

M.Sc. Pharmaceutical Chemistry: Semester – I
[Choice Based Credit System]

[Credit 4]

MPC-101 PRINCIPLES OF INORGANIC PHARMACEUTICAL CHEMISTRY - I

UNIT –I: Bonding in Inorganic Compounds

Weak Chemical Forces-Hydrogen Bonding, Dipole-Dipole Interaction, VSEPR Theory, Molecular Orbital Theory (MOT)-Boron, Nitrogen, Carbon monoxide. Theories of Bonding in Metals (Free Electron, Valence Bond and Molecular Orbital Theories) for Conductors, Insulators and Semiconductors (Extrinsic and Intrinsic).

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, Molecular Orbital Theory for Octahedral & Tetrahedral complexes, π -Bonding of octahedral complexes.

UNIT –III: Reaction Mechanism of Transition Metal Complexes

- a) Reactivity of Metal Complexes, Inert and Labile Complexes
- b) Acid Hydrolysis, Factor Affecting Acid Hydrolysis, Base Hydrolysis
- c) Substitution Reactions in Square Planar Complexes- Trans Effect, factors affecting the rate of substitution reactions in square planar complexes.
- d) Electron Transfer Reactions-Mechanism of One Electron Transfer Reaction, Outer Sphere Type mechanisms, Inner Sphere mechanisms. Cross Reactions and Marcus-Hush Theory.

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 Product : Dentifrices, Anti-Caries Agents.

UNIT –V: Bioinorganic Chemistry

Metal Porphirin : 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.

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. Earnshaw, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty, Pergamon.
6. Pharmaceutical Chemistry Inorganic II Chatwal, G.R., Himalaya Publishing House

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MPC-102 PRINCIPLES OF ORGANIC PHARMACEUTICAL CHEMISTRY- I

UNIT –I: Stereochemistry and Conformational Analysis

Concept of Chirality, Recognition of Symmetry Elements and Chiral Structure, R-S Nomenclature, Diastereoisomerism in Acyclic and Cyclic Systems, Optical Activity without Asymmetric Carbon Atom (Allenenes, Spirans and Biphenyls)

Geometrical Isomerisation of Olefins and Oximes, E-Z Nomenclature, Backmann Transformation, 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 and Asymmetric Synthesis.

UNIT –II:

a) **Mechanism of Organic Reactions:** Types of Mechanisms, Method of Determining Reaction Mechanisms. Aliphatic Nucleophilic Substitutions SN1, SN2, SN1' and SN2'. Neighboring Group Mechanism, Types of Reactions, Thermodynamic and Kinetic Requirements, Potential Energy Diagram, Hydrolysis of Ester, E1 and E2 Mechanism, Hoffmann and Saytzeff Elimination.

b) **Reaction Intermediates:** Structure, Formation and Examples of Participation in Chemical Reaction of the following Carbonium Ion, Carbanion, Nitrenes, Carbenes, Arynes, Free Radicals.

UNIT –III: Aromaticity Concept

Huckle's Rule and Its Limitations, Benzenoid and Non Benzenoid Compounds, Cyclopentadienyl anion, tropylium cation, Azulenes, Annulenes, Heteroannulenes, Fullerenes, Non aromaticity and anti aromaticity.

UNIT –IV: Synthetic applications, Mechanisms and Stereochemistry (Where ever applicable) of the following Organic Reactions and Molecular rearrangements: Pinacol, Pinacolone Rearrangements, Benzilic Acid Rearrangements, Backmann Rearrangements Hoffmann-Curtius, Lossen and Schmidt Rearrangements, Claisen Rearrangement.

UNIT –V: Synthetic Applications, Mechanisms and Stereochemistry (Where ever applicable) of the Following Name Reactions : Birch Reduction, Mannich Reaction, Meerwein Ponderf Verley Reduction and Oppeneur Oxidation, Ozonolysis and Hydrogenation, Diel's Alder Reactions, Wittig Reaction, Reformatski Reaction.

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. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
9. Some Modern Methods of Organic Synthesis, W.Carruthers,Cambridge University Press
10. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
11. Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International.
12. Stereochemistry Chemistry of Carbon Compounds, E.L Eliel, McGraw Hill

M.Sc. Pharmaceutical Chemistry: Semester – I
[Choice Based Credit System]

[Credit 4]

MPC-103 PRINCIPLES OF PHYSICAL PHARMACY – I

UNIT –I: Thermodynamics

Thermodynamic systems- Intensive and Extensive properties, various thermodynamic variables & their definitions. First Law of Thermodynamics: Thermo Chemistry, Second Law of Thermodynamics. Third Law of Thermodynamics. Free energy functions and applications. Thermodynamics of phase equilibria, Thermal analysis (DSC) of Crystals and liquid crystals. Supra molecules. Inclusion compounds. 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, Enzyme Catalysis, Decomposition and Stabilization of Medicinal Agents, Photodegradation, 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 Biologic 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.

Colloids:

Introduction, Types of Colloidal Systems, Optical Properties of Colloids, Kinetic Properties of Colloids, Electric Properties of Colloids, Solubilization, Addendum, Thermodynamics of Micellization.

UNIT –V: Micromeritics:

Particle- characteristics, Particle Size and Size Distribution, Methods for Determining Particle Size, Particle Shape. and Methods for Determining Surface Area, Pore Size. Density of powders, Derived Properties of Powders.

Books Suggested

1. Physical Chemistry, P.W. Atkins, ELBS Publication.
2. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
3. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan
4. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum Publ.
5. Essentials of Physical Pharmacy, Sunjiv Aggarwal, Anmol Publication
6. Chemical Kinetics, .V.B. Patania, Campus Books International
7. Physical Pharmacy , David Attwood, Alexender T. Florence, Pharmaceutical Press

M.Sc. Pharmaceutical Chemistry: Semester – I
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[Credit 4]

MPC-104 PHARMACEUTICAL ANALYSIS - I

UNIT –I: Infrared Spectroscopy

Review of Linear Harmonic Oscillator, Vibrational Energies of Diatomic Molecules, Zero Point Energy, Force Constant and Bond Strength, Anharmonicity, Morse Potential Energy Diagram, Vibration-Rotation Spectroscopy, P.Q.R Branches, Breakdown of Born Oppenheimer Approximation, 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 :- Aspirin and Quinoline.

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, Classification (AXB, AMX, ABC, A2B2), 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: Atomic Absorption Spectroscopy

Introduction, Theory, Instrumental Aspects of Atomic Absorption Spectroscopy, Applications of AAS in Pharmaceutical Analysis.

Books suggested

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
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 Puplication
5. Fundamentals of Molecular Spectroscopy, C. N. Banwell, Mc Graw Hill Puplication
6. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill Puplication
7. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill Puplication
8. Molecular Structure and Spectroscopy, G. Aruldas, Phi Learning, Pvt. Ltd.
9. Spectroscopy, V. B. partania, S. Campus Books international Publication.
10. Instrumental Methods of Chemical Analysis, G.W. Ewing, McGraw Hill Book Company

M.Sc. Pharmaceutical Chemistry
SEMESTER-I
[Choice Based Credit System]

[Credit 3]

LAB COURSE –I

Duration of Exam: 6 Hours

Maximum Marks: 75	Minimum Marks:30
(i) Preparation	20 Marks
(ii) Extraction	20 Marks
(iii) Chromatography	18 Marks
(iv) Practical Record	07 Marks
(v) Viva	10 Marks

(I) Preparation

(A) Organic Preparations 12 Marks

- (a) To prepare Anthraquinone from Anthracene.
- (b) To prepare p-Amino Phenol from Phenyl Hydroxylamine.
- (c) To prepare 2,4-Di nitrophenyl hydrazine from 2,4-Di nitrochlorobenzene
- (d) To prepare Phenyl Urea from Aniline
- (e) To prepare Picric Acid From Phenol
- (f) To prepare P-Bromo Acetanilide
- (g) To prepare Dibenzalacetone from Benzaldehyde (Condensation reaction) i.e. Claisen-Schmidt Reaction.
- (h) To prepare phenyl benzoate from phenol
- (i) To prepare phenyl Azobeta Naphthol from aniline
- (j) To prepare Methyl Orange from Sulphanilic acid

(B) Pharmaceutical Preparations 08 Marks

- (a) To prepare Aluminium Acetate Ear Drop
- (b) To prepare Ammoniated Camphor Ointment. .
- (c) To prepare Electrolyte Maintenance IV Fluid (for Paediatric Use)
- (d) To prepare Salicylic Acid Compound dusting Powder
- (e) To prepare Compound Sodium Chloride and Dextrose oral Powder
- (f) To prepare Strong Iodine Solution
- (g) To prepare Zinc Sulphate Eye/Ear Drop
- (h) To Prepare Effervescent Granules
- (i) To prepare Simple Elixir.
- (j) To prepare KMnO₄ Gargle.

(II) Extraction 20 Marks

- (a) To isolate caffeine from Tea Leaves.
- (b) To Isolate Casein and Lactose from Milk
- (c) To Isolate Glucose from cane sugar.
- (d) To Isolate Cystine from Tea Leaves.

(III) Chromatography 18 Marks

- (a) Separation of ortho and para nitroaniline by TLC.
- (b) Separation of Dyes by TLC.

(IV) Practical Record 07 Marks

(V) Viva 10 Marks

M.Sc. Pharmaceutical Chemistry
SEMESTER-I
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[Credit 3]

LAB COURSE –II

Duration of Exam: 6 Hours

Maximum Marks: 75

- (i) Qualitative Analysis
- (ii) Identification of Drugs
- (iii) Volumetric Assay
- (iv) Practical Record
- (v) Viva

Minimum Marks:30

- 20 Marks**
- 20 Marks**
- 18 Marks**
- 07 Marks**
- 10 Marks**

(I) Qualitative Analysis 20 Marks

Limit tests for Chloride, Sulphate, Lead, Arsenic and Heavy Metals.

(II) (a)Identification of Drugs 10 Marks

Paracetamol, Ibuprofen, Metranidazole, Pyrazinamide, 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.Ferrous oxalate

(III) Volumetric Estimation 18 Marks

- (a) Sodium bicarbonate
- (b) Citric Acid
- (c) Benzoic Acid
- (d) Borax
- (e) Zinc Sulphate
- (f) Sodium nitrite

(iv) Practical Record 07 Marks

(v) Viva 10 Marks

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