरों की मापः अशोधित जन्मदर, आयु विशिष्ट जन्मदर, सामान्य उर्वरता दर, कुल उर्वरता दर, उनके गुण दोषो सहित। जनसंख्या वृध्दि दर का मापन : प्राकृतिक वृध्दि की अशुध्द दर तथा पीर्यल का जनांकिकी सूचकांक, सकल प्रजनन दर, शुध्द प्रजनन दर।
Unit-III	**Index Numbers:** Introduction, definition, Problems in constructing Index numbers, Price, quantity and volume relatives, Link and chain relatives, computation of index numbers: Laspeyre's, Paasche's, Marshal Edgeworth's and Fisher's index number; chain base index number, criteria of a good index number, cost of living index number.
इकाई–III	सूचकांक : प्रस्तावना, परिभाषा, सूचकांक रचना में प्रमुख समस्याएँ, मूल्य, मात्रा तथा आयतन अनुपात, लिंक तथा श्रंखला मूल्यानुपात, सूचकांक की रचनाः लेश्पियेर, पाशे, मार्शल एडजवर्थ तथा फिशर का सूचकांक, श्रृखंला आधार सूचकांक, एक अच्छे सूचकांक के मापदण्ड, जीवन निर्वाह व्यय सूचकांक।
Unit-IV	**Time series:** Introduction, components of time series, mathematical models for time series, Uses of time series, measurement of trend: Graphical method, Method of semi averages, Method of moving average, Method of least squares. Growth curves and their fitting. Modified exponential curve and its fitting. Methods of determination of seasonal variation.
इकाई–IV	कालश्रेणीः प्रस्तावना, कालश्रेणी के घटक, कालश्रेणी के गणितीय अमूर्त, काल श्रेणी के उपयोग।प्रवृत्ति मूल्यों का मापनः बिन्दुरेखीय विधि, अर्ध–माध्यक विधि, चलमाध्य विधि, न्यूनतम वर्ग विधि। विकास वक्र तथा उसका आसंजन । सशोधित चर घातांकी वक तथा उनका आसंजन । मौसमी परिवर्तन के मापन की विधियॉ ।
Unit-V	**Demand Analysis:** Introduction, Definition of demand and supply, laws of supply and demand, price elasticity of demand, price elasticity of supply, types of data required for estimating elasticity. Pareto's law of income distribution, curve of concentration (Lorenz curve and estimation of elasticity from time series data), log normal distribution.
इकाई-V	मॉग विश्लेषणः प्रस्तावना, मांग एवं आपूर्ति की परिभाषा, मांग एवं आपूर्ति के नियम, मांग की मूल्य प्रत्यास्थता, आपूर्ति की मूल्य प्रत्यास्थता, प्रत्यास्थता के आंकलन के लिये आवश्यक आंकडो के प्रकार।

	आय वितरण का पेरेटो का नियम, संकेन्द्रण वक्र (लारेंज वक्र तथा काल श्रेणी आंकडो से प्रत्यास्थता का आंकलन), लाग–नार्मल बंटन।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. Mukhopadhyay, P.: Applied Statistics, New Central Book Agency Pvt. Ltd., Calcutta.
2. Goon A.M., Gupta M.K. and Das Gupta B.: Fundamentals of Statistics, Vol. II World Press, Calcutta.
3. Srivastava O.S.: A Text Book of Demography, Vikas Publishing House, New Delhi.
4. Kapoor V.K and Gupta S.C: Fundamentals of Applied Statistics, Sultan Chand and Co.
5. Chatfield, C.: The Analysis of Time Series, Chapman and Hall.

Suggestive digital platforms and Web-links:

1. https://censusindia.gov.in
2. https://mospi.nic.in
3. https://nptel.ac.in/content/storage2/courses/109104044/lecture-pdf/lecture%2010.pdf
4. https://ncbi.nlm.nih.gov
5. https://nptel.ac.in/content/storage2/courses/110101005/downloads/lecture%2010.pdf
6. https://nptel.ac.in/courses/109/104/109104182

Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): 10
College Exam: 40

Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: 40 Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**

DEPARTMENT OF STATISTICS

Class: B. Sc. III Year | **Marks: 40+ (CCE) 10 = 50**

Subject: Statistics | **Paper: Theory -II**

Title of Paper: SQC and Design of Experiments | **Code of the Paper: 319-II**

Part A: Introduction for code-319-II	
Pre-requisite (if any)	-
Course Objectives	This course will give technical exposure to student of statistical quality control and design of experiments, analyze and interpret data, design and conduct experiments.
Course Learning Outcomes	1. Develop understanding of statistical process control, control charts for variables and attributes.
	2. Develop understanding of statistical product control, sampling inspection plans for attributes.
	3. Appropriately interpret results of analysis of variance tests.
	4. Learn fundamental concepts of design of experiments, completely randomized design and randomized block design.
	5. Design experiments, carry them out, and analyse the data they yield.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	General theory of control charts, causes of variation, process and product control, 3σ–Control limits, Control charts for variables: $\bar{X}$ and R charts. Criteria for detecting lack of control in $\bar{X}$ and R charts. Control charts for attributes: p, np and c charts, applications of c chart.
इकाई-I	नियंत्रण चित्रों के सामान्य सिध्दान्त, विचरण के कारण, विधि नियंत्रण तथा उत्पाद नियंत्रण 3σ–नियंत्रण सीमाएँ। चरों के लिये नियंत्रण चार्ट–$\bar{X}$ तथा R-चार्ट। $\bar{X}$ तथा R-चार्टों में नियंत्रण के अभाव की जांच के मापदण्ड । गुणों के लिये नियंत्रण चार्ट: p, np तथा c, c चार्ट के अनुप्रयोग।
Unit-II	Principles of acceptance sampling, definition of AQL, LTPD, Producer's risk, Consumer's risk, AOQL, ASN, ATI and OC curves. Single and double sampling plans for attributes and variables, Sequential sampling plan.
इकाई-II	स्वीकृति प्रतिचयन के सिध्दान्त, AQL, LTPD, निर्माता की जोखिम, उपभोक्ता की जोखिम, AOQL, ASN, ATI तथा OC वक्र की परिभाषा। गुणो तथा चरों के लिये एकल एवं दोहरी प्रतिचयन योजनाएँ, अनुक्रमिक

	प्रतिचयन योजना।
Unit-III	Analysis of Variance: Definition of different terms, one-way classification and two-way classification with one observation per cell and two-way classification with "m"observations per cell (for fixed effect model). Analysis of covariance with one way classification.
इकाई–III	प्रसरण विश्लेषण :विभिन्न पदों की परिभाषा, प्रति खाने एक प्रेक्षण के लिये एकधा एवं द्विधा वर्गीकरण, प्रति खाने "m" प्रेक्षणों के लिये द्विधा वर्गीकरण (स्थिर प्रभाव प्रतिरूप के लिए) । एकधा वर्गीकरण के लिये संहप्रसरण विश्लेषण ।
Unit-IV	Fundamental Principles of design: Randomization, replication and local control. Layout and analysis of completely randomized design (CRD) and randomized block design (RBD), Estimation and analysis of one and two missing observations in RBD, efficiency of RBD relative to CRD.
इकाई–IV	प्रयोग की अभिकल्पना के मूलभूत सिध्दान्त : यादृच्छिकरण, पुनः प्रयोग तथा स्थानीय नियत्रंण । पूर्णतया यादृच्छिकृत अभिकल्पना एवं यादृच्छिकृत खण्डक अभिकल्पना की संरचना तथा विश्लेषण, यादृच्छिकृत खण्डक अभिकल्पना में एक एवं दो लुप्त प्रेक्षण का आकलन तथा विश्लेषण, पूर्णतया यादृच्छिकृत अभिकल्पना की तुलना में यादृच्छिकृत अभिकल्पना की दक्षता ।
Unit-V	Layout and analysis of Latin square design. Estimation and analysis of one missing observation in LSD. Efficiency of LSD relative to CRD and RBD. Factorial experiments, advantages of factorial experiments, 2^2 and 2^3 designs, main and interaction effects, contrast. Definition of confounding complete and partial confounding.
इकाई-V	लैटिन वर्ग अभिकल्पना की संरचना तथा विश्लेषण, लैटिन वर्ग अभिकल्पना में एक लुप्त निरीक्षण का आकलन एव विश्लेषण । लैटिन वर्ग अभिकल्पना की दक्षता, सी. आर. डी तथा आर. बी. डी. की तुलना में। बहुउपादानी प्रयोगः बहुउपादानी प्रयोग के लाभ, 2^2 तथा 2^3 कारक अभिकल्पना, मुख्य प्रभाव तथा अन्योन्य क्रिया प्रभाव एवं विपर्यास। संकरण, पूर्ण संकरण तथा आशिंक संकरण की परिभाषा ।

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. Duncan A.J. (1974): Quality Control and Industrial Statistics, IV Edition Taraporewala and Sons.
2. Montgomery, D.C (1991): Introduction to the Statistical Quality Control, II[nd] Edition, John Wiley and Sons.
3. Gupta,S.C&Kapoor,V.K. : Fundamentals of Applied Statistics, Sultan Chand & Co.
4. MontgomeryD. C: Design and Analysis of Experiments, John Wiley.
5. Mahajan M.: Statistical Quality Control, Dhanpat Rai and Co.

Suggestive digital platforms and Web-links:

1. https://youtu.be/-rQjvUQcFoO
2. https://youtu.be/mCLT32avPgI
3. https://youtu.be/qb3myJ1gb9g
4. https://youtu.be/IZOY4rKNxg8
5. https://nptel.ac.in/courses/111/104/1111/0475/
6. https://www.investopedia.com/terms/a/acceptance-sampling.asp
7. https://youtu.be/LiqEft4XLbY
8. https://youtube/-rQjvUQcFoO

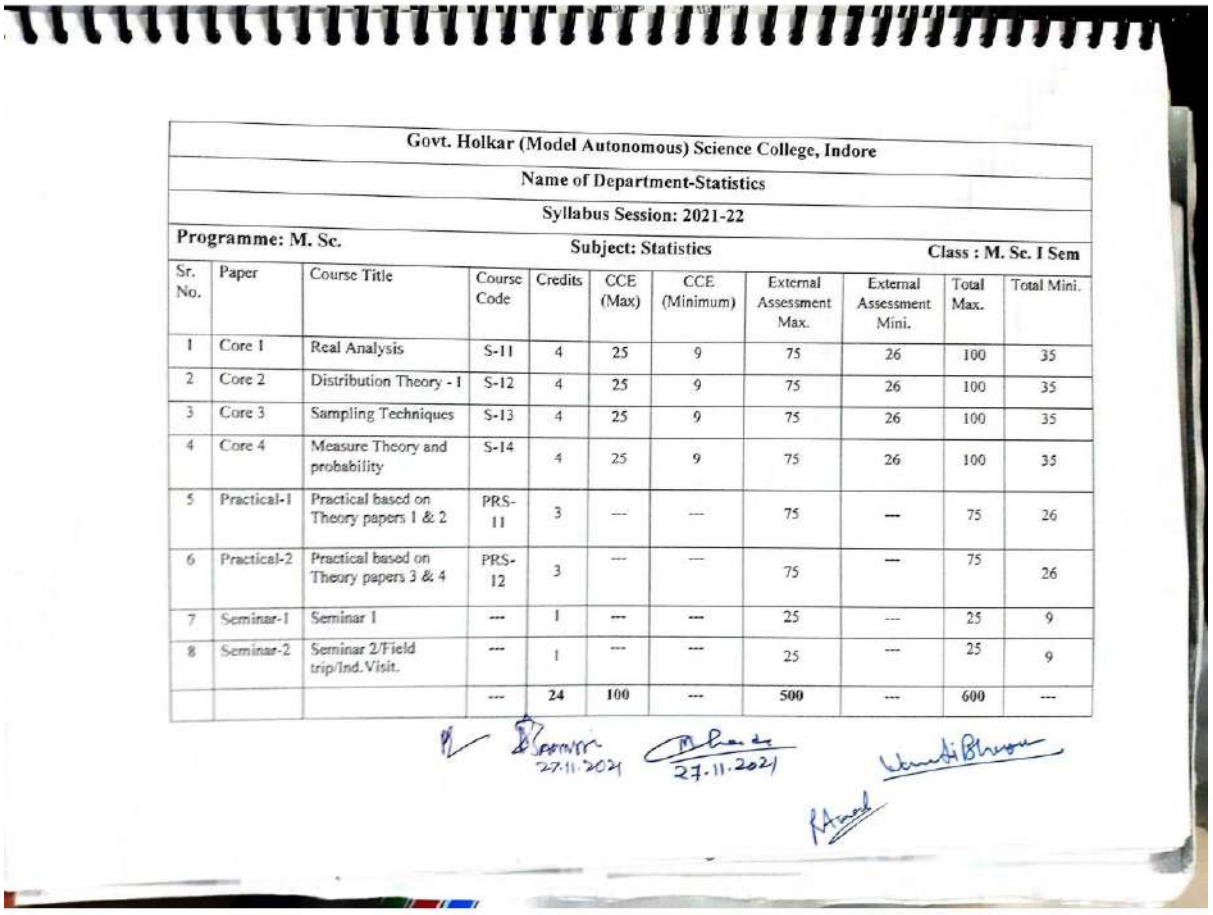
Part D :Assessment and Evaluation

As per HE Syllabus

Suggested Continuous Evaluation Methods:

Maximum Marks: 50
Continuous Comprehensive Evaluation (CCE): 10
College Exam: 40

Internal Assessment: Continuous Comprehensive Evaluation (CCE): 10	Class Test	05
	Assignment/ Presentation	05
	Total	**10**
External Assessment: College Exam Section: Time: **3.00 Hours**	Section (A): Multiple Choice Questions	05 x 01 = 05
	Section (B): Long Questions (200 words each)	05 x 07 = 35
	Total	**40**



Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department-Statistics

Syllabus Session: 2021-22

Programme: M. Sc. **Subject: Statistics** **Class : M. Sc. I Sem**

Sr. No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Minimum)	External Assessment Max.	External Assessment Mini.	Total Max.	Total Mini.
1	Core 1	Real Analysis	S-11	4	25	9	75	26	100	35
2	Core 2	Distribution Theory - I	S-12	4	25	9	75	26	100	35
3	Core 3	Sampling Techniques	S-13	4	25	9	75	26	100	35
4	Core 4	Measure Theory and probability	S-14	4	25	9	75	26	100	35
5	Practical-1	Practical based on Theory papers 1 & 2	PRS-11	3	---	---	75	---	75	26
6	Practical-2	Practical based on Theory papers 3 & 4	PRS-12	3	---	---	75	---	75	26
7	Seminar-1	Seminar 1	---	1	---	---	25	---	25	9
8	Seminar-2	Seminar 2/Field trip/Ind. Visit.	---	1	---	---	25	---	25	9
			---	**24**	**100**	---	**500**	---	**600**	---

27.11.2021

27.11.2021

DEPARTMENT OF STATISTICS

Class: M. Sc. I Sem

Subject: Statistics **Paper: Theory-1**

Title of Paper: Real Analysis **Code of the Paper: S-11**

Max. Marks : 75 **Credits : 04**

Part A: Introduction for code- S-11	
Course Objectives	The main objective of this course is to acquaint students with basic analysis topics with a focus on preparing you the fundamentals of mathematical analysis for first year master courses. Topics covered will include real numbers, sequences and series, functions.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand and Describe set theory and real numbers.
	2. Extract and illustrate sequences and series.
	3. Describe and solve sequence of function and convergence.
	4. Explain and create knowledge of differentiation.
	5. Define multiple integration and their evaluation.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Elements of Set Theory – Introduction to real numbers, n-dimensional Euclidian space, Open and Closed intervals, Compact Sets, Bolzano–Weirstrass and Heine–Borel theorems.
Unit-II	Sequences and Series; Their convergence, Real valued functions, Continuous functions, Uniform Continuity.
Unit-III	Sequences of functions, Uniform Convergence, Power Series and radius of convergence.
Unit-IV	Differentiation: Maxima–Minima of functions, Functions of several variables, Constraints, Maxima-Minima of functions.
Unit-V	Multiple integrals and their evaluation by repeated integration, change of variable in multiple integration, uniform convergence in improper integrals, differentiation under the sign of integration-Leibritz Rule.

Part C: Learning Resources
Text Book , Reference Books, Other resources
Suggested Readings:

1. Apostol, T.M. : Mathematical Analysis Narosa. Indian Edn.
2. Rudin Walter (1976) : Principles of Mathematical Analysis,Mc-Graw Hill.
3. Mullik, S.C. : Mathematical Analysis. Wiley Easern Ltd.

DEPARTMENT OF STATISTICS

Class: M. Sc. I Sem
Subject: Statistics
Title of Paper: Distribution Theory - I
Max. Marks : 75

Paper: Theory-2
Code of the Paper: S-12
Credits : 04

Part A : Introduction for code- S-12	
Course Objectives	The main objective of this course is to acquaint students with some basic concepts in random variable and distributions.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Create knowledge of Distribution function
	2. Understand discrete distribution with their applications.
	3. Understand and create knowledge of different types of continuous distribution.
	4. Understand, compare and relate different distributions.
	5. Understand concept of order statistics.

6. I

As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Random variable and it's Mathematical expectation, Conditional expectation, Joint, Marginal and Conditional p.m.f.'s and p.d.f.'s. Distribution function.
Unit-II	Standard Discrete Distributions – The discrete Uniform Distribution, Binomial, Truncated Binomial, Hyper geometric, Poisson, Truncated Poisson, Geometric and Negative Binomial Distributions.
Unit-III	Continuous Distributions – Continuous Uniform, Exponential, Gamma, Beta and Cauchy Distributions.
Unit-IV	Normal, Lognormal, Laplace, Pareto, Weibull and Power series distribution.
Unit-V	Order statistics – Their distributions and properties, Joint and marginal distributions of order statistics. Extreme values and their asymptotic distributions (statement only)

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. Dudewicz E.J. and Mishra S.N. (1988):Modern Mathematical Statistics, Wiley International
2. Rohatgi V.K. (1984): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern
3. Mukhopadhyay P. (1996): Mathematical Statistics, New Central Book Agency.
4. Goon A.K., Gupta M.K. & Das Gupta: Fundamental of Statistics Vol. I, World Press

DEPARTMENT OF STATISTICS

Class: M. Sc. I Sem
Subject: Statistics
Title of Paper: Sampling Techniques
Max. Marks : 75

Paper: Theory- 3
Code of the Paper: S-13
Credits : 04

Part A : Introduction for code- S-13	
Course Objectives	Techniques for selecting a sample from a population keeping in mind the objectives to be fulfilled and obtain estimator of the population parameter from selected sample and study its properties.
Course Learning Outcomes	After the successful completion of this course , students should be able to
	1. Create, describe and understand concept of simple random sampling.
	2. Create knowledge of stratified random sampling.
	3. Understand concept of regression estimate and systematic sampling.
	4. Understand and explain cluster sampling.
	5. Explain the concept of two-stage sampling and double sampling.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Simple random sampling – definition, notations, properties of the estimates, variances of the estimates f.p.c., Estimates of the standard error for sample, confidence limits. Stratified random sampling – Description, notations, properties of the estimates, estimated variances and confidence limits. Proportional & Optimum allocation, relative precision of stratified random and simple random sampling.
Unit-II	Stratified random sampling – Estimation of sample size with continuous data, stratified sampling for proportions, gains in precision in stratified sampling for proportions. Ratio Estimators – Ratio estimate, Approximate variance of the Ratio Estimate, Estimation of the Variance from a sample, confidence limits, Comparison of the Ratio Estimate with mean per unit, conditions under which the ratio estimate is BLUE, Bias of the Ratio Estimate.
Unit-III	Regression Estimate – The linear regression Estimate, Regression estimate with pre assigned b, Regression estimate when b is computed from the sample, sample estimate of variance, large sample comparison with the ratio estimate and the mean per unit. Bias of the Linear Regression estimate. Systematic Sampling – Description, notations, relation to cluster sampling, variance of the estimated mean, Populations with Linear trend, Comparison of systematic with Stratified and Simple Random sampling.
Unit-IV	Single stage cluster sampling (Clusters of equal Size) – definition, notations, Reasons for Cluster Sampling, variance in terms of intracluster Correlation. Cluster of Unequal Size– Cluster units of unequal size, Selection with Unequal probabilities with replacement, Relative accuracies of three techniques. Sampling with unequal probabilities

	without replacement, The Horvitz – Thomson Estimator.
Unit-V	Subsampling with units of Equal Size/two stage sampling, Finding means and variances in two-stage sampling, variance of the estimated mean in two-stage sampling, sample estimation of the variance. Subsampling with units of unequal size – introduction, sampling methods when n=1 and n>1, two useful results. Double Sampling – Description of the Technique, Double sampling for stratification, optimum allocation, Estimated variance in Double sampling for stratification.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. Cochram, W.G. : Sampling Techniques, Wiley Eastern
2. Singh D and Choudhary F.S.: Theory and Analysis of Sample Surveys Designs, Wiley Eastern.
3. Sukhatme : Sampling Theory of surveys with application. IARS, New Delhi
4. Murthy M.N. : Sampling Theory and Methods, Statistical Publishing Society Calcutta

DEPARTMENT OF STATISTICS

Class: M. Sc. I Sem

Subject: Statistics | **Paper: Theory-4**

Title of Paper: Measure Theory and probability | **Code of the Paper: S-14**

Max. Marks : 75 | **Credits : 04**

Part A : Introduction for code- S-14	
Course Objectives	The main objective of this course is to acquaint students with basic knowledge of measure theory needed to understand probability theory, statistics and functional analysis.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand sets, sigma fields, lim. superior, lim. Inferior measures.
	2. Understand types of measures, random variable, convergence in probability and Measures.
	3. Understand integration of a measurable function and Analyze Monotone Convergence theorem.
	4. Analyze Borell- Cantelli lemma, weak and strong law of large number.
	5. Understand convergence in distribution, characteristics function and Analyze uniqueness theorem.

Part B: Content of the Course

As per HE Syllabus

Particulars/ विवरण	
Unit-I	Classes of Sets, Fields, Sigma Fields, Minimal Sigma-Field, Lim. Superior and Lim. inferior of Sets. Measure, Borel Measure, Probability Measure. Properties of measure.
Unit-II	Lebesgue and Lebesgue – Steljes Measures Measureable Functions, Random Variable, Sequence of Random Variables, Almost Sure Convergence, Convergence in Probability and Measure.
Unit-III	Integration of a Measurable functions with respect to a measure, Monotone convergence theorem.
Unit-IV	Borell – Cantelli Lemma, Independence, Weak and Strong Law of Large Numbers for I.I.D. Sequences, Definition and examples of Markov dependence.
Unit-V	Convergence in distribution, characteristic function, Uniqueness theorem, Statement of Levy's Continuity Theorem, Central Limit Theorem for a Sequence of independent variables under Lindeberg's Conditions, Central limit Theorem for I.I.D. random variables.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. Billingsley, P. (1986): Probability and Measure, Wiley International

2. Kingman, J.F.C. and Taylor, S.J. (1966): Introduction to Measure and Probability, Cambridge Univ. Press
3. Gupta K.P. : Measure Theory

Govt. Holkar (Model Autonomous) Science College, Indore										
Name of Department-Statistics										
Syllabus Session: 2021-22										
Programme : M. Sc.			**Subject: Statistics**						**Class : M. Sc. II Sem**	
Sr. No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Minimum)	External Assessment Max.	External Assessment Mini.	Total Max.	Total Mini.
1	Core 5	Linear Algebra	S-21	4	25	9	75	26	100	35
2	Core 6	Distribution Theory – II	S-22	4	25	9	75	26	100	35
3	Core 7	Statistical Computing	S-23	4	25	9	75	26	100	35
4	Core 8	Statistical Inference -I	S-24	4	25	9	75	26	100	35
5	Practical-3	Practical based on Theory paper 5 & 6	PRS-21	3	---	---	75	---	75	26
6	Practical-4	Practical based on Theory paper 7 & 8	PRS-22	3	---	---	75	---	75	26
7	Seminar-3	Seminar 3	---	1	---	---	25	---	25	9
8	Seminar-4	Seminar 4/Field Trip/Ind. Visit. etc	---	1	---	---	25	---	25	9
			---	**24**	**100**	---	**500**	---	**600**	---

DEPARTMENT OF STATISTICS

Class: M. Sc. II Sem
Subject: Statistics
Title of Paper: Linear Algebra
Max. Marks : 75

Paper: Theory- 1
Code of the Paper: S-21
Credits : 04

Part A: Introduction for code- S-21	
Course Objectives	The main objective of this course is to develop an algebraic and geometric understanding of linear equations, systems of linear equations and linear transformations. Identify linear operations, implement them as matrices in a given basis, and solutions to equations using matrix algebra
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Demonstrate understanding of vector space and its dimensions.
	2. Acquire knowledge on Inner product space and linear equations.
	3. Build and solve linear transformation and matrices.
	4. Determine Bilinear forms, Quadratic forms, Canonical forms.
	5. Analyze Eigen Values, Eigen Vectors and characteristics of matrix.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Vector Space: Linear dependence, basis and dimension of a vector space, finite dimensional vector space, vector subspace.
Unit-II	Inner Product Space and their properties, Schwartz Inequality, Triangle Inequality, orthogonal basis and Gram-Schmidt Orthogonalization Process, Orthogonal projection of a vector, linear simultaneous equations – Cramer's rule.
Unit-III	Linear transformations and their properties, Partitioned matrices, Idempotent Matrices, Kroneker Product, Hadamard Product, Hermite Canonical form, Generalized inverse.
Unit-IV	Bilinear forms, equivalence of bilinear forms, Quadratic forms, reduction of quadratic forms to Canonical forms, orthogonal reduction of real quadratic form. Index and Signature of a quadratic form.
Unit-V	Eigen values, Eigen Vectors and the characteristic equations of a matrix, Eigen Values and Eigen vectors of a Linear Transformation. Cayley-Hamilton Theorem, Minimal Polynomial. Multiplicity of Eigen values. Hermitian Matrices.

Part C :-Learning Resources
Text Book , Reference Books, Other resources

Suggested Readings:

1. Gray Bill, F.A. (1983): Matrices with Applications in Statistics. 2nd Ed. Wads worth.
2. Scarle, S.R. (1982): Matrix Algebra Useful for Statistics, John Wiley and Sons.
3. Datta, K.B. (2006): Matrix and Linear Algebra, Prentice Hall of India EE. Edn.
4. Biswas, S (1984): Topics in Algebra of Matrices, Academic Publication
5. Bellmen, R (1970): Introduction to Matrix Analysis, 2nd Edn. Mc-Graw Hill

DEPARTMENT OF STATISTICS

Class: M. Sc. II Sem

Subject: Statistics

Paper: Theory- 2

Title of Paper: Distribution Theory - II

Code of the Paper: S-22

Max. Marks : 75

Credits : 04

Part A : Introduction for code- S-22	
Course Objectives	The main objective of this course is to develop solid knowledge in basic distribution theory in order to facilitate future research and concept of a test function and its importance in the theory of distributions
Course Learning Outcomes	After the successful completion of this course , students should be able to
	1. Determine two dimensional distribution function and independence of variable.
	2. Acquire knowledge on Correlation and regression and Bivariate Normal distribution.
	3. Interpret and Apply sampling distributions.
	4. Analyze Non Central Sampling distributions.
	5. Understand the distribution arising from the bivariate normal and sampling distribution of correlation coefficient.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Jointly distributed random variable, Distribution function of Joint distribution, Marginal distribution, Conditional distributions and Independence of X and Y. Discrete and Continuous Two-dimensional distribution.
Unit-II	Simple correlation and regression, Non-linear regression, regression of the second kind, correlation index and correlation Ratio, Bivariate Normal distribution.
Unit-III	Sampling distribution of a function of random variables. case of discrete and continuous variables. Three basic sampling distributions chi-square, t and F-distributions. Sampling distributions arising from a univariate Normal distribution (Sample mean, Sample Variance).
Unit-IV	Non central chi-square, t and F distributions, their properties and applications.
Unit-V	Distributions arising from the bivariate normal (Linear functions of two jointly distributed normal variables). Sampling distribution of sample means, variance and covariances in bivariate normal situation, Sampling distribution of 'r' when $\rho = 0$.

Part C :-Learning Resources
Text Book , Reference Books, Other resources
Suggested Readings: 1. Goon A.M.; Gupta M.K. and Das Gupta B.: An Outline of Statistical Theory Vol. I World Press

Calcutta.

2. Mukhopadhyay, P: Mathematical Statistics. Central Book Agency.
3. Gupta S.C., Kapur V.K. : Fundamentals of Mathematical Statistics. Sultan Chand and Sons.
4. Agrawal, B.L. : Basic Statistics. New Age.

DEPARTMENT OF STATISTICS

Class: M. Sc. II Sem

Subject: Statistics | **Paper: Theory-3**

Title of Paper: Statistical Computing | **Code of the Paper: S-23**

Max. Marks : 75 | **Credits : 04**

Part A: Introduction for code- S-23	
Course Objectives	The main objective of this course is to enable students with essential computations and statistical analysis using commonly used statistical software. The goal of course is to familiar student to use statistical language for research.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand Statistics role for national development.
	2. Understand basic knowledge of computers.
	3. Understand, Analyze and use programming in FORTRAN.
	4. Develop simple programs in FORTRAN.
	5. Apply statistical package SPSS.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Statistics for National development; Estimation of National Income-Product approach, Income approach and Expenditure approach. Measuring inequality in income, Ginnie's Coefficient.
Unit-II	History of Computers, Basic Building blocks-Input / Output devices, CPU organization, Storage devices – Primary and Secondary memory, Fundamentals of operating systems (O.S.) Def. and need of O.S., Functions and Types of O.S.; M.S.-DOS Fundamentals, Booting Process (Cold & Warm) file arrangement in DOS. Internal and External DOS Commands.
Unit-III	Problem Solving on Computers: Algorithm and FLOW charts. FORTRAN Programming preliminaries-Constants and Variables. Arithmetic, relational and logical operations and expressions. Executable and Non–executable FORTRAN Statements. Input / Output Statements, Arrays and Subscripted Variables.
Unit-IV	Simple Computer programmes in FORTRAN related to statistics such as – Mean, Median, Mode, Histogram, Variance, Simple Correlation Coefficient, Regression Lines and regression coefficient. Curve fitting using least square theory.
Unit-V	Statistical Package SPSS-Its use in graphics descriptive statistics, representation of multivariate data. Simple Hypothesis Tests, Analysis of Variance and Linear regression.
Part C: Learning Resources	
Text Book , Reference Books, Other resources	

Suggested Readings:

1. C.S.O. (1980): National Statistics – Source and Health.
2. Rajaraman V.: Computer Programming in FORTRAN.
3. Taxali, R.K.: P.C. Software made Simple. Mc-Graw Hill.
4. Sabine L. and Brian, S.E. (2003): A Handbook of Statistical Analysis using SPSS, Taylor and Francis Books.

DEPARTMENT OF STATISTICS

Class: M. Sc. II Sem
Subject: Statistics
Title of Paper: Statistical Inference -I
Max. Marks : 75

Paper: Theory - 4
Code of the Paper: S-24
Credits : 04

Part A : Introduction for code- S-24	
Course Objectives	The main objective of this course is to enable students to derive suitable point estimators of the parameters of the distribution of a random variable and give a measure of their precision and learn various statistical inferential approaches. To perform Test of Hypothesis as well as obtain MP, UMP tests.
Course Learning Outcomes	After the successful completion of this course , students should be able to
	1. Understand characteristics of Good Estimator.
	2. Acquire knowledge of fundamental paradigm of the foundation of statistical inference.
	3. Implement different Methods of Estimation.
	4. Elaborate various concepts related to testing of hypothesis.
	5. Analyze likelihood Ratio Test.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Point Estimation : Unbiasedness, Consistency, Sufficient Conditions for consistent estimators, Efficiency, most efficient estimators, minimum variance unbiased sufficient estimators, Minimal sufficient statistics.
Unit-II	Cramer – Rao inequality, its alternative forms, conditions for the equality, Rao-Blackwell theorem, completeness, complete family of distributions, Lehman – Scheffe theorem.
Unit-III	Methods of estimation : Method of maximum likelihood, properties of maximum likelihood estimators (Statement only), Method of moments, properties of moment estimators. Interval Estimation : confidence interval and confidence limits, construction of confidence interval using pivots, shortest expected length confidence interval.
Unit-IV	Testing of Hypothesis : Statistical hypothesis : simple and composite. Errors of first and second kind, critical region, level of significance, power of the test, most powerful (MP) test, uniformly most powerful (UMP) test, Neyman-Pearson lemma, Unbiased test and unbiased critical region.
Unit-V	Likelihood Ratio Test ; properties of LR tests (No derivation), UMP tests for simple null hypothesis against one sided alternatives, exponential family of densities, UMP tests for one sided null against one sided alternatives in one parameter exponential family.

Part C :-Learning Resources
Text Book , Reference Books, Other resources

Suggested Readings:

1. An Outline of Statistical Theory, Vol.-II – Goon, Gupta and Dasgupta.
2. Fundamentals of Mathematical Statistics – S.C. Gupta and V.K. Kapoor.
3. Theory of Point Estimation – E.L. Lehman.
4. Testing of Statistical Hypothesis – E.L. Lehman.
5. Linear Statistical Inference and it's Application – C.R.Rao.
6. Introduction to the Theory of Statistics – M.A. Mood, F.A. Graybill and D.C. Boes.
7. An Introduction to Probability Theory and Mathematical Statistics – V.K. Rohtagi.
8. A first Course in Parametric Inference - Kale, B.K. (1999) , Narosa , Publishing House.

Govt. Holkar (Model Autonomous) Science College, Indore

Name of Department-Statistics

Syllabus Session: 2021-22

Programme: M. Sc. **Subject: Statistics** **Class: M. Sc. III Sem**

Sr. No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Minimum)	External Assessment Max.	External Assessment Mini.	Total Max.	Total Mini.
1	Core 9	Multivariate Analysis	S-31	4	25	9	75	26	100	35
2	Core 10	Linear Models	S-32	4	25	9	75	26	100	35
3	Elective 1/1	Operation Research	S-33-A	4	25	9	75	26	100	35
	Elective 1/2	Demography	S-33-B							
4	Elective 2/1	Programming with Language 'C'	S-34-A	4	25	9	75	26	100	35
	Elective 2/2	Statistical Inference – II	S-34-B							
5	Open Elective (Inter disciplinary)	Elect any one from Interdisciplinary papers (out of given group)	S-OE-35	4	25	9	75	---	100	35
6	Practical –5	Practical based on papers 9 & 10	PRS-31	3	---	---	75	---	75	26
7	Practical –6	Practical based on papers 11 & 12	PRS-32	3	---	---	75	---	75	26
			---	**26**	**125**	---	**525**	---	**650**	---

DEPARTMENT OF STATISTICS

Class: M. Sc. III Sem | **Paper: Theory-1**

Subject: Statistics | **Code of the Paper: S-31**

Title of Paper: Multivariate Analysis | **Credits: 04**

Max. Marks : 75

Part A: Introduction for code- S-31	
Course Objectives	The main objective of this course is to enable students with scientific view to deal with multidimensional datasets and its uses in the analysis of research data. To understand the extensions of univariate techniques to multivariate frameworks and learn to apply data reduction techniques used in the data analysis.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand the concept of multivariate analysis and its properties.
	2. Evaluate Wishart Distribution.
	3. Describe null and non-null distribution of sample correlation and regression coefficient.
	4. Explain Hotelling's T^2 statistic and its application.
	5. Understand the problem of classification and apply the discriminant analysis.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Multivariate normal distribution and its distribution, the distribution of linear combination of normally distributed variates, Independence of variates, marginal distribution, conditional distribution, moment generating function and characteristics function of multivariate normal distribution.
Unit-II	Maximum likelihood estimate of the mean vector and variance-covariance matrix. Distribution of sample mean vector. Wishart matrix-its distribution and properties.
Unit-III	Null and Non-null distribution of sample correlation coefficient. Null distribution of partial and multiple correlation coefficients. Distribution of sample regression coefficient.
Unit-IV	Null distribution of Hotelling's T^2 statistic. Application in tests on mean vector for one and more multivariate normal population and also on equality of the components of mean vectors in multivariate normal population.
Unit-V	The problem of classification, standards of good classification, procedure of classification into one of the two populations with known probability distributions, discrimination procedures for discrimination between two multivariate normal populations. Principal components and canonical variates.

Part C :-Learning Resources
Text Book , Reference Books, Other resources

Suggested Readings:

1. Andrson, T.W. (1983): An Introduction to Multivariate Statistical Analysis - II Edd. Wiley
2. Kishirsaghar, A.M. (1972): Multivariate Analysis - Marcel Dekkar
3. Giri, N.C. (1977): Multivariate Statistical Inference - Academic Press
4. Sharma, S. (1996): Applied Multivariate Techniques – Wiely
5. Shrivastava, M.S. and Khatri, C.G. (1979): An Introduction to Multiveraite Statistics. North Holand

DEPARTMENT OF STATISTICS

Class: M. Sc. III Sem

Subject: Statistics | **Paper: Theory-2**

Title of Paper: Linear Models | **Code of the Paper: S-32**

Max. Marks : 75 | **Credits : 04**

Part A : Introduction for code- S-32	
Course Objectives	The main objective of this course is to acquaint students with a deeper understanding of the Markov model, linear and non-linear regression models. to develop regression model and apply for the specific perspective data in appropriate manner.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand Gauss-Markov setup, Interpret best linear unbiased estimation.
	2. Obtain and Use Variance and Co-variance of Least Square estimates.
	3. Apply test of Hypothesis for Linear Parametric function.
	4. Describe one way random effect linear models and multiple regression.
	5. Understand Non-linear models and multicollinearity.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Gauss – Markov Setup – Estimability, best point estimates and interval estimates, estimable linear parametric function. Normal equation and least square estimates.
Unit-II	Error and estimation spaces, variances and covariance's of least square estimates. Estimation of error variance, estimations with correlated observations. Least squares estimates with restriction on parameters, simultaneous estimates of Linear parametric functions.
Unit-III	Tests of hypothesis for one and more than one linear parametric function. Confidence interval and regions power of F-test, Multiple comparison test due to Tukey and Scheffe, Simultaneous confidence intervals.
Unit-IV	Introduction to one-way random effect Linear models. Estimation of variance components. Multiple regression. Fitting of orthogonal polynomials and its uses.
Unit-V	Introduction to non-Linear models. Estimations of parameters in case of Multi-collinearity and Ridge regression. Principal component regression.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. Cook, R.D. and Weisberg, S. (1982): Residual and influence in regression Champman & Hall

2. Draper N.R. & Smith H (1998): Applied regression analysis 3rd Edition - Wiley
3. Gunst, R.F. and Mason R.L. (1980): Regression analysis and Application, Marcel Dekker
4. Weisberg S. (1985): Applied Linear Regression Wiley
5. Rao C.R. (1973): Linear Statistical inference and its application Wiley Estern.

DEPARTMENT OF STATISTICS

Class: M. Sc. III Sem

Subject: Statistics | **Paper: Theory-3**

Title of Paper: Operation Research | **Code of the Paper: S-33-A**

Max. Marks : 75 | **Credits : 04**

Part A: Introduction for code- S-33-A	
Course Objectives	The main objective of this course is to enable students to develop the optimization techniques, learn the mathematical formulation of complex decision-making problems and arrives at optimal solutions using different techniques of operations research which will be useful in real world.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand the application of Operation Research.
	2. Understand and solve the concept of L.P.P. and Duality.
	3. Illustrate and use the Transportation.
	4. Understand and solve the Integer Linear Programming Problems.
	5. Interpret and solve Non-Linear Programming Problems.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Definition and Scope of O.R., Phases of O.R., Linear programming problems: Graphical, Simplex, Artificial Variable Techniques, Big M, Two phase methods. Degeneracy and methods for resolving it.
Unit-II	Revised Simplex Algorithm in standard form-I. Duality in Linear Programming Problems. Duality theorems – Basic Duality Theorem, Fundamental Duality Theorem and Existence Theorem. Advantages of duality.
Unit-III	Transportation and Assignment problems with proofs of relevant result and methods of solutions, Goal Programming – Concepts, Goal Programming as an extension of LP, Single Goal Models.
Unit-IV	Integer Linear Programming – Definition, importance and need of integer programming. Gomory's cutting plane method. Geometric interpretation of Gomory's cutting plane method. Branch and bound method. Geometrical interpretation of Branch & bound method. Applications of Integer Programming.
Unit-V	Non-Linear Programming Problems – Definition, practical situation, formulation of Non-Linear Programming Problems, General Non-Linear Programming Problems. Canonical form of Non-Linear Programming Problem. Graphical solution and verification of Kuhn–Tucker conditions. Quadratic Programming–Definition, Kuhn– Tucker conditions. General Quadratic Problem – Wolfe's and Beals's Methods.

Part C :-Learning Resources
Text Book, Reference Books, Other resources
Suggested Readings: 1. Sharma, S.D. (2005) : Operations Research – Kedar Naik Ram Naik & Co. 2. Kanti Swaroop, Gupta P.K. and Man Mohan Singh : Operations Research – Sultan Chand & Sons. 3. Taha H A : Operations Research – Mac Millon 4. Wagner H M : Principles of Operations Research with application Prentics – Hall.

DEPARTMENT OF STATISTICS

Class: M. Sc. III Sem

Subject: Statistics | **Paper: Theory - 3**

Title of Paper: Demography | **Code of the Paper: S-33-B**

Max. Marks : 75 | **Credits : 04**

Part A: Introduction for code- S-33-B	
Course Objectives	The main objective of this course is to acquaint students with demographic data, use different measures for demographic analyses using various techniques across populations. To learn the theories used to understand population studies.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand the basic concept of vital statistics and census.
	2. Illustrate and use the measures of fertility.
	3. Describe the concept of population estimation.
	4. Gain knowledge about population projection and matrix representation and use different methods of migration estimation.
	5. Understand the Poisson process, linear birth and death process.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Census and Vital Statistics data, vital rates and ratio, standardization of rates, Measurement of mortality; Standard death rates, Neo-Natal, Peri-Natal and Infant mortality rates, causes of death rates, Construction of life table and their uses, Abridged life tables.
Unit-II	Measures of fertility; period and cohort measures, use of birth order statistics, Child – woman ratio, Standard fertility rates, Gross and Net reproduction rates, length of generation, Stationary and stable population, Probability models for times for first birth.
Unit-III	Population estimation, Logistic Curve, fitting of Logistic Curve by method of Pearl - Reed and Rhodes methods, Makehan's graduation formula and its fitting.
Unit-IV	Population projection and their matrix presentation, method of solution. Migration and distribution of population. Different methods of estimation of migration.
Unit-V	Poisson process, Liner birth and death process, Birth, death and Migration model, Extinction of population.

Part C: Learning Resources
Text Book, Reference Books, Other resources
Suggested Readings: 1. Techniques of Population Analysis- Barclay, C.W.

2. Introduction to Demography – Spieglaman.
3. Applied Mathematical Demography – Keyfitj, N.
4. An Introduction to the Study of Population – Misra, B.D.
5. Technical Demography – Ramkumar, R.
6. Stochastic Process in Demography and its Applications – S. Biswas.
7. Stochastic Process - J. Medhi

DEPARTMENT OF STATISTICS

Class: M. Sc. III Sem

Subject: Statistics | **Paper: Theory - 4**

Title of Paper: Programming with Language C | **Code of the Paper: S-34-A**

Max. Marks: 75 | **Credits: 04**

Part A: Introduction for code- S-34-A	
Course Objectives	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications of C.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand the fundamentals of C programming.
	2. Understand and use operators and expressions.
	3. Apply input and output functions.
	4. Use function, arrays and pointers in progamming.
	5. Learn to construct statistical programmes in C.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Introduction to C; C-Fundamentals: Character set identifiers of Key words. Constants, variables, arrays, declarations, expressions and statements.
Unit-II	Operators and Expressions – Arithmetic operators Relational and logical operators Assignment Operators. Conditional operators and Library function.
Unit-III	Data Input and output – Preliminaries, Singal Character input single character output, Entering input data, Writing output data. Control Statements : While, Do-While, for, If-Else, Switch, Break, Continue and go to statement.
Unit-IV	Function, Arrays and Pointers.
Unit-V	Writing Simple Programme related to statistics in 'C' – Such as Mean, Median, Variance. Correlation, regression, root extraction matrix computation, Numerical integration random number generation, ANOVA etc.

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. Byron S Gottfried : Programming with C – Tata Mc-Graw-Hill
2. Balaguru Swamy, E : Programming in ANSIC - Tata Mc-Graw-Hill
3. BW Krmghan and D.M. Ditchie (1988) : The C-Programming Language – Prentice Hall
4. Kanetkar, Y : Let Us 'C'

DEPARTMENT OF STATISTICS

Class: M. Sc. III Sem

Subject: Statistics | **Paper: Theory - 4**

Title of Paper: Statistical Inference - II | **Code of the Paper: S-34-B**

Max. Marks : 75 | **Credits : 04**

Part A : Introduction for code- S-34-B	
Course Objectives	To learn various element of decision theory, sequential analysis, non parametric methods, order statistics and test for one and two sample used in research.
Course Learning Outcomes	After the successful completion of this course , students should be able to
	1. Understand the concept of Decision theory.
	2. Apply sequential analysis problems on real life examples.
	3. Interpret and apply Non-Parametric tests.
	4. Illustrate and Apply test for one sample problems on real life example.
	5. Understand and Apply tests for two sample problems.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Elements to Decision Theory – Some basic concepts, loss function, risk function, Minimax approach, Bayes approach; Point Estimation as a decision problem, hypothesis testing as a decision problem, interval estimation as a decision problem, Bayes and minimax estimators, Admissibility of estimators.
Unit-II	Sequential Analysis – Wald Sequential probability Ratio Test (SPRT), Wald Equation Determination of Constants, Wald fundamental identity (no derivation), OC function of SPRT, ASN function of SPRT, SPRT Terminate with One .
Unit-III	Non-parametric methods – Parametric v/s non-parametric methods, order statistics and their distribution. Ranks, Correlation between Ranks and variate values. Treatment of ties in ranks.
Unit-IV	Tests for one sample problems – Run test, Kolmogorov – Smirnov test, Sign test, Wilcoxon's signed ranked test.
Unit-V	Tests for two sample problems – Wald – Wolfwitz Run Test, Wilcoxon's run test, Kolmogorov – Smirnov test, Median test, Wilcoxon signed ranked test, Mann – Whitney U – test.

Part C :-Learning Resources
Text Book , Reference Books, Other resources

Suggested Readings:

1. An Outline of Statistical Theory, Vol.-II – Goon, Gupta and Dasgupta.
2. An Introduction to Probability Theory and Mathematical Statistics – V.K. Rohtagi.
3. Introduction to the Theory of Statistics – M.A. Mood, F.A. Graybill and D.C. Boes.
4. Mathematical Statistics – S.S. Wilks.
5. Sequential Analysis – A. Wald.
6. Non – Parametric Statistical Inference – J.D. Gibbons.
7. Non Parametric Statistics for Behavioral Sciences – S. Siegal

DEPARTMENT OF STATISTICS

Class: M. Sc. III Sem

Subject: Statistics | **Paper: Theory - 5**

Title of Paper: Statistical Techniques | **Code of the Paper: S-OE-35**

Max. Marks : 75 | **Credits : 04**

Part A: Introduction for code- S-OE-35	
Course Objectives	To have a proper understanding of Statistical applications for another branch student. To enable the use of statistical, graphical and algebraic techniques wherever relevant.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Summarize Statistics, graphical representation of data and evaluate measures of central tendency.
	2. Evaluate measures of dispersion, moment, skewness, and kurtosis.
	3. Understand the concept of probability, its laws and Mathematical expectation.
	4. Illustrate correlation and regression analysis.
	5. Apply small sample tests based on t, F and chi-square distributions and design experiments.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	**Statistics-meaning, definition and scope:** • Definition of Statistics, importance, scope and limitations. Primary and Secondary data. • Graphical presentation-Histogram, Frequency polygon, frequency curve, cumulative frequency curve (ogive) • Diagrammatic presentation-Bar diagram, duo-directional bar diagram, two dimensional diagram, Pie-diagram. • Measurer of central tendency-requisities of ideal measure, arithemetic mean, geometric mean and harmonic mean, their properties and merits, demerits. Median, Mode and their merits, demerits. Partition values - Quartiles, Deciles & Percentiles. Determination of median and mode by graphical method.
Unit-II	**Measures of Dispersion:** • Requisites of ideal measure of dispersion • Range, Quartile deviation, Mean deviation, Standard deviation and their merits, demerits. • Various formulae for calculating variance: for individual data, discrete and continuous data. • Coefficient of dispersion based upon range, Q.D., M.D and S.D., coefficients of variation • Moments: moments about origin, any point and mean. Relation between moments about mean in terms of moments about any point. • Skewness: definition, measures of skewness, coefficients of skewness based upon Karl Person and Bowley's. • Kurtosis

Unit-III	**Probability:** • Random Experiment • Trial, event and sample space. • Exhaustive events, favorable events, equally likely events, independent events and dependent events. • Mathematical and Statistical definition of probability with their limitations. • Axiomatic definition of probability. • Addition law of probability. • Conditional probability. • Multiplication law of probability. • Baye's theorem. **Random Variable :** • Discrete and continuous random variable. • Distribution function and their properties. • Probability mass function and probability density function. • Mathematical expectation.
Unit-IV	**Correlation & Regression :** • Bivariate distribution : Scatter diagram. • Karl Person's Coefficient of Correlation. • Curve fitting: Fitting of straight line, second degree parabola. • Regression : Lines of regression and their properties.
Unit-V	**Small Sample Tests:** Applications, Formulae and Assumptions of t, F and Chi-square distributions • t – test for single mean, t – test for difference of means, paired t test. • F-test for equality of two population variance. • test for goodness of fit, test for independence of attributes (2x2 Contingency table). **Analysis of Variance:** • Definition of ANOVA, • One-way and two-way classifications with one observation per cell (for fixed effect model). (Without Proof.) • Basic Principles of Design of Experiments CRD and RBD

Part C :-Learning Resources

Text Book , Reference Books, Other resources

Suggested Readings:

1. S.C. Gupta and V.K. Kapur, "Fundamentals of Mathematical Statistics.", Sultan Chand and Co.
2. S.C. Gupta and V.K. Kapur, "Fundamentals of Applied Statistics.", Sultan Chand and Co.
3. A.K. Goon, M.K. Gupta and Das Gupta, Fundamentals of Statistics Vol. -I. world Press. Calcutta.
4. J.N. Kapur and H.C. Saxena, "Mathematical Statistics". S. Chand and Co.
5. P. Mukhopadhaya – Mathematical Statistics, New Central book Agency, Calcutta.
6. B.L. Agarwal, Basic Statistics, New Age.
7. E.N. Nadar, "Statistics", PHI Learning.

Govt. Holkar (Model Autonomous) Science College, Indore										
Name of Department-Statistics										
Syllabus Session: 2021-22										
Programme: M.Sc.			Subject: Statistics						Class: M.Sc. IV Sem	
Sr. No.	Paper	Course Title	Course Code	Credits	CCE (Max)	CCE (Minimum)	External Assessment Max.	External Assessment Mini.	Total Max.	Total Mini.
1	Core 11	Design of Experiments	S-41	4	25	9	75	26	100	35
2	Core 12	Statistical Quality Control	S-42	4	25	9	75	26	100	35
3	Elective 3/1	Advanced Operation Research	S-43-A	4	25	9	75	26	100	35
	Elective 3/2	Official Statistics	S-43-B							
4	Elective 4/1	Econometrics	S-44-A	4	25	9	75	26	100	35
	Elective 4/2	Stochastic Processes	S-44-B							
5	Practical - 7	Practical based on paper 13 & 14	PRS-41	4	25	9	75	---	100	35
6	Practical - 8	Practical based on paper 15 & 16	PRS-42	3	---	---	75	---	75	26
7	Internship	---	---	3	---	---	75	---	75	26
			---	26	125	---	525	---	650	---

DEPARTMENT OF STATISTICS

Class: M. Sc. IV Sem

Subject: Statistics | **Paper: Theory-1**

Title of Paper: Design of Experiments | **Code of the Paper: S-41**

Max. Marks: 75 | **Credits: 04**

Part A: Introduction for code- S-41	
Course Objectives	To learn the principles in the design of experiments. To learn tests for comparing pairs of treatment means, ANOCOVA, factorial experiments, fractional factorial experiments, confounding, BIBD, PBIBD with solving real life designs in agriculture.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand the concept of Design of Experiment and use these experiments in real life examples.
	2. Describe and use Analysis of Co-variance.
	3. Understand the concept of General Block Design.
	4. Illustrate Balanced Incomplete Block Design.
	5. Understand and use factorial experiments in real life example.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Introduction to design of experiments, completely randomized design (CRD), Randomized block design (RBD), Latin Square design (LSD), Graeco Latin square design, Cross-over designs. Missing plot technique–general theory and applications.
Unit-II	Analysis of co-variance – ANOCOVA for one way classification with single concomitant variable in CRD layout, ANOCOVA for two-way classification with single concomitant variable in RBD layout, Split Plot and Split Block experiments.
Unit-III	General Block Design, Information matrics 'C' and its properties, Concept of connectedness, orthoganality, balance and partial balance.
Unit-IV	Balanced incomplete block design (BIBD) – Definition, Parameters of BIBD, Parametric relations for existence of BIBD, Symmetric BIBD, Analysis with intra block information and recovery of inter block information, Partially Balanced incomplete block design (PBIBD).
Unit-V	General Factorial experiments, factorial effects, best estimates and testing the significance of factors-effects; study of 2^n ($n \leq 4$) and 3^n ($n \leq 3$) factorial experiments in randomized blocks, Complete and Partial Confounding.

Part C: -Learning Resources
Text Book, Reference Books, Other resources
Suggested Readings:

1. Das M. N. and Giri, N.C. (1979): Design & Analysis of Experiment – Wiley Estern.
2. Aloke Dey (1986): Theory of Block Design - Wiley Estern.
3. Angela Deal and Daniel Voss (1999): Design and Analysis of Experiments-Springer.

4. Giri N. (1986): Analysis of Variance – Asia Publisher.
5. John P.W. (1971): Statistical Design and Analysis of Experiments – Mac Millon.
6. Montegomery C.D. (1976): Design and Analysis of Experiments – Wiley.

DEPARTMENT OF STATISTICS

Class: M. Sc. IV Sem

Subject: Statistics **Paper: Theory-2**

Title of Paper: Statistical Quality Control **Code of the Paper: S-42**

Max. Marks: 75 **Credits: 04**

Part A: Introduction for code- S-42	
Course Objectives	To develop scientific view to analyze the industrial data. To learn the statistical quality control techniques used and implemented in industries such as control charts, sampling plans etc. To learn some advanced control chart and the concept of six-sigma.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand and use the concept of S.Q.C.
	2. Solve and use the control charts based on C.V. and V mask.
	3. Understand and apply the sampling Inspection Plans.
	4. Apply Continuous Sampling Plans.
	5. Understand and apply the concept of six sigma.
Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Meaning and scope of SQC, Shewhart control charts for $\bar{X}$, R, np, p, c etc and their uses. OC and ARL of control chart, uses of runs and related pattern of points.
Unit-II	Control charts based on C.V., extreme values, moving averages, Geometric moving averages, modified control charts. Cusum charts, use of V-mask, derivation of ARL. Joint use of Shewhart and Cusum charts. Economic design of control charts.
Unit-III	Sampling inspection plans – Classification and general properties. Sampling plans by variables, estimation of lot defective and plan parameter determination in known and unknown cases.
Unit-IV	Continuous Sampling Plans: CSP-A and CSP-B of Wald and Wolfowitz and their properties. Curtailed and Semi Curtailed Sampling Plans.
Unit-V	Basics of Six-Sigma – Origin and meaning of Six-Sigma, importance and applicability of Six-Sigma, environment for Six-Sigma and implementation of Six-Sigma.
Part C:-Learning Resources	
Text Book, Reference Books, Other resources	

Suggested Readings:

1. Juran J.M. & Gryna F.M. (1980): Quality Planning and Analysis Tata Mc Gram Hill
2. Montgomery, D.C.: Introduction to Statistical Quality Control, John Wiley
3. Wald, A (1981): Statistical Theory of Sampling by Attributes Academic Press.

4. Schilling E.G. (1981): Acceptance Sampling in Quality Control, Marcel – Dekkar
5. Burr I.W. (1976): SQC Methods, Marcel – Dekkar
6. Guenthor N.C. (1977): Sampling Inspection in SQC, Griffin, Landon.

DEPARTMENT OF STATISTICS

Class: M. Sc. IV Sem

Subject: Statistics | **Paper: Theory-3**

Title of Paper: Advanced Operation Research | **Code of the Paper: S-43-A**

Max. Marks: 75 | **Credits: 04**

Part A: Introduction for code- S-43-A	
Course Objectives	The objective of this course is to develop an ability in the students to understand and analyze managerial problems in industry and supply chain management so that they are able to use resources (capitals, materials, staffing, and machines) more effectively, formulate mathematical models for quantitative analysis of managerial problems in industry, develop skills in the use computer tools in solving real problems in industry.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Describe and apply the concept of theory of games.
	2. Understand the goals and objectives of inventory management.
	3. Understand and use the concept of Replacement Problems.
	4. Illustrate and use waiting line models (Queuing System).
	5. Illustrate and apply the concept of Job sequencing.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Theory of games – Basic definitions, Minimax (Maximin) criterion, saddle point, optiomal strategies and value of the game, games with and without saddle points, equivalence of rectangular game of L.P. Fundamental of game theory, solution of m×n game by LP 2×2 games without saddle point, principle of dominance, graphical method for 2xn and mx2 games, business application (Bidding problems).
Unit-II	Inventory management – Preliminaries, EOQ, deterministic elementary static demand. Inventory models: Models - I, II, III (without shortages). Periodic Review Inventory System (PRIS), Advantages and disadvantages of PRIS. Probabilistic inventory models: Instantaneous Demand, No Setup Cost (Discrete and Continuous case).
Unit-III	Replacement – Replacement problem of items that deteriorate and replacement of items that fail completely. Individual replacement policy, mortality theorem, group replacement policy, recruitment and promotion problems. Equipment renewal problem.
Unit-IV	Waiting line models – Queueing system. Transient and steady states. Traffic intensity, Probability distribution in queuing systems. Solution of (M/M/1): (∞/FCFS) – Erlang model, (M/M/1); (N/FCFS); (M/M/S) : (∞/FCFS); (M/E_k/1) : (FCFS); (M/G/1) : (∞/GD) Queuing models.

Unit-V	Job Sequencing – Terminology and notations. Processing **n** jobs through **2** machines, **n** Jobs through **3** machines, **2** Jobs through **m** machines, **n** Jobs through **m** machines. Project management CPM and PERT: Basic steps in CPM and PERT techniques, rules for drawing network diagram, time estimates and critical path in network analysis; Evaluating optimistic most likely, Pessimistic and expected time in PERT. Application areas of CPM and PERT.

Part C:-Learning Resources

Text Book, Reference Books, Other resources

Suggested Readings:

1. Sharma S.D.:Operations Research – Kendarnath Ramnath& Co.
2. Kantiswaroop Gupta P.K.:Operations Research. Sultan Chand & Son& Singh M.
3. Hadely G. : Non-Linear and Dynamic Programming, Addison Wesley.
4. Keinrock, L.:Queuing System Vol - I, John Wiley
5. Mckinsey, J.C.C: Introduction to game theory, McGraw Hill
6. Grass D, Harris C.M.: Fundamentals of Queueing theory – John Wiley

DEPARTMENT OF STATISTICS

Class: M. Sc. IV Sem

Subject: Statistics | **Paper: Theory - 3**

Title of Paper: Official Statistics | **Code of the Paper: S-43-B**

Max. Marks: 75 | **Credits: 04**

Part A: Introduction for code- S-43-B	
Course Objectives	The objective of this course is to develop an ability of the students to understand concept of official statistics used in various organization and industries.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Interpret the role, function and activities of Indian and international system of statistical organization.
	2. Understand the role of National Sample Survey organization.
	3. Understand and use the content of population census of India.
	4. Understand and use the system of collection of Agricultural Statistics.
	5. Describe the relation between Statistics and Industries.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Introduction to Indian and International Systems. Role, Function, and Activities of Central and State level Statistical Organization.
Unit-II	Organization of Large-Scale sample Surveys. Role of National Sample Survey Organization.
Unit-III	Population Growth in developed and developing countries, Evauation of performance of family welfare programs. Scope and Contents of Population Census of India.
Unit-IV	Systems of Collection of Agricultural Statistics. Crop forecasting and estimation, Productivity, Fragmentation of Holdings.
Unit-V	Statistics related to Industries, Foreign trade, Cost of living Educational and other Social Statistics.

Part C: -Learning Resources

Text Book, Reference Books, Other resources

Suggested Readings:

1. Basic Statistics relating to Indian Economy (CSO), 1990
2. Guide to Official Statistics (CSO), 1999
3. Statistical Systems in India (CSO), 1995
4. Principles and Accommodation of National Population Census, UNESCO
5. Estimation of Crop Yields. (FAO). Panse, V.G.
6. Family Welfare Yearbook, Annual Publication of Department of Family Welfare. Monthly Statistics of Foreign Trade in India. DGCIS, Calcutta and other Govt, Publications.

DEPARTMENT OF STATISTICS

Class: M. Sc. IV Sem

Subject: Statistics | **Paper: Theory - 4**

Title of Paper: Econometrics | **Code of the Paper: S-44-A**

Max. Marks : 75 | **Credits : 04**

Part A : Introduction for code- S-44-A	
Course Objectives	Objective of the course is to introduce regression analysis to students so that they are able to understand its applications in different fields in economics. Students will be able to specify assumptions, formulate and estimate appropriate models, interpret the results and test their statistical significance. The course emphasizes on the applications of econometrics in different fields of research.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Identify the nature and scope of econometrics and use of generalized least squares in estimation.
	2. Explain autocorrelation and multicollinearity.
	3. Use and Apply Canonical Correlation and Discriminant Analysis in economic situations.
	4. Evaluate simultaneous linear equation models.
	5. Learn recursive models and simultaneous equation methods.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Nature and Scope of Econometrics, Classical linear model and its extension using ordinary least squares (OLS) estimation and prediction. Use of dummy variables. Generalized least squares (GLS) estimation and prediction. Heteroscedastic disturbances.
Unit-II	Auto-Correlation – meaning, its consequences on OLS and tests of Auto-Correlation. Multicollinearity problem and tools for handling the problem.
Unit-III	Instrumental variable estimation. Errors in variables. Use of Principal components, Canonical correlations and Discriminant analysis in econometrics.
Unit-IV	Simultaneous linear equation model – Examples, Identification problem, Restriction on structural parameters – rank and order conditions. Restrictions on variances & covariances.
Unit-V	Recursive models, Simultaneous equation methods –Indirect least square (ILS) method, two stage least square (2SLS) method, three stage least square (3SLS) method,Limited information estimators, Full information maximum likelihood method predication.

Part C :-Learning Resources
Text Book , Reference Books, Other resources
Suggested Readings:
1. Johnston, J. (1984): Econometric models, Third edition, McGraw Hill.
2. Madnani, G.M.K. : Econometrics, Oxford &IBH Publishing Co. Pvt. Ltd.

3. Klein,L.R. (1962): An Introduction to Econometrics, Prentice Hall of India.
4. Gujarathi, D. (1979) : Basic Econometrics, McGraw Hill.
5. Apte, P.G. (1990) : Text book of Econometrics. Tata McGraw Hill.
6. Cramer, J.S. (1971) : Empirical Econometrics, North Holland.
7. Koutsoyiannis, A. (1979) : Theory of Econometrics, Macmillan Press.

DEPARTMENT OF STATISTICS

Class: M. Sc. IV Sem

Subject: Statistics

Paper: Theory - 4

Title of Paper: Stochastic Processes

Code of the Paper: S-44-B

Max. Marks : 75

Credits : 04

Part A : Introduction for code- S-44-B	
Course Objectives	To learn and understand stochastic processes approach. To develop an ability to analyze and apply basic stochastic processes for solving real life situations. The course emphasizes on the application of Stochastic Processes in different fields of research.
Course Learning Outcomes	After the successful completion of this course, students should be able to
	1. Understand the stochastic processes, Markov chains and their application from various sciences.
	2. Explain branching process and statistical inference in MC and Markov processes.
	3. Evaluate/apply discrete state space continuous time MC.
	4. Elaborate Renewal theory and residual lifetime process.
	5. Analyze Wiener processes as a limit of random walk, stationery process and auto regressive process.

Part B: Content of the Course	
As per HE Syllabus	
Particulars/ विवरण	
Unit-I	Introduction to stochastic processes (sp's) classification of SP's according to state space and time domain. Countable state markov chains (ms's), Chapman- kolmogrov equations; calculations of n-step transition probability and its limit. Stationary distribution, classification of states; transient MC; random walk and gambler's ruin problem; application from social, biological and physical sciences.
Unit-II	Branching process: Galton- Watson branching process, probability of ultimate extinction, distribution of population size. Martingale in discrete time, inequality, convergences and smoothing properties. Statistical inference in MC and Markov processes.
Unit-III	Discrete state space continuous time MC: kolmogrov-feller differential equations; Poisson process, birth and death process; Applications to queues and storage problems.
Unit-IV	Renewal theory elementary renewal theorem and application and uses of key renewal theorem, study of residual lifetime process.
Unit-V	Wiener processes as a limit of random walk; first passage time and other problems. Stationary process: weakly stationary and strongly stationary processes; moving average and auto regressive processes.

Part C :-Learning Resources
Text Book , Reference Books, Other resources
Suggested Readings: 1. Adke, S.R. and Manjunath, S.M. (1984): An introduction to Finite Markov processes, Wiely Eastern.

2. Bhat, B.R. (2000) Stochastic Models: Analysis and Applications, New age International, India.
3. Ross, S. Introduction to Probability Model, Elsevier Publication.
4. Cinlar, E. (1975): Introduction to Stochastic Processes, Prentice, Hall.
5. Feller, W. (1968): Introduction to Probability and its Applications Vol. 1, Wiely Eastern.
6. Harrils, T.E. (1963): The Theory of Branching Process, Springer Verlag.
7. Hoel, RG, Port, S.c. and Stone, C.J. (1972): Introduction to Stochastic Processes, Houghton Miffin & Co.
8. Jagers, P.(1974): Branching Processes with Biological Applications, Wiley.
9. Karlin, S. and Taylor, H.M. (1975): A first course in Stochastic Processes, Vol. 1, and Academic Press
10. Medhi, J. (1982): Stochastic Processes, Wiley Eastern.
11. Parzen, E. (1962): Stochastic Processes, Holden-Day.

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Seed Technology

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

B.Sc. Seed Technology 2021-22 Syllabus

1.1.3 Details of Course offered by the institution that focus on employability/internship/skill development during the year

	Name of the course	Course code	Activities/Content with a direct bearing on Employability/ Entrepreneurship/ Skill development
B.Sc. I Sem	**Principles of Seed Technology** (Major)	**S1-SEED-1T**	**1. History, Concept and Seed Development Programme** 1. History and evolution of seed industry in india. 2. Concept and aim of seed technology. 3. Definition, types and Characteristics of good Seed.Difference between Seed and Grain. 4. Seed development programme : 1.1 Basis for seed programme 1.2 Types of seed programme 1.3 National seed programme 1.4 National seed policy 5. Role of following agencies in the development of Indian seed industry. 5.1 National Seed Corporation (NSC) 5.1 TARAI Development Corporation (TDC) 5.2 State Farm Corporation (SFC) 6. Introduction of Madhya Pradesh Rajya Beej Evam Farm Vikas Nigam **2. Embryology of Angiosperms:** 1. Structure of flowers. 2. Microsporengium, microsporogenesis and developmentof male gametophyte. 3. Megasporangium, megasporogenes is and development offemale gametophyte. 4. Polination, fertilization and apomixes. 5. Development of monocot and dicot embryo, types of Endosperm and types of fruit. **3. Seed structure, chemical composition, dormancy and deterioration:** 1. Structure of monocot seed (maize and wheat), dicot seed(Pea, gram, soyabean and castor) 2. Difference between monocot and dicot seed. 3. Chemical composition of seeds. 4. Seed dormancy- types, causes and methods of breakingdormancy. Advantages and disadvantages of seed dormancy. 5. Seed deterioration - symptoms and causes **4. Seed germination:**

			1. Seed germination: patterns (steps), types and basic requirements for germination. 2. Normal and abnormal seedlings. 3. Germination inhibitors and promoters. 4. Metabolism of storage products during germination. **5. Plant tissue culture:** 1. Plant tissue culture – general procedures and its importance in agriculture. 2. Synthetic seeds – methods of preparation and its importance. 3. Terminator seeds, terminator technology, advantage and disadvantages. 4. Somatic hybridization.
B.Sc. I Sem	**Seed Production and practices** (Minor)	**S1-SEED-2T**	**1. General principles, methods and maintenance of seed production** 1. Seed production system in India (Breeder seed,foundation seed and certified seed) 2. Importance & history of seed production 3. Methods of seed production 4. Maintenance of breeder seeds: a. Methods in self-fertilized crops b. Methods in cross fertilized crops 5. Development, trial and release of a variety 6. Breeder seed production in Madhya Pradesh 7. Maintenance of breeder seed of recommended crop varieties of Madhya Pradesh. **2. Seed production for Cereals, Pulses and vegetables seeds** 8. List of some locally available cereals, pulses andvegetable crop seeds. a. Wheat b. Paddy c. Maize 9. Methods of seed production for pulses: a. Gram b. Pigeon pea 10. Methods of seed production for vegetable seeds: a. Tomato b. Potato c. Onion **3. Seed production for Oil seeds, fibre, Sugar and forage seeds** 11. List of some locally available Oil seeds, fibre, sugar and forage seeds 12. Methods of seed production for oil seeds:

			a. Ground nut b. Mustard c. Sunflower 13. Methods of seed production for fibres: a. Cotton b. Jute 14. Methods of seed production for sugar: a. Sugarcane b. Sugar beet 15. Method of seed production for forage seeds: a. Berseem b. Lucerne **4. Economically Important Families** 1. Study of following families with reference to the seedstructure, floral structure and economic importance. a. Brassicaceae b. Asteraceae c. Solanaceae d. Poaceae **5. Study of weeds and their control** 1. Weed: characteristics and classification. 2. Crop-weed competition, losses and benefits of weeds 3. Weeds control in India 4. Study of kharif and Rabi crop weeds: 4.1 *Amaranthus viridis* 4.2 *Cuscuta reflexa* 4.3 *Argemone mexicana* 4.4 *Euphurbia hirta* 4.5 *Eclipta alba* 4.6 *Chenopobiun album* 4.7 *Asphodelus tenuifolius* 4.8 *Phalaris minor* 4.9 *Parthenium hysterophorus*
B.Sc. I Sem	Introduction of Seed Technology (Open Elective)	S1-SEED-3T	**1. History, Concept and Seed Development Programme** 1. History and evolution of seed industry in india

			2. Concept and aim of seed technology. 3. Definition, types and Characteristics of good Seed Difference between Seed and Grain 4. Role of following agencies in the development of Indian seed industry: 5.1 National Seed Corporation (NSC) 5.2 TARAI Development Corporation (TDC) **2. Embryology of Angiosperms: 12** 1. Structure of flowers. 2. Microsporengium, microsporogenesis and developmentof male gametophyte 3. Megasporangium, megasporogenes is and development offemale gametophyte 4. Pollination, fertilization 5. Development of monocot and dicot embryo, types of Endosperm and types of fruit. **3. Seed structure, chemical composition, dormancy and deterioration: 12** 1. Structure of monocot seed (maize and wheat), dicot seed(gram and castor) 2. Difference between monocot and dicot seed 3. Chemical composition of seeds. 4. Seed dormancy- types, causes and methods of breakingdormancy. Advantages and disadvantages of seed dormancy **4. Seed germination:** 1. Seed germination: pat terns (steps), types and basic requirements for germination. 2. Normal and abnormal seedlings. 3. Metabolism of storage products during germination. **5. Plant tissue culture:** 1. Plant tissue culture – general procedures and its importance in agriculture. 2. Synthetic seeds – methods of preparation and its importance. 3. Terminator seeds, terminator technology, advantage and disadvantages.
B.Sc. II Sem	**Seed Production and practices** (Major)	**S2-SEED-1T**	**General principles, methods and maintenance of seedproduction** 1 Seed production system in India (Breeder seed,foundation seed and certified seed) 2 Importance & history of seed production 3 Methods of seed production 4 Maintenance of breeder seeds:

			4.1 Methods in self-fertilized crops 4.2 Methods in cross fertilized crops 5 Development, trial and release of a variety 6 Breeder seed production in Madhya Pradesh 7 Maintenance of breeder seed of recommended crop varieties of Madhya Pradesh. **Seed production for Cereals, Pulses and vegetables seeds** 1. List of some locally available cereals, pulses andvegetable crop seeds. 2. Methods of seed production for cereals 2.1 Wheat 2.2 Paddy 2.3 Maize 3. Methods of seed production for pulses 3.1 Gram 3.2 Pigeon pea 4 Methods of seed production for vegetable seeds 4.1 Tomato 4.2 Potato 4.3 Onion **Seed production for Oil seeds, fibre, Sugar and forage seeds** 1. List of some locally available Oil seeds, fibre, sugar and forage seeds 2. Methods of seed production for oil seeds 2.1 Ground nut 2.2 Mustard 2.3 Sunflower 3. Methods of seed production for fibres 3.1 Cotton 3.2 Jute 4. Methods of seed production for sugar 4.1 Sugarcane 4.2 Sugar beet 5. Method of seed production for forage seeds 5.1 Berseem 5.2 Lucerne **Economically Important Families** 1. Study of following families with reference to the seed structure, floral structure and economic importance. 1.1 Brassicaceae

			1.2 Asteraceae 1.3 Solanaceae 1.4 Poaceae **Study of weeds and their control** 1. Weed: characteristics and classification. 2. Crop-weed competition, losses and benefits of weeds 3. Weeds control in India 4. Study of kharif and Rabi crop weeds: 4.1 *Amaranthus viridis* 4.2 *Cuscuta reflexa* 4.3 *Argemone mexicana* 4.4 *Euphurbia hirta* 4.5 *Eclipta alba* 4.6 *Chenopodiun album* 4.7 *Asphodelus tenuifolius* 4.8 *Phalaris minor* 4.9 *Parthenium hysterophorus*
B.Sc. II Sem	**Principles of Seed Technology** (Minor)	**S2-SEED-2T**	**History, Concept and Seed Development Programme** 1. History and evolution of seed industry in india. 2. Concept and aims of seed technology. 3. Definition, types and Characteristics of good Seed.Difference between Seed and Grain. 4. Seed development programme: 3.1 Basis for seed programme 3.2 Types of seed programme 3.3 National seed programme 3.4 National seed policy 5. Role of following agencies in the development of Indian seed industry: 5.1National Seed Corporation (NSC) 5.2TARAI Development Corporation (TDC) 5.3 State Farm Corporation (SFC) 6. Introduction of Madhya Pradesh Rajya Beej Evam Farm Vikas Nigam **Embryology of Angiosperms:** **12** 1. Structure of flowers. 2. Microsporangium, microsporogenesis and developmentof male gametophyte

			3. Megasporangium, megasporogenesis and development offemale gametophyte. 4. Pollination, fertilization and apomixes. 5. Development of monocot and dicot embryo, types of Endosperm and types of fruit. **Seed structure, chemical composition, dormancy and deterioration:** **12** 1. Structure of monocot seed (maize and wheat), dicot seed(Pea, gram, soyabean and castor) 2. Difference between monocot and dicot seed 3. Chemical composition of seeds. 4. Seed dormancy- types, causes and methods of breakingdormancy. Advantages and disadvantages of seed dormancy 5. Seed deterioration - symptoms and causes **Seed germination:** 1. Seed Germination: patterns (steps), types and basic requirements for germination. 2. Normal and abnormal seedlings. 3. Germination inhibitors and promoters 4. Metabolism of storage products during germination. **Plant tissue culture:** 1. Plant tissue culture – general procedures and its importance in agriculture. 2. Synthetic seeds – methods of preparation and its importance. 3. Terminator seeds, terminator technology, advantage and disadvantages. 4. Somatic hybridization.
B.Sc. II Sem	**Seed Production and Weed Management** (Open Elective)	**S2-SEED-3T**	**General principles, methods and maintenance of seedproduction** 1 Method and types of seed production 2 Maintenance of Nucleus, breeder and foundation seeds: 2.1 Methods in self-fertilized crops 2.2 Methods in cross fertilized crops 3 Development, trial and release of a variety **Seed production for Cereals, Pulses and vegetables seeds** 3. Methods of seed production for cereals 3.1 Wheat 4. Methods of seed production for pulses: 4.1 Gram 4.2 Pigeon pea 5 Methods of seed production for vegetable seeds:

			5.1 Tomato 5.2 Potato **Seed production for Oil seeds, fibre, Sugar and forage crop seeds** 1. List of some locally available Oil seeds, fibre, sugar and forage seeds 2. Methods of seed production for oil seeds. 2.1 Ground nut 2.2 Mustard 3. Methods of seed production for fibres 3.1 Cotton 4. Methods of seed production for sugar 4.1 Sugarcane 5. Method of seed production for forage seeds. 5.1 Berseem 5.2 Lucerne **Economically Important Families** 2. Study of following families with reference to the seed structure, floral structure and economic importance. 2.1 Brassicaceae 2.2 Asteraceae 2.3 Poaceae **Study of weeds and their control** 1. Weed: characteristics and classification. 2. Crop-weed competition, losses and benefits of weeds 3. Methods of Weeds control.
B.Sc. IInd Year	**Plant Breeding**	**218 - I**	**Unit-I** 1. Plant Breeding-Introduction, objectives, Activities and important achievements. 2. Modes of pollination in crop plants- i) Self-pollination, cross-pollination. ii) Factors promoting self –pollination. iii) Factors promoting cross- pollination. 3. Self incompatibility-Definition-types methods induction & application 4. Male sterility-Definition, types, methods, induction & application. **Unit-II** 1. Germplasm & its conservation- Introduction, Germplasm collection, centre of origin & diversity. 2. Seed bank & types of seed collection. 3. Plant Introduction-Definition,Types, procedure, merits & demerits. 4. Selection –Definition, Types, Methods, merits and demerits. **Unit-III**

			1. Hybridization-Definition, objectives and types. 2. Techniques of Hybridization- (i) Selection and evaluation of parents (ii) Emasculation (iii) Bagging and Tagging (iv) pollination (v) Collection and storage of F1 seed (vi) Growing of F1 generation. 3. Improvement in self pollinated crops through hybridization application. 4. Procedure, merits and demerits and achievements of pedigree methods. 5. Procedure, merits and demerits and achievements of bulk methods. **Unit-IV** 1. Heterosis- Definition, types, basis of heterosis. 2. Use of heterosis in crop improvements. 3. Hybrid, synthetic and Composite Varieties. 4. Mutation Breeding –Mutagens, procedure, Precautions ,application, achievements. **Unit-V** 1. Plant Breeding for disease resistance-Procedure, Precaution & achievements. 2. Plant Breeding for insect resistance-procedure, precaution & achievements. 3. Plant Breeding work done in following crops - Wheat-Maize-Rice-Cotton-Potato-Sugarcane
B.Sc. IInd Year	**Seed Testing and Quality Control**	**218 - II**	**Unit I** 1. Principal, Importance and procedure of Seed testing. 2. Equipment's for seed sampling and seed testing laboratory- i) Trier ii) Seed divider iii) Seed germinator iv) Seed blower v) Hot air oven vi) purity work board vii) Counting Equipment. 3. Procedure for samples handing in the laboratory. 4. Determination of heterogeneity. 5. Determination of genuineness (Genetic purity). 6. Types of Seed sample. **Unit II** 1. Physical purity test- components, equipments and method. 2. Germination test- requirements and steps. 3. Viability test- requirement and method. 4. Vigor test- methods. 5. Health test- objectives, steps. 6. Moisture test- equipments, methods. **Unit III** 1. Concept and objectives of seed certification. 2. Method of seed certification 3. Function of seed certification agency.

			4. Standard for seed certification. 5. Essential qualities of certified seed. **Unit IV** 1. Field crop inspection- Objectives and principles. 2. Method and stages of field crop inspection. 3. Techniques for seed crop inspection for wheat, soybean, pea, gram, cotton, Berseem and lucerne 4. Seed inspector qualities, power and duties. **Unit V** 1. Seed legislation in India. 2. Seed act (1966) 3. Seed Control order (1983) 4. Essential commodity act. 5. Requirement for sale of seed
B.Sc. III Year	Paper I – Seed Pathology and Entomology	318 - I	1. Seed Pathology- History, objectives and importance. 2. Disease –Development, Stages. 3. Seed borne disease – i) Mechanism of infection ii) Factors affecting seed infection iii)Important epidemic seed borne diseases 4. Seed borne Pathogen- Alternaria, ustilago, colletrotrichum. 5. Control measure of seed borne pathogen. 1. Dry seed examination. 2. Storage fungi and their harmful effect on seeds. 3. Factors affecting storage fungi. 4. Isolation and identification of storage fungi. 5. Control measures for storage fungi. 2. Seed health test. 3. Mycotoxins – i) Types and effect of Mycotoxins. ii) Mycotoxins producing Fungi iii)Factors affecting mycotoxin production. iv)Detection of Mycotoxins. v) Control measures for Mycotoxins. 1. Role of insects in agriculture.

			2. Harmful insects of crop plants and storage insects – i) Termite ii) Grasshopper ii) iii) Rice weevil iv) Khapra beetle 3. Beneficial insects of crop plants – (1) Honey bee (2) Silk moth (3) Lac insect 4. Outline of insect control. 1. Insecticides-classification. 2. Fumigants and method of fumigation. 3. Insecticidal poisoning and their treatment. 4. Insecticidal machinery – Sprayers, Dusters and Fumigators. 5. Integrated Pest Management.
B.Sc. III Year	Paper II – Seed Processing, Storage And Marketing	318 – II	1. Concept, principles and importance of seed processing. 2. Methods of seed conditioning. 3. Equipments and their mechanism for seed conditioning- scalper, huller, debearder, corn sheller. 4. Layout of a seed processing plant. 1. Seed Dryng- principles, advantages and methods. 2. Seed dryers. 3. Seed cleaning – methods and seed grading. 4. Separation- types of separators. 5. Seed Blending – method. 6. Screen - types 1. Seed treatment- definition, advantage, kinds of seed treatment. 2. Methods of Seed treatment- Mechanical, Physical and Chemical. 3. Seed treating chemicals. 4. Seed treating equipments. 5. Seed conveyors and elevators, picker belt. 1. Seed Bagging - Methods and advantages. 2. Seed Storage - Principles and methods. 3. Factors affecting seed storage. 4. Changes during seed storage. 5. Basic requirement for good seed storage. 6. Pest problems and their treatment during seed storage. 1. Seed Marketing – Objectives and importance.

			2 Major components of seed marketing- (i) Forecasting of seed demand (ii) Supply of seed (iii) Seed marketing structure (iv) Seed sales promotion; (v) Determination of cost of seed production and seed pricing. 3 Minimum support price.

M.Sc. Seed Technology 2021-22 Syllabus

1.1.3 Details of Course offered by the institution that focus on employability/internship/skill development during the year

	Name of the course	Course code	Activities/Content with a direct bearing on Employability/ Entrepreneurship/ Skill development	Link to the relevant document
M.Sc. I Sem	**Introduction to Seed Technology (Paper-1)**	SE-11	1) Seed Technology & Seed science -Introduction and aims of seed technology, role of seed technology in modern agriculture, relation of seed technology with other disciplines. 2) History of seed technology in India, 3) Seed development programme, Basis and types of seed programme. 4) National Seed Corporation (NSC) and Tarai Development Corporation (TDC). 1) Seed-Definition, types of seeds (on the basis of cotyledons, endosperm, longevity ,storability, propagation),difference between seed and grain, class of improved seed. Characteristics of good Seed 2) Different parts of seed & their Work. 3) Role of Improved seed. 4) Importance of seeds to human. 1. Morphological and Anatomical Structure of monocotyledonous seeds- Wheat, Maize, Onion, 2. Morphological and Anatomical Structure of Dicotyledonous seeds- Gram, Castor, Pea, Soyabean, Pigeon Pea, Green Gram, Tomato 3. Difference between dicot and monocot seeds 1.Classification of crop (based on Season, Life cycle & Uses) 2.Major crop families belonging to the Dicotyledons & Monocotyledons Fabaceae (Pisum ,Glycine) Brassicaceae(Brassica, Raphanus) Solanaceae (Brinjal, Tomato) Malvaceae (Cotton ,Okra) Poaceae (Wheat, Maize) 1) Variety – definition ,types ,Characteristics and maintenance. 2) Identification, Release and Notification of Variety	

			3) Deterioration of variety-deterioration of uniformity, Genetic shift 4) Patent- requirement, limits and breeding procedure with special reference to India. 5) Plant variety protection, World trade organization, the protection of plant varieties and farmers right act 2001.	
M.Sc. I Sem	**Floral Biology, Seed Development and Maturation (Paper-2)**	SE-12	1. Floral biology-floral types , structure of flower, Classes of Floral Parts, ,Floral Insertion ,Aestivation, various floral parts(Calyx, Corolla, Perianth, Androecium, Gynoecium). 2. Structure, Development and types of Anther. 3. Microsporogenesis, Development of male gametophytes and their structures 4. Megasporogenesis. Development of female gametophytes and their structures 5 Structure of pollen Grain 1) Pollination- types, adaptation, advantages & disadvantages, differences between self & cross pollination 2) Fertilization -Double fertilization and triple fusion, factors affecting fertilization 3) Ovule- development, their structure and Different types of ovule, Placentation 4) Embryo sac- Structure and types 1) Embryogeny - Development of typical monocot and dicot embryos. 2) Endosperm - Development and types. 3) Embryonic Axis, Cotyledons- development and their structure in representative crop plants with reference to food storage. 4) Seed coat structure and development in representative crop plants. 1) Fruits – Development and Maturation, types of fruits. 2) Apomixis - classification, significance and its utilization in different crops for hybrid seed production.	

			3) Polyembryony - types and significance; haplontic and diplontic sterility. 4) Embryo abortion- causes & rescue.	
			1) Factor affecting seed set- Temperature, Relative humidity, day length, wind velocity, direction of flower anthesis, pollen viability, stigma receptivity, nutrition and irrigation. 2) Parthenogenesis and Parthenocarpy -Definition, Types. 3) Development of seedless fruit crops and their commercial exploitation 4) Advantages and disadvantages of parthenogenesis and parthenocarpy Seed dispersal- sources for seed dispersal.	
M.Sc. I Sem	**Seed Physiology (Paper-3)**	SE-13	1) Steps of seed formation, Physiology of seed development, seed Ripening, and maturation process 2) Chemical composition of seed- Carbohydrate storage, Lipid storage, Protein storage and other chemical compound in seed. 3) Synthesis and accumulation of seed reserves such as lipid, protein, carbohydrates. 4) Induction of desiccation tolerance, hormonal regulation of fruit and seed development. 1) Seed germination- External and Internal Factor affecting seed Germination. 2) Physiological processes during seed germination- water Imbibition, Enzyme Activation, Initiation of Embryo growth, Rapture of seed coat and emergence of seedling, Seedling establishment. 3) Role of embryonic axis, growth hormones and enzyme activities, effect of age, size and position of seed on Germination. 4) Metabolism of storage product during seed germination (Carbohydrate, lipids, Proteins) Respiration- an Index of Overall metabolism 1) Types of seed Germination- Epigeal and Hypogeal Germination. 2) Morphology of Dicot and Monocot seedling. 3) Seed Germination pattern in pea, chick pea, castor, soybean, radish, maize, and wheat.	

			4) Seed dormancy- types, significance, mechanism, endogenous and exogenous factors regulating dormancy. Impermeable seed coat 5) Role of phytochrome and PGR, genetic control of dormancy. 1) Seed viability, pre and post-harvest factors affecting seed viability. 2) Seed deterioration- symptoms of seed deterioration, causes of seed deterioration. 3) Lipid peroxidation and other viability theories. 4) Means to prolong seed viability; mechanism of desiccation sensitivity and recalcitrance with respect to seed longevity. 1) Seed vigor and its concept. 2) factors affecting seedling vigor, Increasing seedling vigor 3) Physiological basis of seed vigor in relation to crop performance and yield. 4) Seed invigoration and its physiological and molecular control. 5) Seed longevity- life - Span of seeds. Factor Influencing The Life-Span Of seeds	
M.Sc. I Sem	**Principles of Seed Production (Paper-4)**	SE-14	1) Introduction: Seed as basic input in agriculture. 2) General Principles of seed Production 3) Seed development in cultivated plants; seed quality concept and importance of genetic and physical purity in seed production. 4) Types of cultivars, their maintenance and factors responsible for deterioration. 5) Method of Seed Production of self Pollinated Crop (Wheat, Soyabean) with Special reference to Land requirement, Isolation, Agronomic Management, Rouging, Harvesting and Threshing. 1) Method of Seed Production of Cross Pollinated Crop (Maize) with Special reference to Land requirement, Isolation, Agronomic Management, Rouging, Harvesting and Threshing. 2) Mode of pollination and reproduction in crop plants and their modification in relation to hybrid seed production. 3) Principles of hybrid seed production, isolation distance, synchronization of flowering, rouging etc.	

			4) Male sterility and self incompatibility system in hybrid seed production. 5) Role of pollinators and their management. 1) Seed multiplication ratios, seed replacement rate, demand and supply. 2) Suitable areas of seed production and storage, agronomy of seed production agro climatic requirements and their influence on quality seed production. 3) Generation system of seed multiplication; Production technology of Nucleus Breeder, Foundation and Certified seeds. 4) Causes for deterioration of seed quality, certification standards for self and cross pollinated and vegetatively propagated crops. 1) Hybrid Seed - Methods of development of hybrids. 2) One, two (A, B) and three line (A, B and R) system; maintenance of parental lines of hybrids. 3) Planning and management of hybrid seed production technology of major field crops (Maize , Sorghum) and vegetables (Tomato, Brinjal). 1) Planning of seed production for different classes (Nucleus, breeder, foundation &Certified) of seeds for self and cross pollinated crops. 2) Seed quality control system and organization, seed village concept. 3) Seed production agencies, seed industry and custom seed production in India. 4) Private seed organization and their Role in Seed Industry.	
M.Sc. II Sem	**Seed Production of Cereals, Pulses & Oil Seeds (Paper-1)**	SE-21	1) Basic principles and method of seed production Technology and importance of quality seed. 2) Basic strategies of seed production, 3) Floral structure, breeding and pollination mechanism and method of seed production in self-pollinated cereals and millets viz, Barley, Paddy and Ragi.	

			1) Floral structure, breeding and pollination mechanism and method of seed production in cross-pollinated cereals and millets viz , Sorghum, Bajra. Floral structure, breeding and pollination mechanism, methods and techniques of seed production in pulses viz Pigeon pea, Chick pea, Green gram. Floral structure, breeding and pollination mechanism, methods and techniques of quality seed production in minor oil seeds viz Safflower, Mustard, Linseed, and Sesame. Floral structure, breeding and pollination mechanism, methods and techniques of seed production in major oil seeds viz Groundnut, Castor, Sunflower and Soybean.	
M.Sc. II Sem	**Production In Vegetables , Fiber & Fodder Crops (Paper-2)**	SE-22	1) Maintenance of breeder seed in self and cross pollinated crop. 2) Floral structure, breeding and pollination mechanism, methods and techniques of seed Production in fiber producing plants/crops viz Cotton, Jute and Sunhemp. Floral structure, breeding and pollination viz mechanism, methods and techniques of seed Production in major vegetable plants /crops viz Onion, Tomato, Radish, and lady's finger. Floral structure, breeding and pollination mechanism, methods and techniques of seed production in spices yielding plants viz Chili, Coriander and fennel. Floral structure, breeding and pollination mechanism, methods and techniques of seed Production in vegetatively propagated crops like Sugarcane, Potato, Turmeric and Ginger. Floral structure, breeding and pollination mechanism, methods and techniques of seed Production in fodder and fiber crop viz Berseem, Lucerne, and Oats.	

M.Sc. II Sem	**Seed Processing & Storage (Paper-3)**	SE-23	1) Seed processing- Introduction: Principles of seed Processing, 2) Method of seed Processing, Seed Processing Equipments. 3) Seed Conditioning-method of seed conditioning, conditioning equipment's- Huller ,Debearder, Corn Sheller, Scalper. 4) Relative humidity and equilibrium. Required moisture content of seed. 5) Loss of viability in important agricultural and horticulture crops, viability equations and application of nomogram. 1) Seed Dryng,- Methods, Seed Driers, Advantages & Disadvantages. 2) Seed cleaning equipment and their function, Types of Screens, selection of screen for seed cleaning. 3) Seed Separation and Grading 4) Types of Separator- Screen cleaners, specific gravity separator, indented cylinder, velvet spiral, disc separator, spiral separator, Colour sorter, delinting machines. 1) Layout of a seed Processing Plant-Location of the seed processing plant, basic Seed Flow Pattern in seed processing, Principle of a planned layout of the plant, Types of layout. 2) Requirement and economic feasibility of seed processing plant. 3) Elevating and conveying equipment. 4) Supporting Equipments in Processing Plant-Balances, Picker Belt, Aspirator, Dehumidifier, Blower 1) Seed treatment-methods 2) Seed treating formulations and Equipment's (Slurry treater, Mist -O- Matic, Drum Mixer) 3) Seed disinfestations, identification of treated seeds, advantages of seed treatment. 4) Seed Bagging- Methods, advantages. Packaging principles and materials, bagging and labeling with proper tagging (Breeder seeds, golden yellow , foundation seeds, white certified seeds blue).	

			1) Seed storage- Methods, factors affecting Storability of Seeds, changes in Seed during storage. Basic Requirements for Good Seed Storage, Thumb rules of seed storage 2) Pest Problems and their Treatments in Storage 3) Concepts and significance of moisture equilibrium, methods of maintaining safe seed moisture content. 4) Seed Blending- Method ,Seed Blenders 5) Storage structure. Storage problems of recalcitrant seeds and their conservation.	
M.Sc. II Sem	**Seed Quality Testing (Paper-4)**	SE-24	1) Objective concept and components of seed quality 2) Seed Testing-Procedure of Seed Testing. 3) Instruments devices and tools used in seed testing. ISTA and its role in seed testing 4) Seed sampling: definition, objectives, seed lot and its size; types of samples; sampling devices. construction of Seed Lot Number 5) Procedure of Seed sampling; Sampling intensity, methods of preparing composite and submitted samples; sub- sampling techniques, dispatch receipt and registration of submitted samples in the seed testing laboratory. 1) Physical Purity, definition objective and method of purity separation, weight of working samples for physical purity analysis, components of purity analysis and their definitions and criteria. General Principle of purity separation, 2) Pure seed definitions applicable to specific genera and families multiple seed units; general procedure of purity analysis. 3) Calculation and reporting of results prescribed seed purity standards. 4) Determination of weed seeds and other seeds by number per kilogram; determination of Other Distinguishable Varieties (ODY) determination of test weight and application of heterogeneity test. 1) Seed moisture content: importance of equilibrium principles and methods of moisture estimation - types, instruments and devices used.	

			2) Pre-drying and grinding requirements, procedural steps in moisture estimation; calculation and reporting of results. 3) Germination test: purpose of germination test: definitions, requirements for germination, instrument and substrata required, principle and methods of seed germination testing, testing of substrata 4) General procedure for each type of method, duration of test, seedling evaluation, calculation and reporting of results. 5) Dormancy: definition, importance, causal mechanisms, types and methods for breaking dormancy. 1) Viability -definition and importance of viability tests, different viability tests- quick viability test (TZ- test), advantages. 2) Principle, preparation of seeds and solutions, procedure, evaluation and calculation of test results 3) Vigor testing: concept, historical development, definitions, principles and procedures of different methods used for testing vigor. 1) Genetic purity testing: objective and criteria for genetic purity testing. 2) Types of test; laboratory, field testing based on seed, seedling and mature plant morphology; principles and procedures of chemical, biochemical and molecular tests. Roughing, definition stages plants to be rougher. 3) Seed health Testing: field and seed standards; designated diseases. 4) Significance of seed health testing - detection methods (Standard Blotter method, 2, 4-D Blotter Method, Agar plate Method, Embryo count method, Seed Washing Test) for seed borne fungi, bacteria and viruses.	
M.Sc. III Sem	**Seed legislation and certification (Paper-1)**	SE-31	1. Historical development of Seed Industry in India, Future of seed industry, Important seed industry in India. 2. Seed quality-concept and factors affecting seed quality during different stages of production. 4. Concept and objectives of Central Seed Certification Board (CSCB).	

			5. Seed legislation and seed law enforcement as a mechanism of seed quality control. 1. Regulatory mechanisms of seed quality control organizations involved in seed quality control programmes. 2. Seed Act (1966), 3. SEED Rules (1968),Seed Control Order (1983), Essential Commodities Act (1955),Plants, Fruits and Seeds Order (1989). 4. Introduction, objectives and relevance of plant quarantine, regulations and plant quarantine setup in India. 1. Seed Certification; history, concept and objectives of seed certification. 2. Seed certification agency/organization and staff requirement; legal status and phases of seed certification, formulation, revision and publication of seed certification standards. 3. Indian Minimum Seed Certification Standards (I.M.S.C.S.). General and specific crop standards including GM varieties, field and seed standards; planning and management of seed certification programmes. 4. Eligibility of a variety for certification, area assessment, cropping history of the seed field, multiplication system based on limited generation concept, isolation and land requirements. 1. Field Inspection- objectives, principles, phases and procedures, reporting and evaluation of observations; pre and post-harvest control tests for genetic purity evaluation (Grow- out test), post-harvest and evaluation. 2. seed crop inspection techniques for cotton, wheat, soybean, pea berseem. 3. Maintenance and assurance of certification records and reports; certification fee and other service charges. 4. Training and legislation for seed growers. OECD seed certification schemes. 1. National Seed Development Policy (1988) and EXIM Policy	

			regarding seeds, plant materials New Seed Bill-2004. 2. Introduction to WTO and IPRs; Plant Variety Protection and its significance; UPOV and its role. 3. DUS testing -principles, applications, 4. Essential features of PPV & FRAct,2001 and related Acts.	
M.Sc. III Sem	**Seed Pathology (Paper-2)**	SE-32	1-History, Terminology and economic importance of seed pathology, 2. Plant pathology, symptoms of major plant disease 3. Important seed transmitted microbes and pathogens. 4. Seed infection- Mechanism. Factors affecting seed infection. 5. Seed Transmission, Types of Seed Transmission, Factors Affecting seed Transmission. 6. Disease- Development stage 1. Storage fungi, their harmful effect on seeds, factors affecting storage Fungi and Control measures for storage fungi 2. Detection techniques and identification of common seed borne pathogens. 3. Morphology and anatomy of typical monocotyledonous and dicotyledonous seeds. 4. Mode and mechanism of transmission of seed borne pathogens and micro organism 5. Rate of transmission of major plant pathogens, micro organism in relation to seed certification and tolerance limits 6. Types of losses caused by seed-borne diseases. 1. Role of micro organisms in seed quality deterioration. 2. Management of seed borne plant pathogens/diseases and procedure or health of seed production. 3. Different seed health testing methods for detecting micro organisms. 4. Methods of treatment to control seed borne diseases. 5. Loose smut of wheat, Ergot of bajra, leaf blight of chili, rust of wheat, Karnal bunt of wheat, early blight of potato, Tikka disease of groundnut, blast disease of paddy, Wilt of pigeon pea, red rot of sugarcane	

			1. Mycotoxins-Types of mycotoxins 2. Effect of Mycotoxins 3. Mycotoxin producing fungi. 4. Detection of mycotoxins. 5.Factors affecting mycotoxin production. 6. Control measures form mycotoxins. 1. Pest Risk Analysis (PRA) and disease free seed production. 2. Sanitary & Phyto-sanitary (SPS)measures in seed trade. 3. International regulation (ISHI) in respect of seed health standards, Seed certification. 4. Black arm of cotton, bacterial leaf blight of paddy, Leaf roll of potato, leaf curl of tomato, Ear cockle disease of wheat.	
M.Sc. III Sem	**Seed Entomology (Paper-3)**	SE-33	1. Entomology, Insect-Classification, Characters, morphology, features of body parts (head, mouthparts, antennae, thorax, wings, legs, abdomen, sense organs), Metamorphosis. 2. Factor Which Turn an Insect into Pest, Role of Insets in agriculture Study of Following Beneficial insects with respect to their systematic position, distribution and life cycle :-(1) honeybee (2) silk moth (3) lac insect (4) ladybird beetle 1. Study of Harmful insects with respect to their systematic position, distribution, life cycle, way of infestation/Damage, symptoms and control measures:-(1) Termite (2) Gram Caterpillar (3) Fruit Fly (4) Grasshopper (5) Mustard aphid 1- Study of following Storage insects with respect to their systematic position, distribution, life cycle, way of infestation/Damage, symptoms and control measures. (1)Pulse Beetle (2) Lesser Grain Borer (3) Rice Weevil (4) Khapra beetle	

			1. Integrated Pest Management and History 2. Insecticides- Classifications and used of insecticides, Diagnosis and treatment of insecticidal poisoning. 3. Mode of action and chemical nature of insecticides. 4. Fumigants and method of fumigation. 5. Biological control and its significance. 6. Insecticidal machinery -Sprayers, Dusters, Fumigators.	
M.Sc. III Sem	**Plant Breeding (Paper-4)**	SE-34	1. Plant Breeding- Introduction, Objective, Activities and important achievements of plant breeding. 2. Modes of pollination 3. Self incompatibility - Definition- types, methods induction & application 4. Male sterility - Definition, types, methods, induction & application. 1. Germplasm & its conservation-Introduction, germplasm collection, center of origin & diversity. 2. Seed banks and role in crop improvement genetic advance. 3. Plant Introduction – Definition -Types, procedure, merits & demerits. 4. Selection- Definition, Types, Methods, merits and demerits. 1. Hybridization- Definition, objective and types. 2. Techniques of Hybridization- (1) Selection, evaluation of parents (2) Emasculation (3) Bagging and Tagging (4) pollination (5) Collection and storage of F1seed (6) Growing of F1 generation. 3. Improvement in self pollinated crops through hybridization application. 4. Procedure merits & demerits and achievements of pedigree methods.	

			5. Procedure merits & demerits and achievements of bulk methods. 1) Heterosis Definition types & basis. Genetical and Physiological basis of heterosis production of inbreed. 2) Use of heterosis in crops improvements for pigeon pea, sorghum, pearl millet. 3) Hybrid, synthetic and composite varieties. 4) Mutation Breeding-Mutagens, procedure, Precautions, application, achievements. 1. Plant breeding for disease resistance- Procedure, Precaution & achievements. 2. Plant Breeding for insect resistance- procedure, precaution & achievements 3. Plant Breeding work done in following crops- -Wheat -Maize -Rice – Cotton -Potato -Sugarcane	
M.Sc. III Sem	**Basics of Seed Technology (Open Elective)**	SE-OE	1) Seed Technology -Introduction and aims of seed technology, role of seed technology in modern agriculture, relation of seed technology with other disciplines. History of seed technology in India, 2) Seed-Definition, types of seeds, difference between seed and grain, class of improved seed. Characteristics of good Seed 1. Structure of flowers. 2. Microsporangium, microsporogenesis and development of male gametophyte 3. Megasporangium, megasporogenesis and development of female gametophyte. 4. Pollination, fertilization and apomixes. 5. Development of monocot and dicot embryo, types of Endosperm and types of fruit. 6. Structure of Dicotyledonous seeds- Gram, Castor monocotyledonous seeds- Wheat, Maize	

			7. Different parts of seed & their work 1) Seed production -method of seed production. 2) Seed processing-principles, layout of seed processing plant, seed drying and its method, seed cleaning and its method, seed separation and different separators, seed treatment and its methods, seed treater. 3) Seed bagging- method, Advantages. 4) Seed storage- method of seed storage, factor affecting seed storage. 1) Seed testing – seed lot, seed sampling, sampling and testing equipment's, procedure of seed testing, moisture test, germination test, physical purity test, viability test, health test, Genetic purity test. 2) Seed certification- method of seed certification. 3) Field crop Inspection- objectives, stages and method. Seed marketing components of seed marketing	
M.Sc. IV Sem	**Seed Marketing and Management (Paper-1)**	SE-41	1. Importance and promotion of quality seed, formal and informal seed supply system. 2. Basic concepts of marketing with special reference to seed; seed marketing structure, seed marketing principles, the marketing mix, 3. Direct marketing and contract marketing 4. Marketing corporation. 1. Seed marketing planning and process-market research, marketing research. 2. Marketing strategy components, seed marketing cycle 3. Importance and scope of seed industry in India. 4. Major constraints/problems in seed industry/seed sector role of seed association/Federation in seed trade. 5. Problems in Marketing in demand and supply, Institution site. 1. Seed supply chain organization 2. Demand and supply of seed, seed replacement rate (SRR), seed multiplication Ratio (SMR).	

			3.Cost of production and returns; determining seed needs; seed pricing and policy. 4.Seed processing and packaging, demand forecasting. Value Chain finance 1. Seed marketing intelligence and product mix. 2. Sales promotion, distribution channels. 3. Marketing costs and margins. 4. Role of information technology and telecommunication in marketing of seed. 1. Silent features of national seed policies, role of various sectors/agencies in efficient seed Marketing. 2. Quality control and assurance programme. Responsibilities of seed companies and Dealers under Seed Act, EXIM policies for seed trade etc. Market research and market information services	
M.Sc. IV Sem	**Statistic And Computer Application in Agriculture (Paper-2)**	SE-42	1- Definition Aims Characteristics and Limitations of statistics. Classification and Tabulation of data Definition. 2- Advantages and disadvantages of Arithmetic mean, Median, Mode, Geometric Mean, Harmonic Mean and Weighted Mean as measures of central tendency: 3- Range Quartile Deviation Mean Deviation 4- Variance Standard Deviation and coefficient of variation as measures of dispersion. Definition of probability , Additive and Multiplicative Laws of Problems based on them. 1- Definition, merits and demerits of complete enumeration and sample survey types of data need for sampling, sampling and Non-sampling errors concept of standard error. 2- Concepts of unit and population, sampling unit sampling frame, problem of in complete frame. 3- Random sampling, simple Random sampling (SRS) with and without replacement (SRSWR), estimation of population Mean, Variance and their unbiased estimators.	

			1- Basic concepts used in tests of Significance, statistical Hypothesis null Hypothesis two types of error level of significance, degree of freedom, definition and uses of z test in testing significance of difference between two means. 2- F test in testing equality of two variances test as test of independence of attributes in 2x2 contingency table only. Scattered diagram positive and negative correlation, correlation coefficient, rang of correlation coefficient, concept of line of best fit. 3- Basic principles of Experimental Design, Description and Analysis of Completely Randomized Design (CRD) Ramdomized Black Design (RBD) and Latin Square Design (LSD). 1) Introduction of computer. A brief history of computing Data processing and information. Characteristics of the computer, function, capability and limitation, strength and weakness of computer. 2) Generation of computers, First, Second, Third fourth and fifth generation computer with their features only, types of computer. 3) Introduction to Email and Internate. 1- Anatomy and components of computer, computer organization CPU, ALU, Input and Output devices peripheral devices, hard disk , compact disk, various types of memories. 2- Introduction to MS Office – MS Word, MS Excel, MS Power point. 3- Types of software, system software and Application software. Introduction to DOS, (disk Operating System). Fundamentals of DOS commands. Internal commands, external commands, files and directory Editor. Elementary Idea of Basic (Computer Language).	
M.Sc. IV Sem	**Nursery Management and Plant Propagation (Paper-3)**	SE-43	1. Nursery - Importance, Scope, Establishment and Layout of Nursery, Management of Nursery, Horticultural Tools, 2. Seed Bed preparation, characteristic. 3. Orchard-Establishment and management.	

			1. Plant Propagation-Different types of vegetative propagation-By Natural Propagules, Cutting. 2. Grafting- Methods of Grafting 3. Budding- Types of Budding 4. layering- Methods of Layering 1. Plant tissue culture – History, Techniques, basic Requirement, Nutrient Media, Totipotency- significance of totipotency, Sterilization Techniques, Application of plant tissue culture. 2. Differentiation- Types 3. Callus Culture, Anther Culture, Meristem Culture, Embryo Culture. 1. Somatic Hybridization –Steps & its significance 2. Transgenic plants-techniques, application, GEAC, BT cotton & its utility in modern agriculture. 3. Terminator seed –Terminator technology, advantages and disadvantages of terminator seed. 1. Synthetic seed- method, application of synthetic seed. 2. Seed priming: physiological and biochemical basis, types of priming technology, biochemical and molecular changes associated, pre germination, film coating and pelleting, seed coloring, biopriming. 3. Cryopreservation.	
M.Sc. IV Sem	**Organic Farming and Soil Management (Paper-4)**	SE-44	1. Organic farming- Principles, Need of organic Farming, Benefits package of practices for organic farming, soil nutrient management. 2. Organic manure-FYM/Rural compost, City Compost, Oil cakes. 3. Vermi Compost- method of Preparation, Pit Construction. 4. Green Manure.	

			1. Organic product certification-Steps. 2. Organic seed-objectives, characteristics, organic variety, organic seed production. 3. Weeds-Characters, Classification, Crop –weed Competition, Weed Control. 4. Herbicide- Classification. 1. Soil-Types, Profile, Function and Characteristics 2. Composition and Formation of Soil. 3. Physical, Chemical and Biological properties of soil. 4. Soil Testing- method of sampling. 1. Soil Erosion-Causes, types of soil Erosion. hydrogen cycle, control of soil erosion due to water 2. Soil Conservation-Importance, Methods of soil Conservation, Water Shed Management. 3. Soil Water- Types of soil water, losses of soil water, conservation 1. Soil Productivity and soil Fertility, nitrogen cycle, decomposition of organic matter 2. Plant nutrition- essential elements for Nutrients, Macro and Micro Nutrients, Deficiency Symptoms of Nutrients. 3. Fertilizers - Method of fertilizer application	

Government Holkar (Model Autonomous) Science College, Indore (M.P.)

Department of Zoology

Title: Colour Syllabus Showing Employability/Entrepreneurship/Skill Development

Department of Zoology

Class : M.Sc. I Sem.
Subject : Zoology
Paper: Core 1
Title of the paper - Biosystematics ,Taxonomy and Evolution

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO11

Part A : Introduction for Code ZO11 (M.Sc. I Sem. I Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	Knowledge regarding Biosystematics, Taxonomy and Evolution
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of - 1 Classification of animals on the basis of their relation to other animals by body structure & external characters and Dimension of Speciation.
		-2 Application of the principles and techniques for Taxonomic procedures. Able to apply the International rules of Nomenclature to give a scientific name to animals
		- 3 Calculation and understand different biological indices.
		- 4 Concepts and Theory of Organic Evolution.
		- 5 Macro & Micro evolution & Molecular Population Genetics.

Part B : Content of the Course

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. I Semester Zoology Session 2021-22

Paper – 1: Biosystematics Taxonomy and Evolution (ZO11) M. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit I	Definition and basic concepts of biosystematics taxonomy and classification. History of Classification. Types of Taxonomy Chemotaxonomy, Cytotaxonomy and Molecular taxonomy Dimensions of speciation and taxonomic characters. Species concepts: different species concepts.
Unit II	Origin of reproductive isolation, biological mechanism of genetic incompatibility. Taxonomic procedures: Taxonomic collections, preservation, curetting, process of identification. Taxonomic keys, different types of keys, their merits and demerits. International code of Zoological Nomenclature (ICZN). Operative principles, interpretation and Application of important rules: Formation of Scientific
Unit-III	Phylogenetic . gradualism and punctuated equilibrium. Modes of speciation (allopatry & sympatry) Evaluation of biodiversity indices. Evaluation of Shannon-Weiner Index. Evaluation of Dominance Index. Similarity and Dissimilarity Index
Unit-IV	Concepts of evolution and theories of organic evolution. Neo Darwinism and population genetics: A. Hardy-Weinberg law of genetic equilibrium. B. A detailed account of destabilizing forces: i Natural selection ii Mutation iii Genetic Drift iv Migration v Meiotic drive. Trends in Evolution Molecular Evolution a) Gene evolution b) Evolution of gene families c) Assessment of
Unit-V	Major trends in the origin of higher categories Micro and macro evolution. Molecular population genetics Pattern of cha nges in nucleotide and amino and sequence. Phylogenetic and biological concept of species. Origin and Evolution & Taxonomically important microbes and animals.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. S. Tiwari)
VC Nominee

(Dr. Pramila Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman, BOS Member

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources -
Text Book, Reference Books, Other resources – 1. Principal of Animal Taxonomy – G.G. Simpsom, 2. Principal of Systematic Zoology on Ernest Mayr, 3. Origin of Species - Charles Darwin, 4. Organic Evolution – Rastogi, 5. Organic Evolution – Lull, 6. Principles of Animal Taxonomy – Ashok Verma, 7. Contemporary Taxonomy – D.L.J. Quicke

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rupika Chowdhary)
Subject Expert

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. I Sem. **Marks: 75 + (CCE) 25 = 100**
Subject : Zoology **Credit : 4**
Paper: Core 2
Title of the paper - Structure and Function of Invertebrates **Code of the paper : ZO12**

Part A : Introduction for Code ZO12 (M.Sc. I Sem. II Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To gain Knowledge regarding Structure and Function of Invertebrates
	Course Learning outcomes	On completion of the course, the student is expected to be able to gain Knowledge and Understanding of - 1 Structure and organization of invertebrate animals.
		-2 Modifications in various functions of animals during transition from lower invertebrates to higher vertebrates
		- 3 Mechanism of Osmoregulation in Invertebrates.
		- 4 Primitive and Advanced nervous system in Invertebrates.
		- 5 Significance of larval forms of invertebrates.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rushira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Krishna Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman, BOS Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. I Semester Zoology Session 2021-22

Paper – 2: Structure and Functions of Invertebrates (ZO12) **M. Marks: 25 (CCE)+ 75(Th.)= 100**
Min. Marks : 10 (CCE) + 30 (Th.) = 4
Credits – 4

UNIT- I	1. Theories of Origin of metazoa 2. Organization of Coelom A. Acoelomates B. Pscudocoelomates C. Coclomates 3. Locomotion. A. Amoeboid flageller and cillary movement in protozoa B. Hydrostatic movement in Coelenterata. C. Locomotion in annelids. D. Locomotion in Echinodermats. 4. F. 1. Structure, affinities and life history of the following minor Phyla - A. Rotifera B. Entoprocta C. Phoronida D. Ectoprocta
UNIT - II	1. Patterns of Feeding and digestion in lower invertebrates. 2. Patterns of Feeding and digestion in higher invertebrates. 3. Organs of respiration and Mechanism in lower invertebrates. 4. Organs of respiration and Mechanism in higher invertebrates.
UNIT - III	1. Excretion in lower invertebrates. 2. Excretion in aquatic higher invertebrates. 3. Excretion in terrestrial higher invertebrates. 4. Mechanism of Osmoregulation in fresh water and Marine Invertebrates.
UNIT- IV	1. Primitive Nervous systems in Coelenterata and Echinodermata. 2. Advanced nervous system in Annelida, 3. Advanced nervous system in Arthropoda. 4. Advanced nervous system in Mollusca.
UNIT - V	1. Larval forms of Trematoda, Cestoda and Annelida. 2. Larval forms of Crustacea. 3. Larval forms of Mollusca. 4. Larval forms of Echinoderms.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Priti Tiwari)
VC Member

(Dr. Pratima Bhatt)
Industrial Member

(Dr. Reena Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rushita Choudhary)
Subject Expert

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. I Sem.
Subject : Zoology
Paper: Core 3
Marks: 75 + (CCE) 25 = 100
Credit : 4

Title of the paper – Quantitative Biology, Biodiversity and Wildlife **Code of the paper : ZO13**

Part A : Introduction for Z013 (M.Sc. I Sem. III Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	Knowledge regarding Biostatistics, Study of Biodiversity, Study of Wild life, Study of Wild life and its Conservation
	Course Learning outcomes	1 Explain mean, Mode, Median, SD and Graph, Bar Diagram.
		2 Describe Sampling theory, Variance, Co-relation, T-test & Chi square test.
		3 Describe Biodiversity - Concept, Causes for the loss of biodiversity, Data of National Biodiversity.
		4 Explain Wild life – Values, protection act, Conservation, Causes for extinction, Endangered and threatened Indian species.
		5 Study of wild life – National Parks and Sanctuaries, different project, wild life of M.P. and wild life crossing.

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Rushira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Krishna Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. I Semester Zoology Session 2021-22
Paper – 3: Quantitative Biology, Biodiversity and Wildlife (ZO13)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

UNIT- I	**Biostatistics** 1 Mean – Definition & Calculation. 2. Median - Definition & Calculation. 3. Mode - Definition & Calculation. 4. Standard deviation (SD) - Definition and Calculation. 5. Graphs & Histogram including application. 6. Bar diagram & Pictogram including application.
UNIT - II	1. Sampling theory 2. Experimental designing : Completely randomized design and randomized block design 3. Variance and analysis 4. Co-relation, types of correlation. 5. Karl persones coefficient correlation 6. T- test , Chi square test.
UNIT - III	**Biodiversity** 1. Concept and principal of biodiversity. 2. Causes for the loss of biodiversity. 3. Biodiversity conservation method. 4. National Biodiversity status of india. (vertebrates.) 5. Medicinal uses of various parts of animals.
UNIT- IV	**Wildlife of India** 1. Values of wildlife positive and negative values. 2. Wildlife protection Act.(Legal Provision) 3. Causes for the extinction of Wildlife. 4. Conservation of wildlife in India. 5. Endangered and threatened Indian species. 6. Wildlife Corridor.
UNIT - V	**Wildlife and conservation** 1. National Parks and Sanctuaries 2. Project Tiger & Project Gir lion 3. Crocodile – conservation. 4. wildlife in M.P. with references to Reptiles, Birds and mammals 5. Biospheres reserves & Safari Park. Wildlife Crossing.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rupika Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. [illegible])
Subject Expert

(Dr. [illegible])
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. Biostatistics – P. Ramakrishnan 2. Biostatistics – Veer bala Rastogi 3. Principles and practical of Biostatistics – Solomon Christopher 4. Wildlife – T.C. Majpuria 5. Biodiversity wildlife – Gupta Agrawal 6. Environmental Science – Dhaliwal sangha Ralhan 7. Biodiversity – Krishnamurthy.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Krishna Choudhary)
Subject Expert

Dr. A. K. Tiwari
HOD Member

(Dr. Rakesh Sharma)
Chairman, BOS Member

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. I Sem.
Subject : Zoology
Paper: Core 4
Title of the paper - Biomolecules and Structural Biology

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO14

Part A : Introduction for Code ZO14 (M.Sc. I Sem. IV Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	*Course Objectives*	Knowledge regarding Biomolecules and Structural Biology
	Course Learning outcomes	On completion of the course, the student is expected to be able to gain knowledge and understanding of - 1 Concepts of Chemical Properties (such as pH pk etc) of Acids and Base and Structure of Amino acids peptides and Proteins.
		-2 Structure and functional importance of DNA and RNA
		- 3 Carbohydrates and Fat metabolism
		- 4 Biosynthesis of biomolecules
		- 5 Mechanism of Enzymes and Principles of thermo dynamics.

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Prabha Khachi)
Industrial Member

(Dr. Rekha Sharma)
Chairman, BOS

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. I Semester Zoology Session 2021-22

Paper – 4 : Biomolecules and Structural Biology (ZO14) **Max. Marks: 25 (CCE)+ 75(Th.)= 100**

Min. Marks : 10 (CCE) + 30 (Th.) = 40

Credits - 4

Unit-I	**Chemical Foundation of biology - I** 1. pH, PK, acids bases, buffers, weak bonds 2. Acid soluble pool of living tissues . 3. Nanoparticles. 4. Structure of amino acid and peptides. 5. Primary, secondary, tertiary and quaternary structures of proteins, protein folding and
Unit-II	**Chemical Foundation of biology – II** 1. Structure and types of Nucleotides. 2. DNA: Double helical structure of DNA, 3. DNA replication, recombination and repair 4. RNA: Structure of RNA, role of RNA in gene expression 5. Functional importance of lipid storage and membrane lipids
Unit-III	**Carbohydrate and Fat matabolism:** 1. Basic concepts of metabolism: Coupled and interconnecting reactions of metabolism cellular energy resources and ATP synthesis 2. Glycolysis and gluoneogenesis, glycogenolysis. 3. Citric acid cycle 4. Oxidative phosphorylation. 5. Fatty acid metabolism.
Unit-IV	**Biosynthesis:** 1. RNA synthesis and splicing 2. Biosynthesis of amino acids 3. Biosynthesis of nucleotides 4. Protein synthesis and its regulation. 5. Biosynthesis of membrane lipids and steroids and fatty acids.
Unit-V	**Enzymes and Thermodynamics:** 1. Enzymes: Terminologies, classification and basics of enzyme kinetics 2. Mechanism of enzyme catalysis 3. Regulation of enzyme action 4. Concept of free energy and thermodynamic principles in biology 5. Energy rich bonds, compound and biological energy transducers resonance, isomerisation.

(Dr. Lata Bhatt Parchaiya)
Subject Expert

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources – 1. Cell Biology – C.B. Pawar, 2. Cell Biology – Copper, 3. Biochemistry – Lehninger, 4. Fundamental of Biochemistry – J.L. Jain, 5. Molecular Biology – P.K. Gupta

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman, BOS Head

(Miss Harshita Panchal)
Student representative

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. I Semester Zoology Session 2021-22

Practical-1 : (Based on Theory paper 1st and 2nd)) (PRZO11)

Time : 4 Hrs.
Max. Marks: 75
Min. Marks: 30

1.	Spotting – Classification and Identification of various phyla including **minor phyla**	-	10 Marks
2.	Spotting: related with Various types of 1. Adaptions, 2. Homologies and Analogies. 3. Modification of mouth parts.	-	05 Marks
3.	Practical related with evolution . 1. Hardly Weinberg law of genetic equilibrium. 2. Exercise based on variation . 3. Examples of micro and macro evolution. 4. Mode of speciation (allopatry and sympatry) examples.	-	10 Marks
4.	**Digramatic representation** of major dissection of any one animal showing its nervous system (**Leech,** Squilla, Prawn, Sepia, Loligo)	-	10 Marks
5.	**Digramatic representation** of minor dissection of any one animal showing its system/organ (Grasshopper-Testis , Honeybee-Sting, Scorpion-Book lungs Echinus-Aristotle Lantern, Starfish-Tube feet, Aplysia-General viscra)	-	05 Marks
6.	Permanent Mounting (Protozons, Hydra, Obelia colony, Medusa Daphnia, Cyclops and moutn parts of insects) Malpighian Tubules of **Insectes.**	-	05 Marks
7.	Larval forms of **helminthes,** Arthropods, Echinodermates and Molluscs.	-	10 Marks
8.	Viva Voce	-	10 Marks
9.	Practical Records/collection.	-	10 Marks
		Total	**75 Marks**

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rucha Choudhary)
Subject Expert

(Miss Harshita Panchal)
Student representative

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. I Semester Zoology Session 2021-22

Practical-2: (Based on Theory paper 3rd and 4th) (PRZO12) **Max. Marks: 75**

Min. Marks: 30

1.	Spotting (10 Spots : 3 + 3 + 4) Problem based on Biodiversity, wild life and molecular biology. (Mammals, Fishers group and molecular biology)	-	20 Marks
2.	Map Marking and Comments on National Parks of M.P. on Map.	-	05 Marks
3.	Exercise based on Mean, Mode, & Median.	-	05 Marks
4.	Exercise based on correlation / standard deviation.	-	05 Marks
5.	Squash preparation to show Mitosis & Meiosis.	-	05 Marks
6.	Preparation to show different types of chromosomes / DNA extraction / RNA extraction/ estimation.	-	0 5Marks
7.	Preparation of Nano partials	-	05 Marks
8.	Determination of pH.	-	05 Marks
9.	Demonstration of Salivary amylase activity with effect of pH various	-	05 Marks
10.	Demonstration of Pepsin activity with effect of pH various.	-	05 Marks
11.	Viva Voce	-	**05 Marks**
12.	Practical Record & Collection	-	**05 Marks**
		Total	**75 Marks**

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rushna Choudhary)
Subject Expert

(Dr. Kriti Tiwari)
VC Member

(Dr. Prerana Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman, BOS

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. II Sem. Marks: 75 + (CCE) 25 = 100
Subject : Zoology Credit : 4
Paper: Core 5
Title of the paper - General and Comparative Animal Physiology and Endocrinology Code of the paper: ZO21

Part A : Introduction for Code ZO21 (M.Sc. II Sem. V Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	Knowledge regarding General and Comparative Animal Physiology and Endocrinology
	Course Learning outcomes	1 Explain physiology of Respiration, nerves impulse transmission, transport of gases and neurotransmitters.
		2 Study of Patterns of physiology of digestion, excretion, Osmoregulation, Thermoregulation in different animal group and pregnancy.
		3 Comparative study of different Receptors including Lateral line systems in Fishes.
		4 Study of Bioluminescence, Pheromones, Chromatophores and Hormones.
		5 Study of Various Endocrine glands and Hormone and Reproduction.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rashmi Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
UG Member

(Dr. Reshma Khatri)
Industrial Scientist

(Dr. Rekha Sharma)
Chairman, BOS Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. II Semester (Zoology) Session 2021-22

PAPER – 5 : General and Comparative Animal Physiology and Endocrinology (ZO21)

Max. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks: 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit - I	1. Respiratory pigments through different phylogenic groups 2. Transport of oxygen and carbon dioxide in blood and body fluids 3. Regulation of respiration 4. Physiology of impulse transmission through nerves and synapses 5. Autonomic nervous system, neurotransmitters and their physiological functions
Unit-II	1. Comparative physiology of digestion 2. Patterns of nitrogenous excretion in different animal groups 3. Osmoregulation in different animal groups 4. Thermoregulation in homeotherms, poikilotherms and hibernation 5. Physiology of pregnancy, placental hormones, pregnancy diagnosis tests, parturition and breast and lactation (human being)
Unit-III	1. Comparative study of mechanoreception 2. Comparative study of photoreception 3. Comparative study of phonoreception & equilibrium reception 4. Comparative study of chemoreception 5. Comparative study of Lateral line systems in Fishes.
Unit-IV	1. Bioluminescence 2. Pheromones (Invertebrates & vertebrates) 3. Chromatophores and regulation of their function among animals 4. Hormones, chemical nature and their classification. 5. Mechanisms of hormone action (a) protinous Hormones (b) steroidal Hormones.
Unit-V	1. Structure & Function of pituitary, pancreas, adrenal and thyroid. 2. Phylogeny of endocrine glands (pituitary, pancreas, adrenal, thyroid) 3. Ontogeny of endocrine glands 4. Neuroendocrine system in vertebrates. 5. Hormone receptors. signal transaction mechanisms 6. Hormones and reproduction a. Seasonal breeders b. Continuous breeders

Dr. Kavita Bhattacharya
Subject Expert

(Dr. Rashmi Chaudhary)
Subject Expert

(Dr. [illegible])
HOD

(Dr. [illegible])
Principal

Rsharp
(Dr. Reema Sharma)
Dean Academic

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. Comparative Animal Physiology – Prosser and Brown, 2. General Endocrinology – Turner and Bagnara, 3. Animal Physiology – A.K. Berry, 4. Comparative Animal Physiology – Philip C. Withers, 5. Animal Physiology – Hurkurt Mathur

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam: 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman, BOS

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class: M.Sc. II Sem.
Subject : Zoology
Paper: Core 6
Title of the paper - POPULATION ECOLOGY AND ENVIRONMENTAL PHYSIOLOGY

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO22

Part A : Introduction for Code ZO22 (M.Sc. II Sem. VI Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To gain Knowledge regarding Population Ecology And Environmental Physiology
	Course Learning outcomes	On completion of the course, the student is expected to be able to gain Knowledge and Understanding of - 1 Populations, their characteristics and regulation of population
		-2 Correlating physiological adaptations to environment and pollution, control measures for environmental degradation.
		-3 limiting factors, predator-prey relationships and physiological responses of the body to environment.
		-4 Environmental Hazards as well as risk factors to human health.
		-5 Concept of homeostasis and methods of relaxation of Stress and body by Yoga, meditation

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rushita Chaudhary)
Subject Expert

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. II Semester (Zoology) Session 2021-22

PAPER – 6 : Population Ecology and Environmental physiology (ZO22)

Max. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks: 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit - I	1. Populations and their characters. 2. Demography : Life tables, generation time, reproductive value. 3. Population growth: Growth of organisms with non-overlapping generations, stochastic and time lag models of population growth, stable age distribution. 4. Population regulation: Extrinsic and intrinsic mechanisms.
Unit-II	1. Eco-physiological adaptations to fresh water environments. 2. Eco-physiological adaptations to marine environments. 3. Eco-physiological adaptations to terrestrial environments. 4. Eco-physiological Parasitic adaptation.
Unit-III	1. Environmental limiting factors. 2. Inter and intra-specific relationship. 3. Predatory- prey relationship, predator dynamics, optimal foraging theory (patch choice, diet choice, prey selectivity, foraging time). 4. Mutulism , evolution of plant pollinator interaction.
Unit-IV	1. Environmental Hazards and human health. 2. Conservation and management of natural resources. 3. Environmental impact assessment. 4. Concept and importance of sustainable development.
Unit-V	1. Concept of homeostasis. 2. Endothermi and physiological mechanism of regulation of the body temperature. 3. Physiological response to oxygen deficient stress. 4. Physiological response to body exercise, Meditation, yoga and their effects.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Chaudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Prabha Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. Environmental Biology – P.K. Nair, 2. Ecology – Arumugan, 3. Ecology – Odum, 4. Ecology – Rastogi, 5. Environmental Biology – S.K. Gupta

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Ajit Tiwari)
VC Member

(Dr. Prabha Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman, BOS

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. II Sem.
Subject : Zoology
Paper: Core 7
Title of the paper - **Tools and Techniques in Biology**

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO23

Part A : Introduction for Code ZO23 (M.Sc. II Sem. VII Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	Knowledge regarding Tools and Technique's
	Course Learning outcomes	On completion of the course, the student is expected would be able to get the Knowledge and Understand the basic principles, working and Applications of - 1 Explain Microscopy, Colorimetry, Chromatography and of related instruments.
		-2 Demonstrate Microbiological, Cytological, Histological, Molecular biological techniques
		-3 To understand of basic principles, application and types of Radioactivity, demonstrate Immunological Surgical Immunodetection techniques.
		-4 To Learn different mode of application of microtome and cell culture techniques.
		-5 To be familiarized to cytological and molecular biological techniques.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rashmi Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
UC Member

(Dr. Prabhat Khare)
Internal Member

(Dr. Neeta Sharma)
Chairman, BOS

(Miss Nandita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore

M.Sc. II Semester (Zoology) Session 2021-22

PAPER – 7 : Tools and Techniques in Biology (ZO23) **Max. Marks: 25 (CCE)+ 75(Th.) = 100**

Min. Marks: 10 (CCE) + 30 (Th.) = 40

Credits – 4

Unit - I	1. General Principle, Instrumentation and applications of a) Colorimeter b) Spectrophotometer c) Flame photometer d) Light, Electron microscope and phase contrast microscope 2. Separation techniques:- a) Centrifugation – Ultracentrifugation, Density gradient & differential Centrifugation. b) Chromatography- Principle and Applications of Paper, TLC, Affinity, Gel and HPLC. c) Electrophoresis – Principles and Applications of PAGE and Agarose gel electrophoresis.
Unit-II	1. Microbiological Techniques:- a) Types of Bacterial culture media and sterilization. b) Inoculation Methods. c) Microbial assay of vitamins and amino acids. d) Different Staining techniques for Bacterial identification. e) Basic design and Applications of Fermentor. 2. Cryotechniques a) Cryopreservation of cells, tissues, organs and organisms. b) Freeze fracture and freeze drying method.
Unit-III	1. Radioactivity:- a) Types and applications of different Radioisotopes . b) Measurement of radioactivity. c) Autoradiography. 2. Immunological techniques and its applications:- a) Immunodiffusion (single and double). b) Immunoelectrophoresis. c) Immunofluorocence & Immunoblotting. d).ELISA & RIA.
Unit-IV	1. Microtomy a) Types of microtomes b) Fixatives & fixation of tissue c) Dehydration of tissue and paraffin block preparation d) Sectioning, stretching & staining (Single & Double) 2. Cell culture techniques. a) Design and functioning of tissue culture laboratory b) Essential components and Preparation of tissue culture media.
Unit-V	1. Cytological techniques a) Karyotyping & Giant chromosome. b) Chromosome banding techniques (G,C,Q, R, banding) c) Flow cytometry. 2. Molecular biology techniques a) Insitu hybridization (FISH and GISH), b) Southern and northern hybridization. c) DNA Sequencing methods., (d) Polymerase Chain reaction (PCR):- Principle, procedure & applications.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rachna Choudhary)
Subject Expert

(Dr. Amit Tiwari)
VC Nominee

(Dr. Pratima Gupta)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. Text book of Principles and Techniques of Biochemistry and Molecular Biology– Keith Willson and Jon Walker, 2. Principles and Techniques of Practical Biochemistry -Peter N. Campbell, Anthoni D. Smith, 3. Biophysical chemistry – Upadhayay and Nath.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Ramesh Khanna)
Industrial Member

(Dr. Rekha Sharma)
Chairman, BOS

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. II Sem.
Subject : Zoology
Paper: Core 8
Title of the paper - MOLECULAR CELL BIOLOGY AND GENETICS

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the paper : ZO24

Part A : Introduction for Code ZO24 (M.Sc. II Sem. VIII Paper)	
Pre- requisite (if any)	B.Sc. in Biology including Zoology
Course Objectives	Knowledge regarding Molecular Cell Biology And Genetics
Course Learning outcomes	On completion of the course, the student is expected to be able to gain knowledge and understanding of - 1 Transport across cell membrane, Cell movements and transportation of protein
	-2 Cell- Cell signaling
	-3 Cell- Cell adhesion and communication
	-4 The process of Sex determination and Human Genome project.
	-5 Human genetic disorders, Genetic Diseases Genetic screening and Genomics

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rushika Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pallavi Khatri)
Industrial Member

(Dr. Rekha Sharma-Agrawal)
Chairman, BOS

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. II Semester (Zoology) Session 2021-22

PAPER – 8 : Molecular Cell Biology and Genetics (ZO24)

Max. Marks: 25 (CCE)+ 75(Th.) = 100
Min. Marks: 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit-I	**Biomembrane** 1. Molecular composition arrangement and functional consequences 2. Transport across cell membrane, diffusion, active transport, pumps, uniports, symports and antiports 3. Micro filaments and microtubules structure and dynamics 4. Cell movements, intracellular transport, role of kinesins and dynein. 5. Transportation of proteins through golgi post translational modifications.
Unit-II	**Cell. Cell signalling** 1. Cell surface receptors 2. Second messenger system 3. Signaling from plasma membrane to nucleus 4. Gap junctions and connexins 5. Integrins
Unit-III	**Cell, Cell adhesion and communication** 1. Ca++ dependant homophilic cell . cell ahension 2. Ca++ independent homophilic cell . cell ahension 3. Genome organization, hierarchy in organization 4. Chromosomal organization of genes. 5. Non Coding DNA and its importance.
Unit-IV	**Sex determination** 1. Sex determination in drosophila and mammals. 2. Basic concept of dosage compensation 3. Cytogenetic of human chromosomes 4. Human genome project (HGP) & its significance. 5. Transgenic animals & their applications
Unit-V	**Genetic Diseases and Genomics** 1 Human genetic disorders and gene therapy. 2 Prenatal diagnosis & genetic counseling 3 Genetic screening 4 Structural and Functional Genomics.5 Gene libraries

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. A.K. Tiwari)
VC Member

(Dr. Pramila Kharti)
Industrial Member

(Dr. Rekha Sharma)
Chairman, Dept.

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. Genetics – Strick berger, 2. Genetics – P.K. Gupta, 3. Genetics – C.B. Pawar

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rashmi Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Gupta)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. II Semester (Zoology) Session 2021-22

Practical - 3: (Based on Theory papers 5th and 6th) (PRZO21)

Max. Marks: 75
Min. Marks: 30

Exercise:

1.	Study of endocrine glands (Any 4 – Spot) and ecological spot (Any 4) Total-8 spot.	-	16 Marks
	Endocrinological spots comments on prepared histological slides.		
2.	Experiment based on Haematology- Hb % / Blood group & RH factor/ Total and differential counts WBC / Count of RBC	-	10 Marks
3.	paper chromatography and Gel chromatography.	-	05 Marks
4.	Demonstration of Enzyme Action/ Estimation of pH.	-	05 Marks
5.	Detection of protein, carbohydrate and fats.	-	04 Marks
6.	Detection of Nitrogenous products in given samples.	-	05 Marks
7.	Exercise based on ecological experiment.	-	10 Marks
8.	Viva Voce.	-	10 Marks
9.	Practical Records and collection.	-	10 Marks
	Total Marks	-	**75 Marks**

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rashmi Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. [illegible])
Industrial Member

(Dr. [illegible])
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. II Semester (Zoology) Session 2021-22

Practical -4 : (Based on Theory papers 7th and 8th) (PRZO22)

Max. Marks: 75
Min. Marks: 30

1. Comments upon the structure and application of analytical instruments i. Colorimeter ii. Sectrophotometer iii. Centrifuge iv. Flame Photometer v. Autoclave vi laminar air flow vii. **Microtome** viii. Kymographic Instruments ix. B.P. Instruments. x. **Electrophoresis (gel)**	-	20
2. Problem based on genetics.	-	05
3. Isolation of DNA from Plant and Animals cells.	-	05
4. Estimation techniques based for RNA and DNA	-	05
5. **(A). Microtomy Section cutting/stretching of ribbon/staining.**	-	**05**
(B). Histochemistry by staining techniques to identify tissue contents	-	**05**
6. Estimation of Gene and Genotypic frequencies in light of Hardy Weinberg law based on facial traits. Bar bodies in cheek cell.	-	05
7. Demonstration of chromosomal polymorphism in some insect population.	-	05
8. Viva Voce	-	10
9. Practical Record	-	10
	Total Marks 75	

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rashmi Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. [illegible])
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. III Sem.
100

Marks: 75 + (CCE) 25 =

Subject : Zoology

Credit : 4

Paper: Core 9

Title of the paper - Comparative Anatomy of Vertebrates

Code of the paper : ZO31

Part A : Introduction for Code ZO31 (M.Sc. III Sem. IX Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To impart knowledge of comparative anatomy of vertebrates.
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of - 1 Evolutionary origin and Comparative study of integument, Respiratory organ and Alimentary Canal in Vertebrates.
		-2 Comparative study of heart, blood and blood circulation, aortic arches and skeletal elements in vertebrates.
		-3 Comparative study of Urinogenital system, nervous system (brain, spinal cord and their nerves) in vertebrates.
		-4 Anatomical adaptations in vertebrates.
		-5 General organization of Agnatha and Gnathostomes.

(Dr. Lata Bhatt Saraiya)
Subject Expert

(Dr. Rachna Chaudhari)
Subject Expert

(Dr. [illegible])
VC Nominee

(Dr. Bhatt Saraiya)
Academic Member

(Dr. Rohan Chauhan)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology,
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. III Semester Session 2021-22

Paper – 9 : Comparative Anatomy of Vertebrates (ZO31)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks: 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit-1	1 Origin of Chordata: Protochordata and **Euchordata.** 2 Vertebrate morphology: Shap, size, colour and their importance. 3 Comparative account of integument and its derivatives in vertebrates. 4 Comparative account of respiratory organs in vertebrates. 5 Comparative account of Alimentary Canal in vertebrates.
Unit-2	1 Comparative account of heart in vertebrates. 2 Comparative account of Evolution of aortic arches and portal systems in vertebrates. 3 Comparative account of blood and blood circulation in vertebrates. 4 Comparative account of girdles and limb bones of vertebrates. 5 Comparative account of jaw suspensorium and vertebral column.
Unit-3	1.Comparative account of Kidney in vertebrates. 2.Comparative account of Reproductive organs in vertebrates. 3.Comparative account of olfactory organ and taste buds. 4.Comparative account of brain and spinal card in vertebrate. 5.Comparative account of Cranial and spinal nerves in vertebrates.
Unit-4	1. Comparative account of electroreceptors. 2. Anatomical aerial adaptations in vertebrates. 3. Anatomical aquatic adaptations in vertebrates. 4. Anatomical terrestrial adaptation in vertebrates. 5. Origin, evolution, general organization and affinities of Ostracoderms .
Unit-5	1. General organization of Cyclostomes. 2. Specialized and degenerated characters of Cyclostomes. 3. General organization of Gnathostomes . 4. General account of Elasmobranchi and Holocephali. 5. General account of Dipnoi and Crossoptergii.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rupesh Chaudhary)
Subject Expert

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1 Carter, G.S. Structure and habit in vertebrate evolution – Sedgwick and Jackson, London., 2. Kingsley, J.S. Outlines of Comparative Autonomy of Vertebrates, Central Book Depot. Allahabad, Kent, C.G. Comparative anatomy of vertebrates, 4. Malcom Jollie, Chordata morphology. East – West Pres Pvt. Ltd., New Delhi. 5 Milton I lildergrand. Analysis of vertebrate structure. IV. Ed. John Wiley and Sons Inc., New York.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology

ass : M.Sc. III Sem.
ubject : Zoology
Paper: Core 10
Title of the paper - Eco-toxicology

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO32

Part A : Introduction for Code ZO32 (M.Sc. III Sem. X Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To impart Knowledge of Eco-toxicology
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of - 1 Basic Knowledge of General Principles of factors of Eco-system.
		-2 Recycle and Re use techniques for solid & liquid waste, remote Sensing uses in biological System and Environment indicators.
		-3 Different type of environmental pollution
		-4 Basic Concept of Toxicology.
		-5 Effect of pesticides and heavy metals on environment and diseases caused by them.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rupal J. Choudhari)
Subject Expert

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. III Semester Session 2021-22

Paper – 10 : Eco- Toxicology (ZO32)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks: 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit-1	1. General principles of Environmental Biology with emphasis on ecosystems. 2. Abiotic and biotic factors of ecosystems. 3. Communities of the environment, their structure & significance. 4. Energy flow in environment : Ecological energetics.
Unit-2	1. Productivity, Production and analysis. 2. Recycling and reuse, reduce technologies for solid and liquid wastes and their role in environmental conservation. 3. Remote sensing –basic concepts and its uses in biological systems. 4. Environmental indicators and their role in environmental balance.
Unit-3	1. Kinds of environmental pollution, causes and their control methods. 2. Radioactive compounds and their impact on the environment. 3. Vehicular exhaust pollution, causes and remedies. 4. Noise pollution causes and remedies.
Unit-4	1. Toxicology- Basic concepts, principles and various types of toxicological agents. 2. Toxicity testing principles, hazards, risks and their control methods. 3. Food toxicants and their control methods. 4. Public Health Hazards due to environmental disasters.
Unit-5	1. Pesticides, types, nature and their effects on environment. 2. Important heavy metals, their role in environment and diseases caused by them. 3. Agrochemical use and misuse, alternatives. 4. Plastic pollution and remedies.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. K.K. Tiwari)
VC Member

(Dr. Krishna Khatri)
Industrial Member

(Dr. Reena Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. Clark : Elements of ecology, 2. Odum : Fundamentals of Ecology, 3. South Woods : Ecological methods, 4. Trivedi and Goel : Chemical and biological methods for water pollution studies

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rupali Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. [illegible])
Industrial Member

(Dr. Rekha Sharma)
Chairman, BOS

(Miss Harshita Panchal)
Student representative

Department of Zoology

Marks: 75 + (CCE) 25 = 100
Credit : 4

ass : M.Sc. III Sem.
ubject : Zoology
Paper: Elective 1/1
Title of the paper - Limnology

Code of the paper : ZO33A

Part A : Introduction for Code ZO33A (M.Sc. III Sem. XI Paper) (Elective -1)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	Knowledge regarding Limnology
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 Lottic and lentic ecosystem of fresh water with reference to fishery
		-2 Limnological parameter of water bodies
		-3 The significance of aquatic flora, fauna, insects, birds and macrophytes in water bodies
		-4 Pollution of rivers, causes and control measures.
		-5 Legislation and regulation on discharge of industrial effluents and domestic wastes in rivers and reservoirs.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Pancholi)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore

M.Sc. III Semester Session 2021-22

Paper – 11 : Limnology (Elective – 1) (ZO33A)

M. Marks: 25 (CCE)+ 75(Th.)= 100

Min. Marks : 10 (CCE) + 30 (Th.) = 40

Credit – 4

Unit-1	1. Limnology – Definition, historical and scope. 2. Fresh water resources of India and their Management. 3. Lotic ecosystem of freshwater and their fishery (a) Rivers (b) Springs (streams). 4. Lentic ecosystem of fresh water and their fishery (a) Ponds (b) Lakes (c) Reservoir
Unit-2	1. Physical characteristics of fresh water fishery Resources – Depth, Light, Temperature, Turbidty. 2. Chemical characteristic of fresh water fishery resources – Part A – Minerals i.e., Carbonats, Bicarbonate, Phosphate, Sulphate, chloride, Nitrate, Nitrite. 3. Chemical characteristics of fresh water fishery resources Part B – Gases – CO_2 and DO. 4. Estimation and Role of BOD and COD in the fish culture.
Unit-3	1. Phytoplankton-Definition, Types, seasonal variation and role in fish culture. 2. Zooplankton Definition ,Types, seasonal variation and role in fish culture. 3. Aquatic insects and their importance in fish culture. 4. Aquatic birds and their importance in fish culture.
Unit-4	1. Aquatic (fresh water) pollution: its causes effect on fishes and remedy. 2. Pollution status of River Ganga and their remedy including Ganga action plan i.e. measures taken to clean river Ganga. 3. Pollution status of River Yamuna action plan i.e. measures taken to clean river Yamuna. 4. Bioindicatior and their relationship with water quality.
Unit-5	1. Sewage – Definition, Composition, treatment and use in pisciculture. 2. Hydrophytes and their role in fish culture. 3. Uses and Misuses of various inland water resources. 4. Legislations to regulate fresh water pollution.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rashmi Chaudhary)
Subject Expert

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources – 1. Anathakrishnan : Bioresources Ecology, 2. Goldman : Limnology, 3. Odum : Ecology, 4. Pawlosuske : Physico- chemical methods for water, 5. Wetzal : Limnology

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattarchaya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Smt. Tiwari)
VC Member

(Dr. Rajlaxmi Khatri)
Industrial Member

(Dr. Rekha Sivanna)
Chairman & Member

(Miss Harshita Panchal)
Student representative

Department of Zoology

lass : M.Sc. III Sem.
ubject : Zoology
Paper: Elective 1/2
Title of the paper - Immunology

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO33B

Part A : Introduction for Code ZO33B (M.Sc. III Sem. XI Paper) (Elective -1)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To Impart knowledge about Immunology
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 The focus of this course is on the general principles of immunology, historical background, adaptive and innate immunity, hmoral and cell- mediated immunity.
		-2 To understand general aspects of immune system like different components of the immune system, generation and functions of these components, structure and functions of primary lymphoid organs – Thymus; Bursa of Fabricus., structure and functions of secondary lymphoid organs – spleen; lymph nodes and the lymphatic system, antigens and immunogenicity – Essential features of antigens and factors that govern immune response: epitopoes, haptens, protein epitomes, immune response to hapens and carriers.
		-3 To introduces the students with fundamentals and applications of Immunoglobulins – immunoglobulin classes and subclasses, general properties of immunoglobulins, the complement system – Complement components; the classical complement pathway; the alternative complement pathway; regulation of the complement system: Biological effect of complement and the major histocompatibility complex.
		-4 The focus of this course is on the Hypersensitivity and immunization programme.
		-5 This course will introduce students to the principles of advanced Immunology, both at the molecular and cellular levels. Cells involved in the immune response: Lymphoid cells –T- cells, B-cells, NK cells, Dendritic Cells, Mononuclear phagocytic system, Antigen presenting cells, Polymorphonuclear granulocytes – neutrophils, eosinophils, basophils and mast cells, platelets and various modern immunological techniques.

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. [illegible])
Internal Member

(Dr. Rekha Sharma)
Chairman, BOS Zool.

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore

M.Sc. III Semester Session 2021-22

Paper: 11: Immunology (Elective -1) (ZO33B)

Max. Marks: 25 (CCE)+ 75(Th.)= 100

Min. Marks: 10 (CCE) + 30 (Th.) = 40

Credits – 4

UNIT-I:	1. General principles of immunology and historical background. 2. Adaptive and innate immunity. 3. Humoral and cell- mediated immunity.
UNIT-II	1. Structure and functions of primary lymphoid organs – Thymus; Bursa of Fabricus. 2. Structure and functions of secondary lymphoid organs – spleen; lymph nodes and the lymphatic system: mucosa – associated lymphoid tissue (MALT) 3. Antigens and immunogenicity – Essential features of antigens and factors that govern immune response: epitopoes, haptens, protein epitomes, immune response to haptens and carriers. Immunogenicity.
UNIT-III	1. Immunoglobulins – immunoglobulin classes and subclasses, general properties of immunoglobulins structure and functions of specific immunoglobulins (IgG, IgA, IgM, IgD and IgE). 2. The complement system – Complement components; the classical complement pathway; the alternative complement pathway; regulation of the complement system: Biological effect of complement. 3. The major Histocompatibility complex.
UNIT-IV	1. Hypersensitivity – type I and type II. 2. Hypersensitivity- type III and type IV. 3. Immunization – Types of immunization. Active immunization (Immunoprophylaxis). Passive immunization (Immunotherapy)
UNIT-V	1. Cells involved in the immune response: Lymphoid cells –T- cells, B-cells, NK cells, Dendritic Cells, Mononuclear phagocytic system. (Monocytes and Macrophage). 2. Antigen presenting cells, The Polymorphonuclear granulocytes – neutrophils, eosinophils, basophils and mast cells, platelets. 3. Immunological techniques- Antigen-antibody Interactions, Heamaglutination and complement fixation, Direct and indirect immunofluorescence, Radio – immunoassay,

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. [illegible])
VC Nominee

(Dr. Prateema Khare)

(Dr. Rekha Sharma)
Chairman & Head

(Miss. Harshita Panchal)
Student representative

art C : Learning Resources
Text Book, Reference Books, Other resources - 1 Kuby Immunology, W.H. Freeman, USA, 2 W. Paul, Fudamentals of Immunology., 3 I.M. Roitt, Essential Immunology, ELBS Edition., 4 Tizzard : A text Book of Immunololgy., 5 Anantha Narayan & Paniker : Text Book of Microbiology.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology

lass : M.Sc. III Sem.
ubject : Zoology
Paper: Elective 2/1
Title of the paper - Aquaculture

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO34A

Part A : Introduction for Code ZO34A (M.Sc. III Sem. XII Paper) (Elective -2)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To import knowledge about Aquaculture.
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 Aquaculture Special reference to fisheries science.
		-2 Fish, Prawn, Mussel, Oyster and Frog Culture.
		-3 New techniques related to fish culture and transport of fish.
		-4 To prepare fish farm related information & fish preservation technique.
		-5 Fish related diseases and fish marketing.

(Dr. Lata Bhattacharya)
Subject Expert

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore

M.Sc. III Semester Session 2021-22

Paper -12 : Aquaculture (Elective- 2) (ZO34A)

Max. Marks: 25 (CCE)+ 75(Th.)= 100

Min. Marks: 10 (CCE) + 30 (Th.) = 40

Credits – 4

Unit-1	1. Aquaculture: history, definition, scope & importance. 2. Fishery resources of India in general & Madhya Pradesh in particular. 3. Abiotic & biotic factors of water necessary for fish life. 4. Ecological characteristics of lakes & rivers. 5. General ecological characteristics of reservoirs of India.
Unit-2	1. Fish culture: - Mono, Poly, mixed and composite Fish culture. 2. Fresh water prawn culture and its prospects in India. 3. Culture of Mussels, clams, oysters & pearl oysters. 4. Sewage fed fish culture, paddy cum fish culture 5. Frog culture.
Unit-3	1. Stripping and bundh breeding 2. Hypophysation and breeding. 3. Transport of live fishes & seeds. 4. Different types of crafts & gears used for fish catching. 5. Common weeds of fish ponds and methods of their eradication.
Unit-4	1. Fresh water fish farm engineering: selection of site, construction of fish farm & soil chemistry. 2. Designing, layout & construction of different types of fish ponds. 3. Fresh water aquarium - Setting and management of fresh water aquarium. 4. Fish preservation & processing. 5. By products of fish Industry & their utility.
Unit-5	1. Water pollution, its effects on fisheries and methods of its abatment. 2. Bactrial and viral diseases in fishes and their control. 3. Proftozoan and Helminthes diseases in fishes and their control. 4. Biochemical composition and nutritional value of fish. 5. Fish marketing.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Padma Khare)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources – 1. C.B.L. Shrivastava : Fishes of India, 2. Jhingaran : Fish and fisheries of India, 3. S.S. Khanna : An Introduction to fishes, 4. R.S. Rath : Fresh water Aquaculture, 5. Gopalji Shrivastava : Fishes of U.P. & Bihar

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Miss Harshita Panchal)
Student representative

Department of Zoology

ass : M.Sc. III Sem.
ubject : Zoology
Paper: Elective 2/2
Title of the paper - Cellular Organization and Molecular Organization

Marks: 75 + (CCE) 25 = 100
Credit : 4
Code of the paper : ZO34B

Part A : Introduction for Code ZO34B (M.Sc. III Sem. XII Paper) (Elective -2)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To gain Knowledge regarding Cellular Organization and Molecular Organization
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 The new and novel applications to solve biomedical problems and basic understanding of yeast
		-2 The cytochemistry of some organelles, genetics, developmental biology
		-3 Application of DNA technology and molecular biology in targeting of biomolecule
		-4 The concept of normal cells and cancer cells and the genetic basis of cancer and the role of oncogenes and proto-oncogenes.
		-5 Eradication human cancer, tumor suppressor genes human papillomavirus and its vaccine and receptor – Ligand interaction.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Fatima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. III Semester Session 2021-22
Paper -12: Cellular Organization and Molecular Organization (Elective-2) (ZO34B)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks: 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit-I	1. General organization and characters of viruses (Examples - SARS CoV-2 and Hepatitis C Virus). 2. Vaccination strategies to combat **SARS-CoV-2.** 3. Yeast: Structure, reproduction and chromosome organization: Basic ideas of its applications as vectors for gene cloning. 4. Cell cycle: Cell cycle control in mammalian cells and *Xenopus*.
Unit-II	1. Cytochemistry of Golgi complex and its role in cell secretion. 2. Peroxisomes and staining of Peroxysomal proteins. 3. Nucleolus: structure and biogenesis and functions of Nucleolus. 4. Intracellular digestion: ultra-structure and function of Lysosomes.
Unit-III	1. Synthesis and targeting of mitochondrial proteins. 2. DNA sequences of different complexity. 3. Knockout mouse and their applications 4. CRISPR and cas9 and applications.
Unit-IV	1. Difference between normal cells and cancer cells. a. Biochemical changes. b. Cytoskeleton changes. c. Cell surface changes. 2. Genetic basis of human cancer. 3. Chromosomal abnormalities in human cancer. 4. General idea of Oncogenes and proto- Oncogenes.
Unit-V	1. Oncogenes and cancer. 2. Tumor Suppressor genes. 3. Human Papillomavirus (HPV) and its vaccine. 4. Receptor – Ligand interaction and signal transduction. Cross talk among various signaling pathways.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchika Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

([illegible])
Industrial Member

(Dr. Rekha Sharma)
Chairman & HOD

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. The biology of Cancer – Weinberg, Robarts, 2. Karps Cell Biology – Gerald Karp, 3. Cell Biology – Verma & Agrawal

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Chaley)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Dean

(Miss Rishita Panchal)
Student representative

Department of Zoology

lass : M.Sc. III Sem.
00

Marks: 75 + (CCE) 25 =

Subject : Zoology
Paper: Open Elective (Inter disciplinary)
Title of the paper - Basic of Bioinformatics

Credit : 4

Code of the paper : OE-BB

Part A : Introduction for Code OE-BB (M.Sc. III Sem. XIII Paper) (Op. Elective - 1)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	Knowledge regarding Basic of Bioinformatics
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 Introduction to Bioinformatics and Biological database
		-2 Sequence Alignments
		-3 Structural Bioinformatics
		-4 Motif and Domain database and Phylogenic analysis
		-5 System Biology

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. A. K. Tiwari)
VC Member

(Dr. Pratima Gupta)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore

M.Sc. III Semester Session 2021-22

Paper – 13 **(Open Elective-1 Out of given group) : Basic of Bioinformatics** (OE-BB)

Max. Marks: 25 (CCE)+ 75(Th.)= 100

Min. Marks: 10 (CCE) + 30 (Th.) = 40

Credits – 4

Unit -I

Introduction to Bioinformatics and Biological database:

- What is Bioinformatics and its relation with molecular biology
- Applications of Bioinformatics.
- Nucleic acid Databases (NCBI), Protein databases (Primary, Secondary and Composite).
- Specialized Genome databases: (SGD).
- Structure Databases (CATH, SCOP)
- File Format (,PDB, Swiss-Prot)

Unit-II

Sequence Alignments:

- Introduction to Sequences, Alignments and Dynamic Programming;
- Local Alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST Algorithm), and multiple sequence alignment (Clustal W algorithm).

Unit-III

Structural Bioinformatics:

- Protein Structure: Primary, Secondary, Super Secondary, Domains, Tertiary, Quaternary, Ramachandran plot.
- Protein Secondary Structure Classification Databases: CATH, SCOP, Protein Secondary Structure prediction methods: GOR, Chau-Fosman., Visualization Tool (Rasmol, Spdbv).,*Protein Tertiary structure prediction methods*: Homology Modeling, Fold Recognition, Abintio Method ,Protein folding, Molecular Docking of Protein.

Unit- IV

Motif and Domain database and Phylogenic analysis:

- Motif database and analysis tools, Domain database(Smart)and analysis tools

Phylogeny: Introduction to Phylogenetic analysis, Concept of Phylogenetic tree.

Unit- V

System Biology:

- Introduction, associated disciplines, interactomics, Metabolic pathway database (KEGG), Drug Discovery and design: Target identification, target validation, lead identification, lead optimization, preclinical pharmacology and taxology.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Khatri)

(Dr. Rekha Sharma)
Chairman, BOS

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources -

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Chinchkhare)
Subject Expert

(Dr. Ajit Tiwari)
VC Member

(Dr. Padmini Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. III Semester Session 2021-22

Practical: For Open Elective-1: Basic of Bioinformatics M.Sc. Classes

1. To explore NCBI database.
2. To Perform Multiple Sequence Alignment using Clustal W.
3. To Perform Sequence Alignment using Blast tools.
4. To Explore Structural database using PDB Database.
5. To Analysis the protein structure using Rasmol Visualization tools.
6. To Access the SCOP Database to Study Protein Classification.
7. To Access CATH Database.
8. Generate a Chemical Structure using SMILE (Pubchem sketcher).
9. To Explore Pathway Database at KEGG.
10. To find Motif using Motif Search Tool.

Code	Theory/Practical	Teaching Hours/week	Credit	Examination Scheme		
				External	Internal	Total
Open Elective 1 inter –disciplinary	Basic of Bioinformatics	4	4	75	25	100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchika Choudhary)
Subject Expert

(Dr. S. Tiwari)
HOD & Member

(Dr. Sushma Khare)
Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. III Semester Session 2021-22

Practical -5 : (Practical based on theory paper 9 & 10) (PRZO31) **M. Marks: 75**

1. Use of software for dissection of related animal.
2. **Diagramatic demonstration/Video clipping/Software to explain** Major Dissection of **Mystus/ Scoliodon, Frog, Snakes/ Uromastic, Fowl and Rat/Rabbit**. (a) General Anatomy (b) Alimentary canal (c) Nervous system (d) Heart (e) brain
3. **Diagramatic demonstration/Video clipping/Software to explain** Minor Dissection-
   (a) Internal ear of scoliodon
   (b) **General anatomy of** Herdmania
   (c) **Oralhood and wheel organ of** Amphioxus.
   (d) Scroll valve and cruciferous cross of scoliodon.
4. Study of Specimens, slides and bones related to theory papers.
5. Study of comparative account of Vertebral column, Jaw Suspensorium girdles and limb bones.
6. Study of abiotic factors of water sample (i.e. pH, TDS, Do, Co2, Hardness).
7. Toxicological testing methods (a) acute toxicity test (b) LD **50** / LC 50 test.
8. Determination of different toxic chemicals in samples of soil & water .

Scheme for Practical Examination		**M.M. 75**
1.	**Diagramatic demonstration of** Major Dissection	15 Marks
2.	**Diagramatic demonstration of** Minor Dissection	10 Marks
3.	Spotting	20 Marks
4.	Exercise on toxicology	10 Marks
5.	Viva Voce	10 Marks
6.	Practical Record & Collection	10 Marks
	Total	**75 Marks**

(Dr. Lata Bhattarchariya)
Subject Expert

(Dr. Ruchika Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. III Semester Session 2021-22

Practical-6 : (Practical Based on paper 11 & 12) (PRZO32)

1. Study of the lymphoid organs in rats/mice: It will include the study of position of different primary and secondary lymphoid organs in the body and their histological structure. The students and expected to dissect out the rate / mice so as expose thymus, Spleen, lymph nodes and bone marrow.
2. To study of the precipitation reaction between antigen and antibody by Double immunodiffusion (ouchterlony).
3. Radial immunodiffusion method to determine the quantity of antigen and antibody.
4. Demonstration of immune electrophoresis to separate protein fractions in serum samples.
5. Study of enzymes: Linked immunosorbent assay (ELISA) for qualitative and quantitative determination of concentration of certain antigens or antibodies.
6. To perform the rocket immunoelectrophoreses.
7. Isolation of monocytes/macrophages'.
8. Latex agglutination test for diagnosis of certain diseases.
9. Widal test to diagnose typhoid bacilli.
10. Karyotype preparation any animal
11. Calculation of *mitotic index* (in bone marrow or in root tip cells)
12. Demonstration of mitochondria, Golgi body, RNA, DNA in tissue section, any tissue
13. Sex chromatin demonstration
14. Study of Electron micrographs of pro and eukaryotic cells
15. Study of mutants of Drosophila w.m.
16. Demonstration of Alkaline Phosphatase/Ascorbic acid
17. Slides of cancerous tissue.
18. Qualitative and quantitative isolation and estimation of DNA and RNA.
19. Polytene chromosome preparation
20. Finding Gene frequency in human.

(Dr. Late Bhattacharya)
Subject Expert

(Dr. Rashmi Chaudhary)
Subject Expert

(Dr. Rishita Singhal)
Subject Expert

(Dr. Nilima Agrawal)
Chairman, BOS

(Miss Harshita Panchal)
Student representative

Scheme for Practical Examination

	Exercise	M.M. 75	
1.	Spotting	-	10 Marks
2.	Enzyme Linked Immunosorbent Assay (ELISA)/ Diagrammatic representation of rats/mice to expose lymphoid organs	-	10 Marks
3	Radial immunodiffusion / Double diffusion test/ separation of Serum OR Latex Agglutination test.	-	10 Marks
4.	Demonstration of mitochondria/ Golgi body/RNA/DNA in tissue section (any one) / DNA and RNA isolation and estimation	-	10 Marks
5.	Calculation of mitotic index or Preparation of mitotic chromosomes (in Bone marrow or *Allium* root tips)	-	10 Marks
6.	Separation of Protein by PAGE or Histochemical demonstration of age pigment or Demonstration of Alkaline Phosphatase or Ascorbic acid in any tissue (plant/animal)	-	10 Marks
7.	Viva Voce	-	10 Marks
8.	Practical Record	-	05 Marks
		Total	**75 Marks**

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rachna Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Prathma Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. III Semester Session 2021-22

Practical -6 : (Related to 11 & 12 Theory Papers) (PRZO32)

Time : 4 Hour **M.**
Marks: 75

1. Study of plankton.
2. Preparation and Maintenance of Aquarium.
3. Study of common weeds of fish ponds.
4. Methods of culture related to theory papers.
5. Estimation of DO, chloride, BOD, COD, Hardness, pH and Alkalinity of water/Soil.
6. Study of fresh water ecosystem.
7. Identification and comments on Aquaculture animals.
8. Plankton quantification
9. Water analysis for common physic-chemical parameters.

Scheme of practical examination **M.M. 75**

1.	Spotting	-	12 Marks
2.	Limnological exercise	-	10 Marks
3.	Study of culture methods related to theory	-	10 Marks
4.	Maintenance of aquarium	-	10 Marks
5.	Study of craft and gears	-	08 Marks
6.	Viva Voce	-	10 Marks
7.	Practical Record/ Collection	-	15 Marks
	Total	-	**75 Marks**

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Sushma Choudhary)
Subject Expert

(Dr. [illegible])
HOD & Member

(Dr. [illegible])
Subject Expert

(Dr. Rekha Sharma)
Chairman & Member

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. IV Sem.
Subject : Zoology
Paper: Core 11
Title of the paper - ANIMAL BEHAVIOUR AND NEUROPHYSIOLOGY

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO41

Part A : Introduction for Code ZO41 (M.Sc. IV Sem. XIV Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To gain Knowledge regarding Animal Behavior and Neurophysiology
	Course Learning outcomes	On completion of the course, the student is expected to be able to knowledge and understanding of – 1Neurophysiology of perception memory, domestic animal and human behavior.
		-2 Neural And Hormonal Control Of Behavior motivation and communication
		-3 Biological rhythms, learning and memory.
		-4 Reproductive, parental and social behavior
		-5 Thermoregulation communication in birds

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. IV Semester Session 2021-22

Paper 14 - ANIMAL BEHAVIOUR AND NEUROPHYSIOLOGY (ZO41)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit-I	1. Introduction: Ethology as a branch of biology, Classification of behavioral patterns, analysis of behavior (ethogram). 2. Reflexes and complex behavior. 3. Perception of the environment: mechanical, electrical, chemical, olfactory, auditory and visual. 4. Evolution and ultimate causation: Inheritance behavior and relationships.
Unit-2	1. Neural and hormonal control of behavior. 2. Genetic and environmental components in the development of behavior. 3. Motivation: (a) Drive, timing and interaction of drives, (b) physiological basis of motivation, (c) hormones and motivation, (d) aggregation. 4. Communication: Chemical, visual, light and audio, evolution of language (primates).
Unit-3	1. Ecological aspects of behavior: Habitat selection, food selection, optimal foraging theory, anti-predator defenses, aggression and homing territoriality, dispersal, hostparasite relations. 2. Biological rhythms: Circadian and circannual rhythms, orientation and navigation, migration of fishes, turtles and birds. 3. Learning and memory: Conditioning, habituation, insight learning, association learning and reasoning.
Unit-4	1. Reproductive behavior. Evolution of sex and reproductive strategies, mating systems, courtship, sexual selection. parental care. 2. Social behavior. aggregations, schooling in fishes, flocking in birds, herding in mammals, group selection, kin selection, altruism, reciprocal altruism, inclusive fitness, social organization in insects and primates. 3. Parental behavior.
Unit-5	1. Thermoregulation: Homeothermic animals, poikilotherms & Hibernation. 2. Bioluminescence. 3. Vocalization & Communication in birds. 4. Hormone, drugs and human behavior.

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kiran Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources – 1. Life Sciences fundamentals & practice - Pranav Kumar & Usha mina

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Sharma)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. IV Sem.
Subject : Zoology
Paper: Core 12
Title of the paper - Gamete Biology, Development and Differentiation

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO42

Part A : Introduction for Code ZO42 (M.Sc. IV Sem. XV Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To Impart knowledge of Gamete Biology, Development and Differentiation
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1. Basic Concept and theories related to Gamete Biology, Gametogenesis & Biochemistry of fertilization.
		-2 Embryo transfer technology in vitro oocyte maturation, ovarian follicular growth and differentiation.
		-3 Techniques of cryopreservation and Teratological effect.
		-4 Development of gonads and Embryology of Chick and frog.
		-5 Embryonic Stem cells, cell diversification in early Amphibian embryo. Totipotency and Pleuripotency.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rashmi Choudhary)
Subject Expert

(Dr. Anil Tiwari)
VC Member

(Dr. Prabha Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, , A.B. Road, Indore

M.Sc. IV Semester Session 2021-22

Paper 15 - Gamete Biology, Development and Differentiation (Compulsory) (ZO42)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit-I	1. Comparative account of gonads in mammals. 2. Spermatogenesis: Morphological basis in rodents. Gamete specific gene expression and genomics. 3. Biochemistry of Semen: Semen composition and formation, assessment of sperm function. 4. Fertilization: Pre fertilization events, fertilization events and post fertilization events. 5. Biochemistry of fertilization.
Unit-II	1. Ovarian follicular growth and differentiation: morphology, type of ovaries, Endocrinology, molecular biology, Oogenesis and vitellogenesis, ovulation and ovum transport in mammals. 2. Biology of sex determination and sex differentiation a comparative account. 3. Multiple ovulation and embryo transfer technology in vitro oocyte maturation, super ovulation.
Unit-III	1. Hormonal regulation of ovulation, pregnancy and parturition. 2. Hormonal regulation of development of mammary gland and lactation. 3. Hormonal regulation and Physiology of placenta. 4. Cryopreservation of gametes and Embryo. 5. Teratological effects of xenobiotics.
Unit-IV	1. Cell commitment and differentiation. 2. Germ cell determinants and germ cell migration. 3. Development of gonands. 4. Melanogenesis. 5. Frog and Chick embryology.
Unit-V	1. Creating new cell types, the basic evolutionary mystery. 2. Cell diversification in early Amphibian embryo, totipotency and pleuripotency. 3. Embryonic stem cells, renewal by stem cells, epidermis. 4. Connective tissue cell family 5. Haemopoietic stem cells : Blood cells formation, stem cell disorders.

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Shastri)
Industrial Member

(Dr. Rekha ...)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. Nalbandou A.C. – Reproductive physiology, 2. Prakash A.S. 1965-66 Marshall's, Physiology Reproduction (3 Vol.), 3. Gibert S.F. Developmental Biology, Sinauer Associated Inc. Massachulsetts, 4. Ethan Bier, the cold Spring. The cold spring Harbor laboratory Press, New York, 5.Balinsky B.I. Introduction to Embryology sanders; Phliedelphia, 6. Berril N.J. and Karp G. Developmental Biology. McGraw Hill New York, 7. Davidson, E.H. Gene Activity During Early Development. Academic Press, New York.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rupika Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. [illegible])
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. IV Sem.
Subject : Zoology
Paper: Elective 3/1
Title of the paper - Ichthyology (fish Structure and function)

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO43A

Part A : Introduction for Code ZO43A (M.Sc. IV Sem. XVI Paper) (Elective – 3)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To impart Knowledge of Ichthyology (fish Structure and function)
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 Evolutionary origin, Classification and Structure of integument, Fins, girdles in fishes.
		-2 Functional anatomy of respiratory organs, Weberian ossicles and brain.
		-3 Structure and Function of Excretory, luminous, Acoustic and Electric Organs.
		-4 Special organ, Hill stream and Deep sea adaptations in fishes.
		-5 Development and parental care in Fishes.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman B.Stud.

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore

M.Sc. IV Semester Session 2021-22

Paper 16 Ichthyology (Fish Structure and Functions) (Elctive-3) (ZO43A)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit-I	1. Origin and evolution of fishes. 2. Classification of fishes as proposed by Berg. 3. Fish integument and its derivatives. 4. Fins and girdles: structure and types. Origin and evolution of paired fins 5. Mechanism of Locomotion.
Unit-II	1. Alimentary canal and digestion. 2. Accessary respiratory organs. 3. Air bladder and its functions. 4. Weberian ossicles their homologies and functions. 5. Brain and cranial nerves.
Unit-III	1. Excretion and osmoregulation. 2. Acoustico-lateral line system. 3. Luminous organs. 4. Colouration in fishes. 5. Electric organs in fish.
Unit-IV	1. Poisonous organs in fishes. (Poisonous and venomous fishes). 2. Sound producing organs. 3. Deep sea adaptations. 4. Hill stream adaptations. 5. Migration in fishes.
Unit-V	1. Reproductive system 2. Sexual cycle and fecundity. 3. Parental care in fishes. 4. Early development and hatching.5. Biology of fish fry and fingerlings.

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Fatima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. C.B.L. Shrivastava : Fishes of India, 2. S.S. Khanna : An Introduction to fishes , 3. Berg, L.S. – Classification of fishes, Both Recent and Fossil, 4. Brown, M.E. – Physiology of fishes Vol. I and II., 5. Curtis, B. – The Life of Fishes. 6. Hoar, W.H. and Randall, D,S. – Fish Physiology Vol. I-XV., 7. Kyle H. – The Biology of Fishes, 8. Lagler; K.F, Bardach, J.E and Miller, R.F, - Ichthyology, 9. McKeown, B.A. – Fish Migration.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattacharya)
Subject Expert

(Dr. Rashmi Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Manshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. IV Sem.
Subject : Zoology
Paper: Elective 3/2
Title of the paper - Biology of Parasites

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO43B

Part A : Introduction for Code ZO43B (M.Sc. IV Sem. XVI Paper) (Elective – 3)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	Knowledge regarding Biology of Parasites
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 Selected protozoan Parasites like- Entamoeba, Trypanosoma, Leishmania and Plasmodium with structure, life cycle, pathogenicity, treatment and control.
		-2 Concept of parasitism and other animal associations mainly of parasitic Trematodes like- Fasciolopsis, Clonorchis, Heterophyes and Schistosoma structure, life cycle, pathogenicity, treatment and control.
		-3 Structure, life cycle, pathogenecity, treatment and control Cestode Parasitesviz-Diphyllobothrium, Taenia, Hymenolepis and Echinococcus.
		-4 Basic features and characteristics of hosts
		-5 Major means of transmission of parasites stool examination and its significance

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. IV Semester Session 2021-22

Paper-16 : Biology of Parasites (Elective -3) (ZO43B)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Study of the following protozoan and helminthes parasites

UNIT-I	**Protozoan Parasites** (Structure, life cycle, pathogenecity, treatment and control) 1. *Entamoeba histolytica* 2. *Trypanosoma gambiense* 3. *Leishmania donovani* 4. *Plasmodium vivax.*
UNIT-II	**Trematode parasites** (Structure, life cycle, pathogenecity, treatment and control) 1. *Fasciolopsis buskii* 2. *Clonorchis sinensis* 3. *Heterophyes heterophyes* 4. *Schistosoma haematobium.*
UNIT-III	**Cestode Parasites** (Structure, life cycle, pathogenecity, treatment and control) 1. *Diphyllobothrium laturm* 2. *Taenia solium* and *T. saginata* 3. *Hymenolepis nana* 4. *Echinococcus granulosus*
UNIT-IV	**Nematode Parasites** (Structure, life cycle, pathogenecity, treatment and control) 1. *Ascaris* lumbricoides 2. *Enterobius vermicularis* 3. *Ancylosteoma duodenale* 4. *Trichinella spiralis*
UNIT-V	1. Stool examination and its significance with reference to helminthic infection. 2. Blood examination and its significance with reference to microfilaria and malaria parasite. 3. Immunodiagnostic test for Schistosoma, Trichinella and Filarial warms. 4. Larval forms of helminthes.

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. K.K. Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. Faust Beaver and Jung : Animal Agents and Vectors, 2 Belding : Clinical Parasitology. Chandler and Read : Introduction of Parasitology., 4. K.D. Chatterigee: Parasitology in Relation to Clinical Medicine. 5. E.L.L. Soulsby : Helminthes, Arthropods and Protozoa of Domesticated Animals.

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchita Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. [illegible])
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. IV Semester Session 2021-22

Practical-7 : (Based on 14 & 15 Paper) (PRZO41)

Exercise **M: M 75**

1. Exercise on Animal behavior
a. Taxes
b. Reflexes
c. Biological clocks
d. Social behavior
e. Learning behavior
f. Reproductive behavior

2. Developmental Biology
a. Study of embryological slides
b. Study of gametes of frog and chick
- Sperm of frog and chick, ovum of frog and chick,
- T.S. of testis of frog & chick, T.S. of Ovary of chick and frog.)

c. Study of fate maps
d. Study of different stages of spermatogenesis and Oogenesis

Practical -7 : (Based on 14 & 15 Paper)

Scheme for Practical Examination

Max Marks : 75

1.	Spotting	-	10
2.	Exercise based on animal behavior	-	20
3.	Exercise based on developmental biology	-	20
4.	Study of different embryological stages of Morula, Blastula, Gastrula-		05
5.	Viva Voce	-	10
6.	Practical record & Collection	-	10
		Total	75 Marks

(Dr. Lata Bhattarcharya) Subject Expert

(Dr. Ruchira Choudhary) Subject Expert

(Dr. Kirti Tiwari) VC Member

(Dr. Prabha Khatri) Industrial Member

(Dr. Rekha Sharma) Chairman & Head

(Miss Harshita Panchal) Student representative

Department of Zoology

Class : M.Sc. IV Sem.
Subject : Zoology
Paper: Elective 4/1
Title of the paper - Pisci Culture and Economic Importance of Fishes

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO44A

Part A : Introduction for Code ZO44A (M.Sc. IV Sem. XVII Paper) (Elective – 4)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	To import knowledge about Pisci Culture and Economic Importance of Fishes
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 Different methods of fish breeding.
		-2 Management of Ponds for fish culture.
		-3 Prawn, Pearl and Composite fish Culture. Fishery resources of M.P. and India.
		-4 offshore, coastal and Deepsea fisheries of India
		-5 Role of Fisheries in Rural development.

(Dr. Lata Bhattarchaya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Priti Tiwari)
VC Member

(Dr. Pratibha Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Convener

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore

M.Sc. IV Semester Session 2021-22

Paper-17: Pisci Culture and Economic Importance of Fishes (Ichthyology) (Elective -4) (ZO44A)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit-I	1. Collection of fish seed from natural resources. 2. Streeping method of breeding. 3. Dry bundh breeding of carps. 4. Wet bundh breeding of carps. 5. Hypophysation and breeding of Indian major carps.
Unit-II	1. Drugs/hormones useful in induced breeding of fish. 2. Types of ponds required for fish culture. 3. Management of hatcheries and nurseries. 4. Management of rearing ponds and stocking ponds.
Unit-III	1. Composite fish cultures 2. Prawn culture techniques. 3. Pearl culture technique. 4. Fisheries resources of MP 5. Riverine fisheries in India and their problems.
Unit-IV	1. Costal fisheries in India, its problems and solution. 2. Offshore and deep sea fisheries of India, its problems and solution. 3. Role of fisheries in rural development 4. Sewage fed fisheries
Unit-V	1. Methods of fish preservation 2. Marketing of fishes in India. 3. Economic importance and by product of fishes 4. Shark liver oil, its characteristics, manufacture and importance. 5. Transport of live fish & fish seed.

Part C : Learning Resources

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Chowdhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Text Book, Reference Books, Other resources - C.B.L. Shrivastava : Fishes of India, Jhingaran : Fish and fisheries of India, S.S. Khanna : An Introduction to fishes, R.S. Rath : Fresh water Aquaculture, Gopalji Shrivastava : Fishes of U.P. & Bihar, Fish and Fisheries – Shukla & Pandey

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Leta Bhattarcharya)
Subject Expert

(Dr. Ruchita Choudhary)
Subject Expert

(Dr. K. N. Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. IV Sem.
Subject : Zoology
Paper: Elective 4/2
Title of the paper - Cell Biology

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : ZO44B

Part A : Introduction for Code ZO44B (M.Sc. IV Sem. XVII Paper) (Elective – 4)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	Knowledge regarding Cell Biology
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 This unit introduces the students to the basic and advanced feature of eukaryotic chromosomes and its components details of mitotic chromosomes, various types of giant chromosome their structural organization and functional significance, DNA methylation and significance of heterochromatin. This gives them a strong foundation on the basic unit of life. At the end of the course, the student has a strong foundation on the functions of the cell.
		-2 This unit deals with structural organization of various kinds of eukaryotic genes, and their evolution organization evolution and significance of gene families: organization, evolution and significance, jumping genes mutation mechanism and repair mechanism along with the concrete understanding about eukaryotic transcriptional machinery.
		-3 This unit imparts the knowledge of DNA transcription apparatus, zinc finger steroid receptors, domains, Helix-loop helix and Leucine Zipper, transcription and its control, stress response and genetic basis of few disease.
		-4 The main objective of this unit is to understand DNA rearrangement, mechanism of programmed cell, ageing and senescence and early development of *C. elegans*.
		-5 This unit develops a clear understanding on the various stages of development in *Drosophila* and significance of genes.

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchika Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. [illegible])
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore

M.Sc. IV Semester Session 2021-22

Paper 17 : Cell Biology (Elective-4) (ZO44B)

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit-I	1. Molecular organization of eukaryotic chromosomes: structure of nucleosome particles and higher order compaction of mitotic chromosomes, chromatin remodeling. 2. Structural organization and functional significance of polytene chromosomes and lampbrush chromosome. 3. DNA methylation. 4. Organization and significance of heterochromatin.
Unit-II	1. Structural organization of Eukaryotic genes, interrupted genes and overlapping genes and their evolution. 2. Gene families: organization, evolution and significance. 3. Transposable genetic elements of prokaryotes and eukaryotes, gene mutation and molecular mechanism of occurrence of mutation repair mechanism. 4. Organization of eukaryotic transcriptional machinery promoter enhancers transcription factors polymerase activators and repressors.
Unit-III	1. DNA binding domains of transcription apparatus, zinc finger steroid receptors, hemeo domains, Helix-loop helix and Leucine Zipper. 2. Eukaryotic transcription and its control. 3. Environmental modulation of gene activity (stress response) stress genes and stress proteins. 4. Molecular basis of Thalassemia, Muscular Dystrophy, Cystic Fibrosis.
Unit-IV	1. DNA rearrangement. 2. Apoptosis programmed cell death (PCD) – Mechanism & genes involved in eukaryotes. 3. Early development of *C. elegans* up to cleavage & axis formation. 4. Ageing & senescence.
Unit-V	1. *Drosophila* development a. Cleavage b. Gastrulation Origin of Anterior –Posterior (Maternal effect genes and segmentation gene. 2. Drosophila development II origin of dorsal ventral polarity. 3. Basic idea of homeotic selector genes and homeotic mutation. 4. Basic idea of organization of homeoboxes and Evolutionary significance of homeoboxes.

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kiti Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources
Text Book, Reference Books, Other resources - 1. Essential Cell Biology – Bruce Alberts, 2. Molecular Biology of the Cell – Bruce Alberts, 3. Camp bell Biology - Reece

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology

Class : M.Sc. IV Sem.
Subject : Zoology
Paper:
Title of the paper - Applied Zoology

Marks: 75 + (CCE) 25 = 100
Credit : 4

Code of the paper : 45B

Part A : Introduction for Code ZO44C (M.Sc. IV Sem. XVIII Paper)		
1	Pre- requisite (if any)	B.Sc. in Biology including Zoology
2	Course Objectives	Applied Zoology
	Course Learning outcomes	On completion of the course, the student is expected to be able to Knowledge and Understanding of – 1 Vectors and Communicable disease
		-2 Beneficial Insects
		-3 Aquaculture
		-4 Common Pests
		-5 Animal Farming And Culture

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. K.M. Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part B : Content of the Course

Department of Zoology

Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore

M.Sc. IV Semester Session 2021-22

Paper 18 : Applied Zoology

Max. Marks: 25 (CCE)+ 75(Th.)= 100
Min. Marks : 10 (CCE) + 30 (Th.) = 40
Credits – 4

Unit - I VECTORS AND COMMUNICABLE DISEASE

1. Life cycle and control of Malaria
2. Life cycle and control of Filariasis
3. Infection and control of *Tuberculosis*
4. Infection and control of Viral hepatitis

Unit –II BENIFICIAL INSECTS

1. Life cycle of silk moth and production of Silk.
2. Disease of the silkworm and control.
3. Lac insect and lac culture
4. Apiculture

Unit -III AQUACULTURE

1. Fresh water fish culture
2. Prawn culture
3. Pearl culture
4. Frog culture

Unit –IV COMMON PESTS

1. The *rice weevil* (*Sitophilus oryzae*)
2. The *red flour beetle* (*Tribolium castaneum*)
3. The Cabbage butterfly (*Pieris brasicae)*
4. The melon fly (*Bactrocera cucurbitae)*

Unit - V ANIMAL FARMING AND CULTURE

1. Poultry forming
2. Ornamental fish culture
3. Exotic bird breeding and management
4. Goat forming

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Prabha Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Part C : Learning Resources

Part D – Assessment and Evaluation		
Suggested Continuous Evaluation Methods : By Presentation, PPT, By Test, By written Exam Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE): 25 External Exam (EE) : 75		
Internal Assessment: Continuous Comprehensive Evaluation (CCE) : 25	Class Test Assignment/Presentation	25
External Assessment: External Exam : 75 Time : 3 hours	75	75
		100

(Dr. Leta Bhattacharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. [illegible])
VC Member

(Dr. [illegible])
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. IV Semester Session 2021-22

Practical-8 : (Based on 16 & 17 Paper) (PRZO42)

1. Study of common protozoan parasites with special reference to structure, life cycle and pathogenecity of human parasites.
2. Study of some common helminthes parasites including trematodes, cestodes and nematodes of man.
3. Collection, preservation, staining and mounting of protozoan and helminthes parasites.
4. Stool- examination for finding of the helminthic eggs by centrifugal floating technique.
5. Study of Diversity of Nematodes in fish.
6. Preparation of mitotic chromosome from bone marrow
7. Karyotype preparation any animal
8. Calculation of *mitotic index* (in bone marrow or in root tip cells)
9. Demonstration of mitochondria, Golgi body ,RNA,DNA in tissue section ,any tissue
10. Sex chromatin demonstration
11. Study of Electron micrographs of pro and eukaryotic cells
12. Karyotype preparation of human syndromes from books
13. G&C banding in mitotic chromosomes
14. Gel Electrophoresis (PAGE) for protein
15. Polytene chromosome preparation
16. Meiosis –slide preparation in testis or in Anther
17. Study of mutants of Drosophila w.m.
18. Histochemical localization of age pigment
19. Drosophila culture, identification of Male and female fly.

Scheme of Practical Examination Based on Paper 16 & 17 **MM: 75**

1.	Lactophenol mounting of eggs of helminth parasites/ Staining and mounting of helminthes.	-	10 Marks
2.	Stool examinations for finding of helminthic eggs	-	10 Marks
3.	Demonstration Meiosis (anther/testis)	-	10 Marks
4.	Spotting on - Drosophila mutants (w.m) Karyotype of human syndromes Permanent slides of cytology-Mitosis, Meiosis & Cell organeth Electron micrographs Chromosomal aberrations (Total 08 spots, 1.5 mark each)	-	20 Marks
5.	Differences between normal cell & cancerous cell / specialized chromosomes yeast - Virus – SV40 & HIV	-	10 Marks
6	Viva voce	-	05 Marks
7.	Practical Record	-	10 Marks
	Total		**75 Marks**

(Dr. Lata Bhattacharya) Subject Expert
(Dr. Ruchira Choudhary) Subject Expert
(Dr. Kirti Tiwari) VC Member
(Dr. Pratima Khatri) Industrial Member
(Dr. Rekha Sharma) Chairman & Head
(Miss Harshita Panchal) Student representative

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. IV Semester Session 2021-22

Practical-8 : (Based on 16 & 17 Paper) (PRZO42)

Exercise **Time: 5 hour M: M 75**

1. Diagrammatic demonstration/Video clipping/Software to explain Major Dissection of various systems of Labeo, Wallago, Torpedo, Mystus.	-	10 Marks
2. Diagrammatic demonstration/Video clipping/Software to explain minor dissection of Internal ear, accessory respiratory organ, pituitary glands, Webrian ossicles.	-	05 Marks
3. Mounting preparation of permanent slides.	-	05 Marks
4. Age determination of fish with the help of scales	-	05 Marks
5. Identification of fish	-	12 Marks
6. Spotting of museum specimen slides and bones.	-	18 Marks
7. Viva Voice.	-	10 Marks
8. Practical record, collection.	-	10 Marks

Marks 75

(Dr. Lata Bhattarchaya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject expert

(Dr. [illegible] Tiwari)
VC Member

(Dr. Pratima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

Department of Zoology
Govt. Holkar (Model, Autonomous) Science College, A.B. Road, Indore
M.Sc. IV Semester Session 2021-22

Practical-8 : (Based on 16 & 17 Paper) (PRZO42)

Exercise **Time: 5 hour M: M 75**

1. Diagrammatic demonstration/Video clipping/Software to explain Major Dissection of various systems of Labeo, Wallago, Torpedo, Mystus.
2. Diagrammatic demonstration/Video clipping/Software to explain minor dissection of Internal ear, accessory respiratory organ, pituitary glands, Webrian ossicles.
3. Study of museum specimen slides and bones related to theory papers.
4. To prepare permanent slides of available material related to fish.
5. Age determination of fish with the help of scales
6. Collection and Identification of Local fishes.

Scheme of Practical Examination based on paper 16 & 17

Time 5 hours mm. 75

1. Major dissection	-	**10 marks**
2. Minor dissection	-	**05 marks**
3. Mounting of permanent slides	-	**05**
4. Age determination	-	**05**
5. Identification of fish	-	**12**
6. Spotting (Specimen + Slides + bones)	-	**18**
7. Viva Voice	-	**10**
8. Practical record, collection	-	**10**
		75 marks

(Dr. Lata Bhattarcharya)
Subject Expert

(Dr. Ruchira Choudhary)
Subject Expert

(Dr. Kirti Tiwari)
VC Member

(Dr. Fatima Khatri)
Industrial Member

(Dr. Rekha Sharma)
Chairman & Head

(Miss Harshita Panchal)
Student representative

SURESH T SILAWAT

Digitally signed by SURESH T SILAWAT
Date: 2023.07.28 13:52:48 +05'30'