

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

[Credit 4]

MPC – 301 MEDICINAL CHEMISTRY

The synthesis and therapeutic application of compounds under each class of drugs mentioned below. Structure, mechanism of action, SAR, side effects and doses where known shall be discussed.

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, Tolemetin Sodium, Ibuprofen, Naproxen, Aspirin, Paracetamol, Phenyl butazone.

UNIT – II:

- a) **Local Anesthetics:** Classification, structure activity relationship of Local Anesthetics, Mechanism & Site of action of local anesthetics, Synthesis, MOA, Uses and Adverse effects of Benzocaine, Procaine, Lignocaine, Dibucaine, Dipiperidon.
- b) **General Anesthetics:** Definition, classification, theories of General anesthetics, Synthesis, Uses, Adverse effects of Cyclopropane, Halothane, Nitrous oxide, Chloroform, Thiopental sodium, Tribromoethanol.

UNIT – III:

- a) **Antihypertensive drugs :** Hypertension- Types and Causes, Classification of Antihypertensives. Synthesis, therapeutic uses adverse effects of Metraminol, Naphazoline, Hexamethonium bromide, Methyl Dopa, Rauwolfia.
- 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 Mersaly, Ethacrynic acid, Furosemide, Spiromolactone, Chlorthiazide, Acetazolamide.

UNIT – IV:

- a) **Anti-Histaminics:** Introduction and Classification of Anti-Histamines, SAR of Amino Alkylethers and ethylenediamines, Mode of action of H₁ and H₂ Receptor Antagonists. Synthesis, therapeutic uses and adverse effect of Diphenhydramine Hydrochloride, Tripeleminamine HCl, Promethazine HCl, Chlorcucizine 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, Trimethoprim.
- c) **Anti Tubercular Agents:** Introduction, Synthesis, uses and adverse effects of Ethambutol, isonicotinic acid, rifampacin, streptomycin.

UNIT – V:

- a) **Antimetabolites :** Synthesis, Uses and Side Effects of Sulfanilamide, Sulfapyridine, sulfadiazine, SAR of Sulphanilamide.
- b) **Antineoplastic Agents :** Introduction, Role of Alkylating Agents, Synthesis. Uses, Properties & Side Effect of Mustard Drugs, Mechloroethamine, Cyclophosphamide, Melphalon Uracil.

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 publication.
4. Medicinal and Pharmaceutical Chemistry, Harikishan Singh, V. K. Kapoor, Vallabh Prakashan, Delhi.

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MPC-302 CHEMISTRY OF NATURAL PRODUCTS

UNIT – I: Terpenoids and Carotenoids

Classifications, nomenclature, occurrence, general methods of structure determination, isoprene rule. Structure determination, stereochemistry and synthesis of the following representative molecules : Citral, Geraniol α -Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β -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 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, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone.

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.

UNIT –V:

- a) **Prostaglandin** : Occurrence, classification, biogenesis and physiological effects. Synthesis of PGE₂ and PGF_{2a}.
- b) **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. Chemistry of Natural Products, V. K. Alhluwalia, Ane 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

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MPC-303 (a) TOXICOLOGY

UNIT-I

Definition and Types of Toxicology, Basic Principles of Toxicology, factors influencing toxic effects . Carcinogenicity, Mutagenicity, 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, Pd, 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.

Books Suggested

1. Pharmacology and Toxicology, Siddiquie, Anees Ahmad ; Krishna,N. Rama;Jain,S.K.Supernova Publishers 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.

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MPC – 303 (b) PHARMACEUTICAL BIOTECHNOLOGY

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 live vaccines and Genetically improved subunit vaccines as per Pharmaceutical considerations.

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.

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.

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MPC – 304-(a) PHARMACOGNOSY

UNIT-I

Cultivation, Factors Affecting Cultivation, Collection, Harvesting, Drying.
Plant Growth Hormones-Auxins, Gibberellins, Cytokinins, Abscisic acid, ethylene
Pest and Pest Control Methods- Mechanical method, Agricultural method, Biological and Chemical control method.

UNIT -II:

Natural Sources of Drugs: Higher Plants, Microbes, Animals, Marine Organisms.
Classifications of Drugs from Natural Origin: Morphological, Taxonomical, Pharmacological (Therapeutic), Chemical Classification.

UNIT -III:

Phyto-constituents of Therapeutic Significance: General Methods of Extraction, Isolation, Identification and Characterization of Carbohydrates, Glycosides, Phenolic Compounds, Steroids and Alkaloids.

UNIT -IV:

Isolation of the Following Phyto-Constituents (Including Industrial Methods): Morphine, Quinine, Glycosides, Methanol, Thymol, Digitalis and Diosgenin.

UNIT -V:

- a) Herbs as Health Foods and as Cosmetics.
- b) An Introduction to Tissue Culture and Its Scope in Production of Phyto-Pharmaceuticals.
- c) Plant fibers- Source, Uses & Preparation of Cotton, Jute & Flax.

Books Suggested

1. Pharmacognosy , C. K. Kokate, A.P. Purohit and S.B.Gokhale , Nirali Publication.
2. Text Book of Pharmacognosy, S.S.Handa & V. K. Kapoor, Nirali Publication.
3. Text Book of Pharmacognosy , Shah & Quadry, CBS Publishers and Distributors.
4. Pharmacognosy & Phyto Chemistry Part 1 Rangari, V.D., Career Publication.
5. Pharmacognosy & Phyto Chemistry Part 2 Rangari, V.D. Career Publication.
6. Pharmacognosy , V. N. Raje, CBS Publishers and Distributors.
7. Text Book of Pharmacognosy , G. K. singh and Anil Bhandari, CBS Publishers and Distributors.

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MPC-304 (b) Homoeopathic Pharmacy - I

Unit-I

History of Pharmacy with emphasis on emergence of Homoeopathic Pharmacy.
Official Homoeopathic Pharmacopoeia (Germany, Britain, U.S.A., India).
Important terminologies like scientific names, common names, synonyms.
Definitions in Homoeopathic Pharmacy.

Unit-II

Raw Material – Drugs And Vehicles –
Sources of Drugs (Taxonomic classification, with reference to utility).
Classification of Homoeopathic Medicines according to their Botanical and Zoological natural orders

Unit-III

Homoeopathic Pharmaceutics -
Mother Tincture and its preparation – old and new methods.
Various scales used in Homoeopathic Pharmacy.
Drug Dynamisation / potentisation
Posology (focus on basic principles; related aphorisms).
Prescription (including abbreviations).
Concept of placebo.

Unit-IV

Pharmacodynamics -
Homoeopathic Pharmacodynamics.
Drug Proving (aphorisms 105 – 145 of Organon of Medicine) and merits and de-merits of Human and Animals Drug proving.
Pharmacological study of drugs.

Unit-V

Legislations Pertaining to Homoeopathic Pharmacy (as amended from time to time) -
Drugs and Cosmetics Act, 1940; and Drugs and Cosmetic Rules 1945 in relation to Homoeopathy.
Poisons Act, 1919.
Dangerous Drugs Act, 1930.

Book Recommended

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| 1. | Homoeopathic Pharmacy | Dr. M.K. Sahani |
| 2. | Tutorial Pharmacy | Cooper & Gums |
| 3. | Encyclopedia Of Homoeopathic Pharmacoepia Vol. I | Dr. P.N. Verma & Dr. Indu Vaid |
| 4. | Encyclopedia Of Homoeopathic Pharmacoepia Vol. II | Dr. P.N. Verma & Dr. Indu Vaid |
| 5. | Encyclopedia Of Homoeopathic Pharmacoepia Vol. III | Dr. P.N. Verma & Dr. Indu Vaid |
| 6. | Text-book of Homoeopathic Pharmacy | Mandal & Mandal |
| 7. | Homoeopathic Pharmacoepia | M.Bhattacharya |
| 8. | A Encyclopedia of Homoeopathic Pharmacoepia | P.N Verma & Indu Vaid |
| 9. | Text-book of Homoeopathic Pharmacy | D.D. Banerjee |
| 10. | A Treatise of Homoeopathic Pharmacy | Prof. L.M. Khan |

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MPC – 305: HEALTH CHEMISTRY

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, hemoglobin- 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

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

[Credit 3]

LAB COURSE –I

Maximum Marks : 75

Duration of Exam 6 Hours

Min. Marks:30

(i) Titrimetric Method	20 Marks
(ii) Spectrophotometric (UV Visible) Determination	20 Marks
(iii) Chromatography and Ion Exchange Methods	18 Marks
(iv) Practical Record	07 Marks
(v) Viva	10 Marks

(I) (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 Ascorbic Acid Tablets by Iodometric Methods
- (c) Estimation of available Chlorine in Bleaching Powder by Iodometric Methods
- (d) Estimation of available Oxygen in Hydrogen Peroxide by KMnO_4 Method.
- (e) Determination of Heat of Neutralization of Strong acid and Strong base.

(ii) Homeopathic Experiments

- (a) Determination of specific gravity of distilled water and ethyl alcohol.
- (b) Preparation of dispensing alcohol and dilute alcohol from strong alcohol.
- (c) Trituration of one drug upto 6X and upto 3C potency.

(II) Spectrophotometric (UV Visible) Determination

20 Marks

- (a) Determination of the wavelength of the Maximum Absorbance and molar extinction coefficient of a 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) Carbohydrates (iv) Cholesterol (v) Ascorbic Acid (vi) Aspirin (vii) Caffeine

(III) (A) Chromatography

09 Marks

- (i) Separation and Identification of Sugar Present in the given Mixture of Glucose, Fructose and Sucrose by Paper Chromatography and determination of R_f Values.
- (ii) TLC – Separation of Nickel, Manganese, Cobalt and Zinc. Determination of R_f Values.
- (iii) Separation of Zn and Mg. (iv) Separation of Cd and Zn.
- (i) Separation of Anthracene and Picric Acid from Anthracene Picrate by Column Chromatography.

(B) Ion Exchange Method

09 Marks

- (i) Separate and Estimate Mg (II) and Zn (III) by Ion Exchange Method.
- (ii) Column Chromatography of Plant pigments.

(iv) Practical Record

07 Marks

(v) Viva

10 Marks

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LAB COURSE –II

Duration of Exam 6 Hours

Maximum Marks : 75

Min.Marks:30

(ii) Optical Method of Analysis	20 Marks
(iii) Flame Photometric Determination	20 Marks
(iv) Extraction	18 Marks
(iv) Practical Record	07 Marks
(v) Viva	10 Marks

(I) Optical Method of Analysis **20 Marks**

- (a) Determination of Molar Refractivity of Methyl Acetate, Ethyl Acetate, N-Hexane and Carbon Tetra Chloride and Calculate the Refraction Equivalent of Carbon Hydrogen and Chlorine.
- (b) Study the Influence of Solvent on Optical Rotation of Camphor.
- (c) Polarometric determination of the percent of two optical active substance in the given solution.
- (d) Determination of Optical Rotation of Pharmaceutical Substances.

(II) Flame Photometric Determination **20 Marks**

Determination of Sodium and Potassium in a mixture by the uses of Flame Photometer.

(III) Extraction **18 Marks**

(a) Extraction

- (i) Quinine from Cinchona
- (ii) Papain from Papaya
- (iii) Menthol Oil from Peppermint Leaves (dry)
- (iv) Eucalyptus Oil from Eucalyptus Leaves/Bark
- (v) Starch from potato.
- (vi) Casein and Lactose from milk.

(b) Homeopathic Experiments

- (i) Estimation of size of globules.
- (ii) Medication of globules and preparation of doses with sugar of milk and distilled water.
- (iii) Purity test of sugar of milk, distilled water and ethyl alcohol.

(IV) Practical Record **07 Marks**

(V) Viva **10 Marks**

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. Practical Pharmacognosy Zafar & Gandhi, CBS Publishers and Dishtributors.
5. Vogel's Text Book of Quantitative Chemical Analysis , J. Mendham, D.J. Barnes and R.C. Denney, Pearson Publication.