स्नातकोत्तर पाठ्यक्रम की परीक्षा योजना

प्रथम सेमेस्टर सत्र 2019– 20से

विषय – फार्मास्युटिकल केमेस्ट्री प्रथम सेमेस्टर

~~विषय – फार्मास्युटिकल केमेस्ट्री प्रथम सेमेस्टर~~

| प्रश्नपत्र | प्रश्नपत्र का शीर्षक | अधिकतम अंक | | न्यूनतम. उत्तीर्णांक | |
|---|---|---|---|---|---|
| | | सैध्दांतिक | सी.सी.ई | सैध्दान्तिक | सी.सी.ई |
| प्रथम | Principles of Inorganic Pharmaceutical Chemistry -I | 85 | 15 | 28 | 05 |
| द्वितीय | Principles of Organic Pharmaceutical Chemistry-I | 85 | 15 | 28 | 05 |
| तृतीय | Principles of Physical Pharmacy-I | 85 | 15 | 28 | 05 |
| चतुर्थ | Pharmaceutical Analysis-I | 85 | 15 | 28 | 05 |
| पंचम | (A) Mathematics for Pharmaceutical Chemistry<br>(B) Biology for Pharmaceutical Chemistry | 85 | 15 | 28 | 05 |
| | Practical :- 1- Laboratory Course -I | 50 | – | | |
| | 2- Laboratory Course -II | 50 | | | |

13.3.2019

## M.Sc. Pharmaceutical Chemistry: Semester – I

### MPC-101 PRINCIPLES OF INORGANIC PHARMACEUTICAL CHEMISTRY

**Max Marks:35** **Min Passing Marks:12**

**UNIT –I: Bonding in Inorganic Compounds**
Weak Chemical Forces-Hydrogen Bonding, Hydrates and Clathrates on Dipole, Dipole-Dipole Interaction. VSEPR Theory, Molecular Orbital Theory (MOT), Theories of Bonding in Metals (Free Electron, Valence Bond and Molecular Orbital Theories) for Conductors, Insulators and Semiconductors (Extrinsic and Intrinsic).

**UNIT –II: Metal-Ligand Bonding**
Crystal Field Theory, Bent Theory and Energetics of Hybridization. Limitations of Crystal Field Theory and Molecular Orbital Theory, Octahedral, Tetrahedral and Square Planner Complexes, π-Bonding and Molecular Orbital Theory.

**UNIT –III: Reaction Mechanism of Transition Metal Complexes**
Reactivity of Metal Complexes, Inert and Labile Complexes, Acid Hydrolysis, Factor Affecting Acid Hydrolysis, Base Hydrolysis, Substitution Reactions in Square Planner Complexes, Trans Effect, Redox Reactions, Electron Transfer Reactions, Mechanism of One Electron Transfer Reaction, Outer Sphere Type Reactions, Cross Reactions and Marcus-Hush Theory, Inner Sphere Type Reactions.

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


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## M.Sc. Pharmaceutical Chemistry: Semester – I

### MPC-102 PRINCIPLES OF ORGANIC PHARMACEUTICAL CHEMISTRY

**Max Marks:35** **Min Passing Marks:12**

**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 (Allenes, 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. Steoselective Synthesis and Asymmetric Synthesis.

**UNIT –II:**

a) **Mechanism of Organic Reactions:** Types of Mechanisms, Method of Determining Reaction Mechanisms. Aliphetic Nucleophilic Substitutions SN1, SN2, SNI' 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 Redicals.

**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 Sterochemistry (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 Pondorf 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


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## M.Sc. Pharmaceutical Chemistry: Semester – I

### MPC-103 PRINCIPLES OF PHYSICAL PHARMACY

**Max Marks:35** **Min Passing Marks:12**

**UNIT –I: Thermodynamics**

The 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, 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, Accelerated Stability Analysis.

**UNIT –III: Diffusion and Dissolution:**

Steady-State Diffusion, Procedures and Apparatus, Dissolution, Drug Release, Drugs in Polymer Matrices, Release from Granular Matrices, Multilayer Diffusion, Membrane Control and Diffusion Layer Control, Diffusion Principles in Biologic Systems, Thermodynamics of Diffusion, Fick's Second Law, Diffusion and Ecology.

**UNIT –IV: Interfacial Phenomena:**

Liquid Interfaces, Adsorption at Liquid Interfaces, Adsorption at Solid Interfaces, Applications of Surface Active Agents, 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: Micromeritiecs:** Particle Size and Size Distribution, Methods for Determining Particle Size, Particle Shape and Surface Area, Methods for Determining Surface Area, Pore Size, 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

### MPC-104 PHARMACEUTICAL ANALYSIS

**Max Marks:35** **Min Passing Marks:12**

**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)**
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.

**UNIT –III: 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 –IV: 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 –V: Atomic Absorption Spectroscopy**
Introduction, Theory, Instrumentation, Aspects of Atomic Absorption Spectroscopy, Applications of AAS in Pharmaceutical Analysis.

**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 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

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## M.Sc. Pharmaceutical Chemistry: Semester – I

### MPC-105 (a) MATHEMATICS FOR PHARMACEUTICAL CHEMISTRY

**Max Marks:35** **Min Passing Marks:12**

**UNIT –I: Matrix Algebra**
Addition and Multiplication, Inverse, Adjoint and Transpose of Matrices, Special Matrices (Symmetric, Skew symmetric Hermitian, Unit Diagonal Unitary etc.) and their properties, Matrix Equations :- Homogeneous, Non Homogeneous Linear Equations and Conditions for the Solution Linear Dependence and Independence, Introduction to Vactor Spaces, Matrix Eigen Values and Eigen Vactors, Diagonlization, Determination (Examples from Huckel's Theory)

**UNIT –II: Differential Calculus**
Functions, Continuity and Differentiability, Rules for Differentiation, Applications of Differential Calculus Including Maxima and Minima Exact and Inexact Differentials.

**UNIT –III: Integral Calculus**
Basic Rules for Integration, Integration by Parts, Partial Fraction and Substitution. Reduction Formulae, Applications for Integral Calculus.
Functions of Several Variables, Partial Differentiation, Coordinate Transformation (e.g. Cartesian to Spherical Polar) Curve Sketching.

**UNIT –IV: Elementary Statistics**
Organizing and Displaying Data Variables, Univariate Data Bivariate Data, Random Variables. Summarizing Data and Variation: The Mean, The Median, The Mode, The Mean Deviation, The Variance and Standard Deviation, Coefficient of Variation.

**UNIT –V: Permutations and Combinations**
Probability: Definitions, Rules of probability Distributions (Binomial and Normal Distributions). Regression and Correlation, Introduction, Simple Linear Regression Model Correlation Coefficient.

**Book Suggested**


1. The Chemistry Mathematics Book, E.Steiner, Oxford University Press.
2. Mathematics for chemistry, Doggett and Suiclific, LogmanPublication
3. Mathematical for Physical chemistry : F. Daniels, Mc. Graw HillPublication
4. Chemical Mathematics D.M. Hirst, Longman Publication
5. Applied Mathematics for Physical Chemistry, J.R. Barante, Prentice Hall Publication
6. Basic Mathematics for Chemists, Tebbutt, Wiley Publication


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## M.Sc. Pharmaceutical Chemistry: Semester – I

## MPC-105 (b) BIOLOGY FOR PHARMACEUTICAL CHEMISTRY

**Max Marks:35** **Min Passing Marks:12**

**UNIT –I: Cell Structures and Functions**

Structure of Prokaryotic and Eukaryotic Cell, Intercellular Organelles and their functions, comparison of plant and Animal Cells. Overview of Metabolic Processes- Catabolism and Anabolism. ATP-Biological Energy Currency. Origin of Life- Unique Properties of Carbon, Chemical Evoluation and Rise of Living System. Introduction to Biomolecules, Building Blocks of Bio-macromolecules.

**UNIT –II: Carbohydrates**

Structure and Functions of Important Derivatives of Monosaccarides Like Glycosides, Deoxysugars, Myoinositol, Aminosugars. N-Acetylmuramic Acid, Disaccharides and Polysaccharides, Structural Polysaccharides – Cellulose Chitin. Storage Polysaccharide; Starch and Glycogen. Structure and Biological Functions of Glucosaminoglycans or Mucopolysaccharides. Carbohydrates of Glycoproteins and Glycolipids. Roll of Suger in Biological Recognition.

**UNIT –III: Lipids**

Fatty Acids, Essential Fatty Acids, Structure and Function of Triacylglycerols. Glycerophospholipids, Sphingolipids, Cholesterol, Bile Acids, Prostaglandins. Lipoproteins-Composition and Function, Roll in Atherosclerosis.

Properties of Lipid aggregates-Micelles, Bilayers, Liposomes and their possible Biological Functions, Biological Membranes, Fluid Mosaic model of Membrane Structure, Lipid Metabolism- β- oxidation of Fatty acids.

**UNIT –IV: Amino-Acids, Peptides and Proteins**

Chemical and Enzymatic Hydrolysis of Proteins to Peptides, Amino Acid Sequencing. Secondary Structure of Proteins, Forces Responsible for Holding of Secondary Structure. α-Helix, β-Sheets, Super Secondary Structure, Triple Helix Structure of Collagen. Tertiary Structure of Protein-Folding and Domain Structure. Quaternary Structure. Amino Acid metabolism-Degradation and Biosynthesis of Amino Acids, Sequence Determination: Chemical/Enzymatic/Mass spectral, Recemization /Detection. Chemistry of Oxytocin and Tryptophan Realising Harmone (TRH).

**UNIT –V: Nucleic Acids**

Purine and Pyrimidine bases of Nucleic Acids, Base Pairing Via-H-Bonding. Structure of Ribonucleic acids (RNA) and Deoxyribonucleic Acids (DNA), Double Helix Model of DNA and Forces Responsible for Holding it. Chemical and Enzymatic Hydrolysis of Nucleic Acids. The Chemical Basis for Heredity, an Overview of replication of DNA,-Transcription, Translation and Genetic Code. Chemical Synthesis of Mono and Trinucleoside.

**Book Suggested**


1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman and Company, New York
3. Biochemistry, J. David Rawan, Neil Patterson publishers, USA
4. Biochemistry, Voet and Voet, John Wiley Publication
5. Outlines of Biochemistry E.E. Conn and P.K. Stumpf, John Wiley and Sons.
6. Chemistry of Natural Products, V.K. Ahluwalia, Ane Books Pvt. Ltd.

# M.Sc. Pharmaceutical Chemistry

## SEMESTER-I

## LAB COURSE –I

**Maximum Marks: 50** **Duration of Exam: 8 Hours**

| | | |
|---|---|---|
| (i) | Preparation | 12 |
| (ii) | Extraction | 12 |
| (iii) | Chromatography | 12 |
| (iv) | Dairy | 6 |
| (v) | Viva | 8 |

## LAB COURSE –II

**Maximum Marks: 50** **Duration of Exam: 8 Hours**

| | | |
|---|---|---|
| (i) | Qualitative Analysis | 12 |
| (ii) | Identification of Drugs | 12 |
| (iii) | Volumetric Assay | 12 |
| (iv) | Dairy | 6 |
| (v) | Viva | 8 |

## LAB COURSE –I

**Maximum Marks : 50** **Duration of Exam: 8 Hours**

**(I) Preparation**

**(A) Organic Preparations** 8

(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.

**(B) Pharmaceutical Preparations** 4

(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

**(II) Extraction** 12

(a) To isolate caffine 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** 12

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

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## LAB COURSE –II

Maximum Marks : 50 Duration of Exam: 8 Hours

(I) **Qualitative Analysis** 12

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

(II) **Identification of Drugs** 12

Paracetamol, Ibuprofen, Metranidazole, Pyrazinamide, Aspirin, Chloroquine Phosphate, Ascorbic Acid

(III) **Volumetric Assay** 12

(a) Assay of Sodium bicarbonate
(b) Assay of Citric Acid
(c) Assay of Benzoic Acid
(d) Assay of Borax
(e) Assay of Zinc Sulphate

**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


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## फार्मास्युटिकल केमेस्ट्री द्वितीय सेमेस्टर



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|---|---|---|---|---|---|
| प्रथम | Principles of Inorganic Pharmaceutical Chemistry -II | 85 | 15 | 28 | 05 |
| द्वितीय | Principles of Organic Pharmaceutical Chemistry-II | 85 | 15 | 28 | 05 |
| तृतीय | - Principles of Physical Pharmacy-II | 85 | 15 | 28 | 05 |
| चतुर्थ | Pharmaceutical Analysis-II | 85 | 15 | 28 | 05 |
| पंचम | Computer For Pharmaceutical Chemistry | 85 | 15 | 28 | 05 |
| | Practical :- 1- Laboratory Course -I<br>2- Laboratory Course -II | 50<br>50 | – | | |

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## M.Sc. Pharmaceutical Chemistry: Semester – II

### MPC-201: PRINCIPLES OF INORGANIC PHARMACEUTICAL CHEMISTRY

**Max Marks:** ~~35~~ 85 **Min Passing Marks:** ~~12~~ 28

**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, Lead,

**UNIT –II: Synthesis, Properties and Uses of Inorganic Compounds of Pharmaceutical Importance**

a) **Topical Drugs :** Dusting Powders, Lubricants, Astringents
b) **Gastro-Intestinal Drugs:** Antacid, Digestants, Emetics, Adsorbents
c) **Respiratory Drugs:** Expectorants and Antitussives

**UNIT –III: Radiopharmaceuticals**

Basic Properties, Production, Quality Control, Stability, Clinical and Medicinal Applications of Radio Isotopes used in Pharmacy and Medicinal preparations of Diagnostic and Therapeutic Agents.

**UNIT –IV: Calcium and Iron Compounds as Pharmaceutical Agents**

Role of Calcium in Body, Deficiency Disorder of Calcium, Preparation, Properties and Uses of Calcium Acetate, Calcium Carbonate, Calcium Chloride, Calcium Gluconate, Calcium Hydroxide, Calcium Lactate. Importance of Iron in Human Body, Deficiency Disorder of Iron, Preparation, Properties and Uses of Ferric Ammonium Citrate, Ferrous Fumarate, Ferrous Gluconate, Ferrous Succinate, Ferrous Sulphate.

**UNIT: V – Pharmaceutical Aids**

a) Absorbents and Adsorbents, b) Antioxident and Preservatives, c) Excipients,
d) Suspending Agents, e) Filter Aids, f) Colourants, g) Tonicity Adjusting Agent,
h) Colouring, Flavouring and Sweetening agent, i) Ointment and Suppository Bases,
j) Diluents, Binders, Disintegrating Agents, and Lubricants.

**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 Medicical Chemistry, Quardy & Quardy
4. Text Book of Pharmaceutical Chemistry, Bentley & Driver, Oxford University Press, New Delhi.


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## M.Sc. Pharmaceutical Chemistry: Semester – II

## MPC-202: PRINCIPLES OF ORGANIC PHARMACEUTICAL CHEMISTRY

Max Marks: 85 Min Passing Marks: 12 29

**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:**

a) **Physico Chemical Properties in Relation to Biological Action :**
   (i) Factor Affecting Drug Absorption, Distribution, Metabolism and Elimination
   (ii) Study of properties Like Ionization, Partition Coefficients, Acid Base Properties, Hydrogen Bonding and Stereochemistry,

b) **Drug Metabolism :**
   Metabolic Changes of Drugs in the body, Factor Affecting Metabolism, Pathway of Metabolism.

**UNIT –III: Reagents in Organic Synthesis :**

Preparation and Uses of Complex Metal Hydride – Lithium Aluminium Hydride, Gilmen's Reagents, Lithium diisopropylamide, Osmium Tetra Oxide, Dicyclohexylcarbodiisomide, 1-3, Dithiane, Phase Transfer Catalysis, Wilkinson's Catalyst, 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 : Diazole, Pyrazole, Imidazole, Oxazole,

**UNIT –V: Addition to Carbon Hetero Multiple Bonds**

Mechanism of Metal Hydride Reduction of Saturate and Unsaturated Carbonyl Compounds, Acid Ester and Nitriles. Addition of Grignard Reagents, Organozinc and Organolithium reagents to carbonyl and unsaturated carbonyl compounds. Mechanism of Condensation Reaction Involving Enolates – Aldol, Knoevenagel, Claisen, Mannish, Benzoin, Perkin and Stobbe Reactions, Hydrolysis of Esters and amides, Ammonolysis of Esters.

**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.


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## M.Sc. Pharmaceutical Chemistry: Semester – II

## MPC-203 : PRINCIPLES OF PHYSICAL PHARMACY

Max Marks: ~~35~~ 85 Max Passing Marks: ~~12~~ 28

**UNIT –I: Rheology:**
Introduction, 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, Rheologic Properties of Emulsions Microemulsions, 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**
Historical Background, Pharmaceutical Applications of Polymers, Definitions, Molecular Weight Determination from Solution Viscocity, Conformation of Dissolved Linear Macromolecules, Polymers as Thickening Agents, Polymer Solution-Overview, Solvent Selection, Preparing Polymer Solutions.

**UNIT –V:**
Thermodynamics of Polymer Solutions, Phase Separation, Gel Formation, Coacervation and Microencapsulation, Polymers in the solid state-Overview, Mechanical Properties, Interchain Cohesive Forces, Crystallinity, Tacticity, Morphology, Orientation, Thermodynamics of Fusion and Crystallization, Glass-Rubber Transition, Plasticization, Elastomers, Fabrication Technology, Future Trends in Pharmaceutical and Other Biomedical Uses of Polymers.

**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, Sunjiv Aggarwal, Anmol Publication
6. Physical Pharmacy , David Attwood, Alexender T. Florence, Pharmaceutical Press

## M.Sc. Pharmaceutical Chemistry : Semester – II

## MPC-204 : PHARMACEUTICAL ANALYSIS

Max Marks;~~35~~ 85

Min Passing Marks;~~12~~ 28

**UNIT –I: Chromatographic Method**
Principles, Techniques and Applications of Thin Layer Chromatography, Column Chromatography, Gas-Liquid Chromatography in Pharmaceutical Analysis.

**UNIT –II:**
High Performance Liquid Chromatography (HPLC), Ion Exchange Chromatography, Size Exclusion or Gel Chromatography.

**UNIT –III: Solvent Extraction**
Principle of Liquid-Liquid Extraction and Solid-Liquid Extraction, Distribution Law, Factor Favouring Solvent Extraction, Sequences of the Extraction Process, Extraction Techniques – Batch Extraction, Stripping Extraction, Continuous Extraction and Soxhelt Extraction, Important Applications of Liquid-Liquid Extraction.

**UNIT –IV: Titrimetry and Gravimetry**
Determination of Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Arsenic, Cadmium, Lead, Mercury, Calcium and Magnesium by Titrimetric and Gravimetric Methods.

**UNIT –V: Naphelometry and Turbidimetry**
Theory of Naphelometry and Turbidimetry, Instrumentation - Single and Double Beam. Factors Affecting Measurements, Applications of Turbidimetry and Naphelometry.

**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 Holle , Ceneage Learning India Pvt Ltd.

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## M.Sc. Pharmaceutical Chemistry: Semester – II

### MPC-205 : COMPUTER FOR PHARMACEUTICAL CHEMISTRY

Max Marks: ~~35~~ 85 Min Passing Marks: ~~12~~ 28

**Unit-I: Introduction to computers and Computing**

Basic structure and functioning of computer with a PC as illustrative example. Memory I/O devices. Secondary storage Computer languages. Operating syste.ns with DOS as an example Introduction to UNIX and WINDOWS. Principles of programming Alogrithms and flow-charts.

**Unit-II: Computer Programming in FORTRAN/C/BASIC**

Elements of the computer language. Constants and variables. Operations and symbols Expressions. Arithmetic assignment statement. Input and output Format statement. Termination statements. Branching statements as IF or GO TO statement. LOGICAL variables. Double precession variables. Subscripted variables and DIMENSION. DO statement FUNCTION AND SUBROUTINE. COMMON and DATA statement.

**Unit-III: Programming in Pharmaceutical Chemistry**

Developing of small computer codes involving simple formula in pharmaceutical chemistry such as Van der Waals equation, Chemical kinetics (determination of Rate constants) Radioactive decay (Half Life and Average Life). Determination of Normality, Molarity and Molality of solutions.

**Unit-IV: Use of Computer Programmes**

Operation of PC. Data Processing, Running of standard Programs and Packages such as MS WORD, MS EXCEL -special emphasis on calculations and chart formations.MS-POWER POINT, X-Y plot. Simpson's Numerical Integration method. Programmes with data preferably from physical pharmacy laboratory.

**Unit V: Internet**

Application of Internet for Pharmaceutical Chemistry with search engines, various types of files like PDF, JPG, RTF and Bitmap. Scanning, OMR, Web camera.

**Book Suggested:**


1. Fundamentals of Computer : V. Rajaraman , Prentice Hall Publ.
2. Computers in Chemistry : K.V. Raman , Tata Mc Graw Hill Publ.
3. Computer Programming in FORTRAN IV-V Rajaraman , Prentice Hall Publ.
4. Computers in Pharmacy, Rakesh Gupta, Anmol Publ.
5. Coputer Fundamentals with pharmacy Applications, n.k. Tiwari,SB. Publication.

# M.Sc. Pharmaceutical Chemistry

## SEMESTER-II

### LAB COURSE –I

**Maximum Marks : 50** **Duration of Exam : 8 Hrs.**

| | | |
|---|---|---|
| (i) | Volumetric Assay | 12 |
| (ii) | Gravimetric Assay | 12 |
| (iii) | Chromatography | 12 |
| (iv) | Dairy | 6 |
| (v) | Viva | 8 |

### LAB COURSE –II

**Maximum Marks : 50** **Duration of Exam : 8 Hrs.**

| | | |
|---|---|---|
| (i) | Quantitative Analysis | 12 |
| (ii) | Physical Pharmacy | 12 |
| (iii) | Physical parameters of Tablets | 12 |
| (iv) | Dairy | 6 |
| (v) | Viva | 8 |

### LAB COURSE –I

**Maximum Marks : 50**

(I) Volumetric Assay 12
- (a) Assay of Ampicilline
- (b) Assay of Aspirin
- (c) Assay of Aluminium Hydroxide
- (d) Assay of Magnesium Sulphate
- (e) Assay of Lithium Carbonate.

(II) Gravimetric Assay 12
- (a) Assay of Sodium Sulphate (ppt. of $BaSO_4$)

(III) Chromatography 12
- (a) Separation of Paracetamol and Ibuprofen by TLC.
- (b) Separation of Vitamins by TLC.
- (c) Separation of α-amino acid by Paper Chromatography

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## LAB COURSE –II

**Maximum Marks : 50**

(I) **Quantitative Analysis** 12

(a) Potentiometric Analysis of Sulphanilamide by titration with $NaNO_2$
(b) Conductmetric 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.

(II) **Physical Pharmacy** 12

(a) Determination of Heat of Ionization of Acetic Acid.
(b) Investigate the auto Catalytic reaction between $KMnO_4$ and Oxalic Acid.
(c) Investigate the adsorption of oxalic acid by activated charcoal and test validity of Freundlich and Lanmuir, isotherms.
(d) To construct phase diagram for three component system (e.g Chloroform-Acetic Acid-Water).

(III) **Physical parameters of Tablets** 12

(a) Hardness (b) Friability
(c) Disintegration Test of Coated and Uncoated Tablets and Capsules.
(d) Dissolution Test of Coated and Uncoated Tablets and Capsules.

**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. Findlay'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.

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सत्र :- 2020-21

## विषय – फार्मास्युटिकल केमेस्ट्री तृतीय सेमेस्टर

| प्रश्नपत्र | प्रश्नपत्र का शीर्षक | अधिकतम अंक | | न्यूनतम उत्तीर्णांक | |
|---|---|---|---|---|---|
| | | सैध्दातिक | सी.सी.ई | सैध्दान्तिक | सी.सी.ई |
| प्रथम | Medicinal Chemistry | 85 | 15 | 28 | 05 |
| द्वितीय | Chemistry of Natural Products | 85 | 15 | 28 | 05 |
| तृतीय | Toxicology | 85 | 15 | 28 | 05 |
| चतुर्थ | Pharmaceutical Biotechnology | 85 | 15 | 28 | 05 |
| पंचम | Pharmacognosy | 85 | 15 | 28 | 05 |
| | Practical :- 1- Laboratory Course -I | 50 | -- | | |
| | 2- Laboratory Course -II | 50 | | | |

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## M.Sc. Pharmaceutical Chemistry : Semester –III

### MPC – 301: MEDICINAL CHEMISTRY

**Max Marks:35** **Min Passing Marks:12**

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 Heterocyclic acid Analogues, Aryl Propionic acid Analogues, Salicylic acid Analogues.Synthesis, Mode of action, Therapeutic uses and Adverse effects of Iodomethacin, Tolemetin Sodium, Ibuprofen, Naproxen, Asprin, Paracetamol, Phenyl butazone.

**UNIT – II:**

a) **Local Anesthetics:** Classification, structure, activity, relationship of Local Anesthetics, Mechanism & Theories of local anesthetics, Synthesis, MOA, Uses and Adverse effects of Benzocaine, Procaine, Lignocaine, Dibucaine, Diperidon.

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 $H_1$ and $H_2$ Receptor Antagonists. Synthesis, therapeutic uses and adverse effect of Diphenydramine Hydrochloride, Tripelennamine HCl, Promethazine HCl, Chlorcuclizine 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 Chloraquine Phasphate, Amodiaquinine Hydrochloride, Primaquinine Phasphate, Proguanil Hydrochloride, Trimethoprim.

c) **Anti Tubercular Agents:** Ethambutol, isonicotinic acid, rifgmpacin, streptomycin.

**UNIT – V:**

a) **Antimetabolities** : Synthesis, Uses and Side Effects of Sulfanilamide, Sulfapyridine, sulfadiazine, SAR of Sulphanilamide.

b) **Antineoplastic Agents** : Introduction, Roll of Alkylating Agents, Synthesis. Uses, Properties & Side Effect of Mustard Drugs, Mechloroethamic, 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 puplication.
4. Medcinal and Pharmaceutical Chemistry, Harikishan Singh,V. K. Kapoor, Vallabh Prakashan, Delhi.

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## M.Sc. Pharmaceutical Chemistry : Semester –III

### MPC-302: CHEMISTRY OF NATURAL PRODUCTS

**Max Marks:35** **Min Passing Marks:12**

**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 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 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:**

a) **Prostaglandin** : Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGF2a.
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. Ahluwalia, 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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## M.Sc. Pharmaceutical Chemistry : Semester –III

### MPC-303: TOXICOLOGY

Max Marks:35 Min Passing Marks:12

**UNIT-I**

Definition and Types of Toxicology, Basic Principles of Toxicology, Carcinogenicity, Mutagencity, Teratogenicity, Acute, Sub-acute and Chronic Toxicity, Pre Clinical Evaluation of Drugs.

**UNIT –II: Drug Dependence**

Definition, Drugs of Abuse, Classification of Drugs of Abuse, Drug Addiction, Physical Dependence, Psychological Dependence, Mechanism of Tolerance and Dependence.

**UNIT –III: Poisoning**

Classification of Poisons, Factors Modifying the action of Poison, Types 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, Cyanide, Heavy Metal
b) Opium, Morphine, L.S.D.
c) Alcohol, Barbiturates.
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: Drug-Drug Interaction During 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 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.

## M.Sc. Pharmaceutical Chemistry : Semester –III

### MPC – 304: PHARMACEUTICAL BIOTECHNOLOGY

Max Marks:35 Min Passing Marks:12

**UNIT -I: Basics of Immunology**

Immunity, Cells and Tissues of Immue System, Antigens: Characteristics and Types, Antibodies: Structure and Types, Antigen-Antibody Reactions and its Applications, Hypersensitivity.

**UNIT –II: Vaccinology**

Vaccines - Conventional vaccines, Modern Vaccine technologies, Genetically improved live vaccines, Genetically improved subunit vaccines, Pharmaceutical considerations.

**UNIT –III: Genetics**

Structure & Function of DNA, DNA Replication & Repair, Expression of Genetic Information: Structure & Function of RNA, Transcription, Genetic code, Translation, Post translational modification.

**UNIT –IV: Recombinant DNA Technology**

Gene Cloning, Restriction enzymes, Vectors, Genomic libraries, Polymerase Chain reaction. Methodology for Production of Biopharmaceutical by Recombinant DNA Technology: Harmones, Interferons, t-Plasminogen Activator. Monoclonal Antibodies and Hybridoma Technology.

**UNIT –V: Gene Therapy**

General Introduction, Potential target diseases for Gene therapy. Gene transfer methods, Molecular Principles of Drug Targeting, Drug Delivery System in Gene Therapy, Clinical studies.

**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.

## M.Sc. Pharmaceutical Chemistry : Semester –III

### MPC – 305: PHARMACOGNOSY

**Max Marks:35** **Min Passing Marks:12**

**UNIT-I**

Cultivation, Factors Affecting Cultivation, Collection, Harvesting, Drying.
Plant Growth Hormones.
Pest and Pest Control Methods.

**UNIT -II:**
Natural Sources of Drugs: Higher Plants, Microbes, Animals, Marine Organisms.
Classifications of Drugs from Natural Origin: Morphological, Taxonomical, Pharmacological (Therapeutical), Chemical Classification.

**UNIT -III:**
Phyto-constituents of Therapeutic Significance: General Methods of Extraction, Isolation, Identification and Characterization of Carbonyerates, Glycosides, Phenonlic 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.

**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.

## M.Sc. Pharmaceutical Chemistry
## SEMESTER-III

### LAB COURSE –I

**Maximum Marks : 50** **Duration of Exam 8 Hours**

| | | |
|---|---|---|
| (i) | Titrimetric Method | 12 |
| (ii) | Spectrophotometric (UV Visible) Determination | 12 |
| (iii) | Chromatography and Ion Exchange Methods | 12 |
| (iv) | Dairy | 6 |
| (v) | Viva | 8 |

### LAB COURSE –II

**Maximum Marks : 50** **Duration of Exam 8 Hours**

| | | |
|---|---|---|
| (i) | Optical Method of Analysis | 12 |
| (ii) | Flame Photometric Determination | 12 |
| (iii) | Extraction | 12 |
| (iv) | Dairy | 6 |
| (v) | Viva | 8 |

### LAB COURSE –I

**Maximum Marks : 50** **Duration of Exam : 8 Hrs**

**(I) Titrimetric Method** 12

(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.

**(II) Spectrophotometric (UV Visible) Determination** 12

(a) Determination of the wavelength of the Maximum Absorbance and molar excitation 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** 6

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

**(B) Ion Exchange Method** 6

Separate and Estimate Mg (II) and Zn (III) by Ion Exchange Method.

LAB COURSE –II

**Maximum Marks: 50** **Duration of Exam : 8 Hrs**

**(I) Optical Method of Analysis** 12

(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** 12

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

**(III) Extraction** 12

(i) Quinine from Cinchona
(ii) Papain from Papaya
(iii) Menthol Oil from Peppermint Leaves (dry)
(iv) Eucalyptus Oil from Eucalyptus Leaves/Bark

**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.

सत्र - 2020-21

# फार्मास्युटिकल केमेस्ट्री चतुर्थ सेमेस्टर



| | | | | | |
|---|---|---|---|---|---|
| प्रथम | Advanced Medicinal Chemistry | 85 | 15 | 28 | 05 |
| द्वितीय | Drug Design | 85 | 15 | 28 | 05 |
| तृतीय | Modern Analytical Techniques | 85 | 15 | 28 | 05 |
| चतुर्थ | Biopharmaceutics and Pharmacokinetics | 85 | 15 | 28 | 05 |
| पंचम | Pharmacology | 85 | 15 | 28 | 05 |
| | Practical:- 1- Laboratory Course -I<br>2- Laboratory Course -II | 50<br>50 | — | | |
| | Project Work-Duration 60 Hours | 100 | | | |

Sharma

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## M.Sc. Pharmaceutical Chemistry : Semester –IV

### MPC-401: ADVANCED MEDICINAL CHEMISTRY

28

Max Marks:85 / 100

Min Passing Marks:12

**UNIT –I:**

a) Theoretical basis of newer drug delivery systems; Prodrug, Dendrimer and Polymers as carrier.
b) Enzyme inhibition: Rational design based on inhibition kinetics, types, Affinity-labeling agents.

**UNIT –II: Pharmacodynamics**

Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

**UNIT –III: Antibiotics and antibacterials**

Introduction, Antibiotic β-Lactam type - Penicillins, Cephalosporins, Antitubercular – Streptomycin, Broad spectrum antibiotics – Tetracyclines, Anticancer - Dactinomycin (Actinomycin D)

**Unti – IV:**

Classification, mode of action, SAR, side effects, biological evaluation & recent advances in research of the following category of drugs.

a) Anticoagulants and Anti Platelets Drugs
b) Immunosupressants
c) Antiviral and Anti HIV
d) Antiprotozoal
e) NSAIDS

**Unti –V:**

Classification, mode of action, SAR, side effects, biological evaluation & recent advances in research of the following category of drugs.

a) Antihyperlipidemic Drugs
b) Antispasmodics and Antiulcer Drugs
c) Antiparkinsonism
d) Antiaizheimer Drugs

Books Suggested


1. Medicinal Chemistry, V. K. Ahluwalia and M. Chopra, CRC Press.
2. Medicinal Chemistry Kar, Ashitosh., New Age Inetrnational Publ.
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 puplication.

M.Sc. Pharmaceutical Chemistry : Semester – ~~III~~ IV

## MPC – 404: BIOPHARMACEUTICS AND PHARMACOKINETICS

**Max Marks:** ~~35~~ 85 **Min Passing Marks:** ~~12~~ 28

**UNIT –I: Biopharmaceutics**

Definition, passage of drugs arcross biological barrier, Physiochemical, Biological and Pharmaceutical Factors influencing Biopharmaceutical Performance of Drugs.

**Gastrointestinal Absorption of Drugs** – Passage of Drugs across Biological Membranes, gastrointestinal absorption mechanisms.

**Factors Affecting drug Absorption** – Physiological Factors, Dietary Factors, Physiochemical Factors, pH Partion Hypothesis, Dosage form Factors.

**Methods of Studying Gastrointestinal Absorption** – In Vitro and in VIVO Methods.

**Drug disposition** – Distribution in blood, Cellular Distribution, Plasma Protein Binding, Tissue Protein Binding.

Drug Excretion : Routes of Drug Excretion, Renal Excretion of Drugs, Factors Affecting Renal Excretion, Biliary and Salivary Excretion of Drugs.

Drug Biotransformation : Pathway of Drug Metabolism, Drug Metabolizing Enzymes, Factors Affecting Drug Metabolism and Drug Response, Inhibition and Stimulation of Drugs Metabolism.

**UNIT –II: Pharmacokinetics**

Absorption, Distribution, Metabolism and Excretion of Drugs, Fluid Compartment and Circulatory System, Protein Binding, Significance of Plasma drug concentration measurement.

**UNIT –III: Compartment Models**

Model Selection Criteria, Alaika Inforamtion Criterion, One Compartment and Two Compartment Models, Wagner Nelson and Loo Riegelman Methods or Estimation of Absorption Constants, Curve Fittings, Regression Procedure and Area Under Blood Level Curves.

**UNIT –IV: Clinical Pharmacokinetics**

Urinary Excretions, Computation of Pharmacokinetic Parameters From Urine Data, Haepetic Clearance, Biliary Excretion, Excretion Ration, Dosage Reigmen Adjustment in Patients with and without Renal Failure, Pharmacokinetics Drug Interactions and Their Significance in Combination Therapy.

**UNIT –V: Bioavailability and Biocquivalence**

Bioavailability and Bio-equivalence, Federal Requirements, Methods of Determination of Bioavailability using blood level and Urinary Excretion Data, Design and Evaluations, Bioavailability assessment.

**Books Suggested**


1. Biopharmaceutics and Pharmacokinetics Chatwal, G.R., Himalaya Publishing House.
2. Principles & applications of Biopharmaceutics & Pharmacokinetics Tipnis & Bajaj, Career Publ.
3. Biopharmaceutics & Pharmacokinetics , Kulkarni, CBS Publishers and Dishtributors.
4. Essentials of Biopharmaceutics & Pharmacokinetics , Ashutosh Kar, New Age International Publ.

# M.Sc. Pharmaceutical Chemistry

## SEMESTER-IV

### LAB COURSE –I

**Maximum Marks : 50** **Duration of Exam : 8 Hrs**

| | | |
|---|---|---|
| (i) | Instrumental Analysis | 12 |
| (ii) | Multi step Synthesis | 12 |
| (iii) | Pharmacological Experiments | 12 |
| (iv) | ~~Dairy~~ Diary | 6 |
| (v) | Viva | 8 |

### LAB COURSE –II

**Maximum Marks: 50** **Duration of Exam: 8 Hrs**

| | | |
|---|---|---|
| (i) | Solvent Extraction | 12 |
| (ii) | Water Analysis | 12 |
| (iii) | Pharmaceutical and Cosmetic Preparations | 12 |
| (iv) | ~~Dairy~~ Diary | 6 |
| (v) | Viva | 8 |

### LAB COURSE –I

**Maximum Marks : 50** **Duration of Exam: 8 Hrs**

**(I) Instrumental Analysis** 12

(a) Determination of Sulphate by Nephelometric Method.

(b) Determination of the End Point of the Following Solutions by the Conductometric Method

(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) Determination the pH of a Number of Buffer solutions using pH meter.

(d) Karl Fisher Method for Determination of Water in Pharmaceutical Analysis.

**(II) Multi step Synthesis** 12

(a) Preparation of Sodium Ferrooxylate $Na_3[Fe(C_2O_4)_3]\,9\,H_2O$

(b) Preparation of ortho-chloro Benzoic Acid from Phthalic Anhydride.

(c) Preparation of para Nitroaniline from Aniline

(d) Preparation of Acridon from Anthranilic Acid

**(II) Pharmacological Experiments** 12

(i) To Study Central Muscle relaxants using Rotarod Apparatus

(ii) To Study the Hyprotic Activity of Sedatives.

(iii) To Study the Analgesic Activity of Opiod Analgesic on Mice.

## LAB COURSE –II

**Maximum Marks : 50** **Duration of Exam: 8 Hrs**

(I) **Solvent Extraction** 12

Separate and estimate Mg (II) and Fe (III) by Solvent Extraction Method.

(II) **Water Analysis** 12

Determination of Following Parameters in the given sample of the water
Colour, Oder, 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** 12

(a) Preparation of Camphor Liniment.
(b) Preparation of after Save Lotion.
(c) Preparation of Simple Shampoo.
(d) Preparation of Compact Powder.
(e) Preparation of Cleansing Cream.
(f) Preparation of Calamine Lotion.
(g) Preparation of Iodex.
(h) Preparation of Benzyl Benzoate Emulsion.
(i) Preparation of Paste.

**Books Suggested**


1. Practical Pharmaceutical Chemistry - I & II ,Backett, A.H., CBS Publishers and Distributors.
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.


Sharma