

SYLLABUS FOR CUCET M.PHARMA ENTRANCE EXAM

PHARMACEUTICS-I (INTRODUCTION TO PHARMACEUTICS)

1. History of pharmaceutical practice through ages, pharmacy as a career.
2. Pharmacopoeias with special reference to Indian, British, United States, International and Extra Pharmacopoeias and various systems of medicines.
3. Routes of administration and classification of pharmaceutical dosage forms.
4. Definition, general formulation, manufacturing procedures and official products of following categories: Aromatic waters, solutions, syrups, spirits, elixirs, linctuses, lotions, liniments, glycerites, gargles, mouth washes, inhalations, milk and magmas, mucilages, jellies, infusion, decoctions, tinctures and extracts.
5. Methods employed in the preparation of plant extracts.
6. Coarse dispersion: Suspension, interfacial properties of suspended particles, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, formulation of suspensions, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheologic considerations, methods of preparation, physical stability of suspensions.
7. Emulsions: Types of emulsion, theories of emulsification (monomolecular adsorption multi-molecular adsorption and film formation and solid-particle adsorption), physical stability of emulsions, creaming and Stoke's law, coalescence and breaking, phase inversion, evaluation of emulsion and pharmaceutical applications.

PHARMACEUTICAL CHEMISTRY-I (ORGANIC-I)

1. Fundamentals of organic reaction mechanism: Classification of organic reactions, bond breaking and bond-making processes, concerted and stepwise reactions, reactivity and orientation, electrophiles and nucleophiles, aromatic, role of solvent, polarity of solvent.
2. Reaction intermediates: Transition states, rearrangement, carbanions, carbocations, carbon radicals, carbenes, nitriles and benzyne.
3. Stereochemistry: Stereoisomerism, enantiomers, elements of symmetry, chirality, racemic modification, configuration, specification of configuration, sequence rule, conformational isomers, reactions involving stereoisomer's, asymmetric synthesis.
4. Study of reaction mechanism, reactivity and orientation, effect of substituent groups of following categories of reactions:
 - 4.1 Addition reactions: (a) Nucleophilic addition reactions: Nucleophilic addition to C=O, addition of cyanides, derivatives of ammonia, alcohols, Grignard's reagent, Aldol condensation, nucleophilic addition to C=C, C≡C. (b) Electrophilic addition reactions: Addition of hydrogen, halogen, hydrogen halide, sulphuric acid, water, halohydrin formation, dimerisation, alkanes, oxymercurationdemercuration, hydroboration-oxidation, stereoselective and stereospecific reactions, comparison of nucleophilic and electrophilic addition in alpha-beta unsaturated carbonyl compounds. (c) Free radical addition reactions: Peroxide initiated addition of HBr (anti-markonikov orientation)
 - 4.2 Elimination reactions: 1, 2 Elimination reactions, dehydrohalogenation of alkyl halides, E1, E2, E1cb, E1 vs E2, elimination vs substitution.
 - 4.3 Substitution reactions: (a) Free radical substitution: Halogenation of alkanes (b) Nucleophilic Aliphatic: SN1, SN2, SN1 vs SN2, neighboring group effect (c) Nucleophilic Acyl substitution: Esterification reactions, conversion to acids, acid chlorides, amides, esters, nucleophilic substitution alkyl vs acyl. (d) Electrophilic aromatic substitution: Nitration, sulphonation, halogenation, Friedal Craft's alkylation, electrophilic substitution in naphthalene. (e) Nucleophilic aromatic substitution: Bimolecular displacement, benzyne, and aliphatic vs aromatic substitution.

4.4 Condensation and rearrangement reactions: Claisen condensation, Reimer Tieman reaction, Hoffmans degradation of amides, Kolbe's reaction, Fries rearrangement, Cannizaro's reaction and coupling reaction.

PHARMACEUTICAL CHEMISTRY-II (INORGANIC)

1. The occurrence of impurities in pharmaceutical preparations: Types of impurities and limit test for chlorides, sulphate, arsenate, lead, heavy metals and iron.
2. A systematic study of the following pharmaceutical inorganic compounds with reference to their preparations, properties, tests for identity and purity, pharmaceutical uses and assay methods as given in Indian Pharmacopeia (IP).
3. Group IA: Sodium and potassium compounds: Sodium benzoate, sodium bicarbonate, sodium borate, sodium chloride, sodium citrate, sodium fluoride, sodium metabisulphate, sodium phosphate, sodium potassium tartarate, potassium permanganate, potassium dichromate, potassium chloride, potassium bromide and potassium iodide. Group-IB: Copper, silver and gold compounds: Copper sulphate, silver nitrate, strong silver proteins, and mild silver proteins. Group-IIA: Magnesium, calcium and barium compounds: Light and heavy magnesium carbonate, light and heavy magnesium oxide, magnesium hydroxide, magnesium sulphate, magnesium trisilicate, magnesium stearate, calcium gluconate, calcium acetate, calcium carbonate, calcium chloride, calcium lactate, and barium sulphate. Group IIB: Zinc and mercury compounds: Zinc oxide, zinc sulphate, zinc stearate, zinc chloride, mercury, yellow mercuric oxide, mercurous chloride and ammoniated mercury.
4. Group IIIA and IIIB: Boron and aluminium compounds: Boric acid, aluminium hydroxide gel, aluminium magnesium trisilicate and alum. Group IVA and IVB: Bentonite, light and heavy kaolins and kaolin poultice. Group VA and VB: Nitrogen, antimony, and bismuth compounds: Strong and diluted ammonia solutions, strong ammonium acetate solutions, ammonium chloride, sodium antimony gluconate and bismuth subcarbonate.
5. Group VIB: Sulphur, selenium compounds: Sublimated sulphur, precipitated sulphur and selenium sulphide. Group VIIA and VIIB: Hydrogen, oxygen and halogen compounds: Purified water, water for injection, hydrogen peroxide, chlorinated lime, aqueous iodine solution and strong iodine solution. Group VIII: Iron compounds: Ferrous sulphate, ferrous gluconate, ferric ammonium citrate, and iron-dextran inj.
6. A study of major intra and extra cellular electrolytes, essential and trace elements and their physiological role.
7. Selected case studies in medicinal inorganic chemistry from the following topics: a. Biomedical uses of lithium b. Application of platinum compounds in medicine c. Gold (I) compounds as therapeutic agents d. Ruthenium, titanium and gallium compounds in medicine
8. Metal compounds as contrast agents for MRI and medicinal applications of radio-active compounds.

ADVANCE MATHEMATICS

1. Differential equations and its applications: Revision of integral calculus, definition and formation of differential equations, equations of first order and first degree, variable separable, homogeneous and linear differential equations and equations reducible to such types, linear differential equations of order greater than one with constant coefficients, complementary function and particular integral, simultaneous linear differential equations, pharmaceutical applications.
2. Laplace transforms: Definition, transforms of elementary functions, properties of linearity and shifting, inverse Laplace transforms, transforms of derivatives, solution of ordinary and simultaneous differential equations.
3. Biometrics: Significant digits and rounding of numbers, data collection, random and nonrandom

sampling methods, sample size, data organization, diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams, measures of central tendency, measures of dispersion, standard deviation and standard error of means, coefficient of variation, confidence (fiducial) limits.

4. Probability: Probability and events, Bayes's theorem, probability theorems, probability distributions, elements of binomial and Poisson distribution, normal distribution curve and properties.
5. Correlation and regression analysis: Method of least squares, statistical inference, student's and paired t-test, f-test and elements of ANOVA, kurtosis and skewness, applications of statistical concepts in Pharmaceutical Sciences.

PHARMACEUTICS-II (PHYSICAL PHARMACY)

1. Matter: State and selected properties: State of matter, Latent heat and vapour pressure, Sublimation, Critical point, Eutectic point, Solids: Crystalline and amorphous, Polymorphism, Refractive index, Colligative properties, Partition coefficient, Phase equilibrium and Phase rule.
2. Micromeritics: Particle size and size distribution: Average particle size, Number and weight distribution, Particle number, Methods for determining particle size, Optical microscopy, Sieving, Sedimentation, Particle volume measurement, Particle shape and surface area, Methods for determining surface area, Derived properties of powders, Porosity, Packing arrangements, Densities of particles, Bulkiness, Flow properties.
3. Surface and Interfacial phenomenon: Liquid interfaces, Surface and interfacial tensions, Surface free energy, Measurement of surface and interfacial tensions, Spreading coefficient, Adsorption at liquid interfaces, Surface active agents, HLB, Types of monolayer at liquid surfaces, Critical micelle concentration, Adsorption at solid interfaces, Solid-gas and solid-liquid interface, Wetting and detergency, Application of surface active agents, Electric properties of interfaces.
4. Rheology: Newtonian systems: Newton's law of flow, Kinematics viscosity, Temperature dependence and the theory of viscosity, Non-newtonian systems, Plastic flow, Pseudoplastic, Dilatant flow. Thixotropy: Measurement of thixotropy, Bulges and spurs, Negative thixotropy, Thixotropy in formulation, Determination of Rheologic properties, Choice of viscometer, Capillary viscometer, Falling sphere viscometer, Cup and Bob viscometer, Cone and plate viscometer, Viscoelasticity, Pseudorheology.
5. Dispersed systems: Colloids, Types of colloidal systems, Optical properties of colloids, Kinetic properties of colloids, Electrical properties of colloids, Pharmaceutical applications of colloids.
6. Complexation and protein binding: Classification of complexes, Methods of preparation and analysis, Pharmaceutical applications, Protein binding, Factors affecting complexation and protein binding.
7. Chemical kinetics: General considerations and concepts, Half-life determination, Factors affecting rate of reaction, Order of reaction, Determination of order of reaction.

PHARMACEUTICAL CHEMISTRY-III (ORGANIC-II)

1. Nomenclature of heterocyclic compounds: Trivial names, Systematic (Hantzsch-Widman) nomenclature of monocyclic compounds, Naming of fused ring systems (bicyclic and tricyclic systems).
2. Classification of heterocyclic compounds: Monocyclic, bicyclic and tricyclic systems
3. Chemistry, preparation, properties and pharmaceutical applications of following heterocyclic rings:
 - 3.1 Monocyclic rings
A 3-membered with one hetero atom: Aziridine, B 4-membered with one hetero atom: Azetidine
C 5-membered with one hetero atom: Pyrrole, Thiophene, Furan, D 5-membered with two or more hetero atoms: Imidazole, Pyrazole, Oxazole, Isoxazole, Thiazole, Isothiazole, Triazole, Tetrahydrothiazole, Oxadiazole, Thiadiazole. E 6-membered with one hetero atom: Pyridine, Pyran, F 6-membered with two or more hetero atoms: Pyrimidine
 - 3.2 Bicyclic rings - A 5-membered with one hetero atom: Indole B 5-membered with two or more heteroatoms: Benzimidazole, Benzopyrazole, Benzoxazole, Benzothiazole, Benzofuran

C 6-membered with one hetero atom: Quinoline, Isoquinoline, Coumarin

D 6-membered with two or more hetero atoms: Purine, Quinazoline

3.3 Tricyclic rings: Acridine

4. Pericyclic reactions, Conservation of orbital symmetry, Orbital symmetry rules, Mechanism and stereochemistry of electrocyclic, cycloaddition and sigmatropic reactions
5. Applications of reagents used in organic syntheses: Aluminium chloride, Boron trifluoride, Grignard reagent, Phosphorus pentachloride, Thionyl chloride, n-Bromosuccinimide, Raney nickel, Platinum, Palladium, Lead tetra acetate, Osmium tetroxide, Aluminium t-butoxide, Jones reagent, Lithium aluminium hydride, Sodium borohydride, Stannous chloride, Aluminium isopropoxide, Diazomethane, Dicyclohexyl carbodiimide, Ozone, Polyphosphoric acid, Sodamide, Sodium azide, Sodium hydride.
6. Oxidation and hydrogenation/reduction: Types of oxidative reactions and oxidizing reagents, Homogenous and heterogeneous hydrogenation.
7. Chemistry of biomacromolecules: A Carbohydrates: Introduction, classification, Nomenclature, Properties of carbohydrates, monosaccharides, Configuration of monosaccharides, Cyclic structure of glucose, Anomers, epimers and mutarotation, Furanose and pyranose forms of glucose, Disaccharides: sucrose, lactose, maltose, polysaccharides: cellulose, starch, glycogen, conversion of aldose to ketose, methods for lengthening and shortening the chain, characterization tests for identification of carbohydrates. B Lipids: Introduction, Classification, Reaction of fatty acids, Identification, Characterization of lipids, Membrane lipids C Proteins and Amino acids: General properties of amino acid, Synthesis of amino acid, Reaction of amino acid (due to -NH₂ group, -COOH group and due to both), Synthesis and properties of peptides, End group analysis, N and C terminal amino acid determination, Sequence analysis, Primary, Secondary, Tertiary and Quaternary structure.

PHARMACEUTICAL MICROBIOLOGY

1. Introduction and scope of microbiology.
2. Classification of microbes and their taxonomy: Bacteria, Actinomycetes, Rickettsiae, Spirochetes and Viruses. Microbial genetics and variation.
3. Identification and cultivation of microbes: Stains and types of staining techniques, Electron microscopy. Nutrition, cultivation, isolation of bacteria, actinomycetes, fungi, and viruses.
4. Control of microbes by physical and chemical methods: Disinfections, Factors influencing disinfectants, Dynamics of disinfectant, Disinfectants and antiseptic and their evaluation. Sterilization: Methods and equipments. Sterility testing of Pharmaceutical products.
5. Immunity, primary and secondary defensive mechanisms of body, microbial resistance, interferon.
6. Food spoilage and preservation of food.
7. Microbial assay of antibiotics, vitamins and amino acids.

ANATOMY PHYSIOLOGY & HEALTH EDUCATION-I

1. Scope of anatomy & physiology and basic terminology used in the subject.
2. Structure of Human Cell, its components and their functions. Causes of cellular injury, Pathogenesis, Morphology of cell injury, Adaptations and cell death.
3. Elementary Tissues of the Human Body: Epithelial, Connective, Muscular and nervous tissues their sub-types and characteristics.
4. Osseous System: Structure, composition and functions of skeleton, classification of joints and types of movements of joints. 5. Skeletal Muscles: Gross anatomy of muscles, physiology of muscle contraction, physiological properties of skeletal muscles.
5. Haemopoietic System: Composition and functions of blood and its elements, blood groups and their significance, mechanism and significance of blood coagulation.
6. Lymph and Lymphatic System: Composition, formation and circulation of lymph. Basic physiology and functions of spleen.

7. Cardiovascular System: Basic anatomy and physiology of the heart, blood vessels and circulation, basic understanding of cardiac cycle, heart sounds and electrocardiogram, blood pressure and its regulation.
8. Health Education: Concepts of health and disease, causative agents & prevention of disease.
 - a. Classification of food requirements, importance of balanced diet and nutritional, deficiency disorders; their treatment and prevention.
 - b. Demography and family planning: Demography cycle, family planning and various contraceptive methods and medical termination of pregnancy.
 - c. First aid: Emergency treatment of shock, snakebites, burns, poisoning, fractures and resuscitation methods.

PHARMACEUTICS-III (PHARMACEUTICAL ENGINEERING)

1. Unit Operations: Introduction to unit operations, law of material and energy balances, rate of a process, steady and unsteady states, equilibrium state, dimensionless equations, dimensionless formulae, dimensionless groups.
2. Material of Construction: Types of material of construction, factors affecting selection of material of construction, general study of composition, corrosion resistance, properties and applications of the materials of construction with special reference to stainless steel, plastic and glass.
3. Size Reduction: Definition, objectives of size reduction, factors affecting size reduction, mechanisms of size reduction, laws governing energy and power requirements of a mill, ball mill, hammer mill, fluid energy mill and other mills in pharmaceutical industry, wet grinding, selection of size reduction method, selection of degree of size reduction.
4. Size Separation: Standards for powders, standards for sieves, sieving methods, fluid classification methods.
5. Mixing: Theory of mixing, types of mixtures, solid-solid, solid-liquid and liquid-liquid mixing and mixing equipments.
6. Filtration: Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, meta filter, membrane filter, factors affecting filtration, optimum cleaning cycle in batch filters.
7. Centrifugation: Principles of centrifugation, industrial centrifugal filters, and centrifugal sedimenters.
8. Crystallization: Characteristics of crystals like-purity, size, shape, geometry, habit, forms size and factors affecting them, solubility curves and calculation of yields, supersaturation theory and its limitations, nucleation mechanisms, crystal growth, study of various types of crystallizer, tanks, agitated batch, Swenson Walker, single vacuum, circulating magma and crystal crystallizer, caking of crystals and its prevention.
9. Refrigeration, Air Conditioning and Humidity Control: Principles and applications of refrigeration and air conditioning, basic concepts and definition of humidity, wet bulb and adiabatic saturation temperatures, psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for humidification and dehumidification operations.
10. Evaporation: Basic concept of phase equilibrium, factor affecting evaporation, different types of evaporators, single and multiple effect evaporators, evaporation under reduced pressure.
11. Distillation: Raoult's law, phase diagrams, volatility, simple steam and flash distillations, rectification, McCabe Thiele method for calculations of number of theoretical plates, azeotropic and extractive distillation.
12. Drying: Moisture content and mechanism of drying, rate of drying, classification and types of dryers, dryers used in pharmaceutical industries, special drying methods.
13. Corrosion: Types of corrosion, methods of reducing corrosion.

PHARMACEUTICS I

(DISPENSING, COMMUNITY AND HOSPITAL PHARMACY)

1. Prescription: Parts, types and handling of prescription, knowledge of commonly used Latin terms in prescriptions, general dispensing and compounding procedures, labeling of dispensed products, sources of errors in prescription, care required in dispensing of prescription.
2. Pharmaceutical calculations: Different systems of weights and measures, dilution and concentration of solutions, percentage solutions, calculation by allegation, proof spirits, isotonic solution, calculation for adjustment to isotonicity, posology, knowledge of prophylactic and therapeutic doses of commonly used drugs, detection of overdoses in prescription, calculation of doses for infants, adults and elderly patients.
3. Principle involved and procedures adopted in dispensing of mixtures, solutions, emulsions, lotions, liniments, powders, capsules, tablets, tablet triturates, pastilles, lozenges, pills, ointments, creams, pastes, suppositories, jellies, inhalations, paints, sprays and ophthalmic preparations.
4. Incompatibility: Physical, therapeutic and chemical incompatibilities, incompatibility of common occurrence and their correction.
5. Community pharmacy: Organization and structure of retail and whole sale drug store and design, legal requirements for establishment and maintenance of drug stores, dispensing of proprietary products, maintenance of records, patient counseling on rational use of drugs and aspects of health care.
6. Hospital pharmacy: Organization of a hospital pharmacy, responsibilities of a hospital pharmacist, pharmacy and therapeutic committee, hospital formulary, contents, preparation and revision of hospital formulary, inventory control procedures in hospital pharmacy.

PHARMACEUTICAL ANALYSIS-I

- A. 1. Theoretical aspects of quantitative analysis: Significance of quantitative analysis in quality control, different techniques of analysis, statistical treatment of analytical data, types of errors, mean deviation, standard deviation, accuracy and precision, significant figures, rules for retaining significant figures, methods of expressing concentration, primary and secondary standards. 2. Titrimetric techniques: Theoretical considerations and pharmaceutical applications with special reference to Indian Pharmacopoeia of the following analytical techniques: A Acid-Base titrations: Acid base concepts, role of solvents, relative strengths of acids and bases, ionization, law of mass action, common-ion effect, ionic product of water, pH, hydrolysis of salts, Handerson-Hasselbach equation, buffer solutions, neutralization curves, acid-base indicators, theory of indicators, choice of indicators, mixed indicators, universal indicators, polyprotic systems, preparation and standardization of neutralization titrants.
- B. Oxidation-Reduction titrations: Concepts of oxidation and reduction, redox reactions, strengths and equivalent weights of oxidizing and reducing agents, theory of redox titrations, redox indicators, oxidation-reduction titration curves, titrations involving potassium permanganate, ceric ammonium sulphate, potassium iodate, potassium bromate, iodometry and iodimetry, pharmaceutical applications, preparation and standardization of redox titrants like potassium permanganate, ceric ammonium sulphate, potassium dichromate, potassium iodate, potassium bromate, iodine, sodium thiosulphate.
- C. C Precipitation titrations: Precipitation reactions, solubility products, detection of endpoint in precipitation titrations, indicators used in precipitation titrations, preparation and standardization of titrants like silver nitrate, ammonium and potassium thiocyanate, titrations according to Mohr's and Volhard's methods, ammonium and potassium thiocyanate, applications in pharmaceutical analysis.
- D. Gravimetric analysis: Fundamentals of gravimetry, precipitation reagents, precipitation techniques, specific examples of gravimetric estimation like aluminium as hydroxyquinolate, barium as barium sulphate, lead as chromate and magnesium as magnesium pyrophosphate.
- E. Non-aqueous titrations: Scopes and limitations, solvents used in non-aqueous titrations, acid-base equilibria in non-aqueous media, differentiating and leveling effect of solvents, preparation and standardization of perchloric acid and tetrabutyl ammonium hydroxide, titration of weak acid and

weak bases with suitable examples. F. Complexometric titrations: Theory of complexometric analysis, factors influencing stability of complexes, metal ion indicators, types of disodium edetate titrations with suitable examples, preparation and standardization of disodium edetate, methods to increase the selectivity of EDTA titrations.

PHARMACOGNOSY-I

1. Definition, history, scope and development of pharmacognosy, sources of crude drugs and methods of their classification.
2. Plant hormones and their applications, influence of mutation and hybridization with reference to medicinal plants.
3. Pest control and natural pest control agents.
4. Quality control of crude drugs: Different types of adulteration and their evaluation using various methods like organoleptic, microscopic, physical, chemical and biological.
5. An introduction of various types of primary and secondary metabolites as active constituents of crude drugs, general methods of their isolation, classification, properties and systematic pharmacognostic study of: a) Carbohydrates and drugs belonging to this class like: Agar, Guar Gum, Acacia, Isabgol, Pectin, Sterculia, Tragacanth. b) Lipids and drugs belonging to this like: Castor oil, Beeswax, Cocoa butter, Hydnocarpus oil, Kokum butter, Cod liver oil, Woolfat. c) Resins and Tannins, and drugs of these classes like: Podophyllum, Balsams, Turmeric, Ginger, Ipomea and Myrobalan. d) Pharmaceutical aids like: Talc, Kaolin, Bentonite, Gelatin, Cotton and Viscose Rayon.

ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION – II

1. Central Nervous System: Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram and specialized function of the brain. Cranial nerves and their functions.
2. Autonomous Nervous System: Physiology and functions of the autonomous nervous system. Mechanism of neurohumoral transmission in the automatic nervous system.
3. Respiratory System: Anatomy of respiratory organs, functions of respiratory organs, mechanism and regulation of respiration, respiratory volumes and vital capacity.
4. Endocrine System: Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenals, pancreas, testis and ovary; their hormones and functions.
5. Digestive System: Gross anatomy of gastrointestinal tract, functions of its different parts, various gastrointestinal secretions and their role in the absorption and digestion of food.
6. Reproductive System: Anatomy of male & female reproductive system and their hormones, physiology of menstruation, coitus, fertilization, sex differentiation, spermatogenesis and oogenesis, pregnancy its maintenance and parturition.
7. Urinary System: Various parts, structures and functions of kidney and urinary tract, physiology of urine formation and acid-base balance.
8. Sense Organs: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

PHARMACEUTICS -V (DOSAGE FORM DESIGN)

1. 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. Biopharmaceutical consideration in the formulation stages of dosage form development.
2. Study of different types of formulation additives e.g., diluents, binders, disintegrants, lubricants, vehicles, anti-oxidants, preservatives, coloring, flavoring, sweetening, suspending and emulsifying agents. Drug-excipient interactions.
3. Stability studies: Determination of shelf life (expiry date) and overage calculations, stabilization and stability testing protocol for various pharmaceutical products.
4. Polymers: Classification, synthesis, properties, characterization and evaluation of polymers including biodegradable polymers, mechanism of biodegradation in body, pharmaceutical applications of polymers.

5. Dissolution technology: Types of various dissolution apparatus as per pharmaceutical compendia, dissolution media, factors affecting dissolution, dissolution testing of different types of dosage formulations, data interpretation, similarity and difference factors.

6. Solubilization: Theory of solubilization, factors affecting solubilization, methods of solubility enhancement.

PHARMACEUTICAL ANALYSIS-II

1. Conductometry: Ohm's law and ionic conductivities, instrumentation, conductometric titration curves, applications of conductometry in acid-base, redox, precipitation and complexometric titrations with suitable examples.

2. Potentiometry: Theory and principles, reference electrodes, indicator electrodes, instrumentation for potentiometric titrations, location of end point in potentiometry, application of potentiometry in acid-base, redox, precipitation and complexometric titrations with suitable examples.

3. Polarography: Principle, polarographic wave, Ilkovic equation and factors affecting it, dropping mercury electrode, instrumentation, polarographic methods of analysis, pharmaceutical applications.

4. Amperometry: Principle, amperometric titration curves, applications.

5. Coulometry: Principle, apparatus, pharmaceutical applications.

6. Radioimmunoassay: Principle, procedure, pharmaceutical applications.

7. Thermal methods of analysis: Principle, instrumentation, pharmaceutical applications of differential scanning calorimetry, thermogravimetric analysis and differential thermal analysis.

8. X-ray diffraction: Principle, Bragg's Law, instrumentation, pharmaceutical applications.

9. Miscellaneous methods of analysis: Karl-Fischer titrations, Diazotization titrations, gasometry, Kjeldahl's method of nitrogen estimation and oxygen flask combustion.

PHARMACEUTICAL CHEMISTRY- IV (BIOCHEMISTRY) 1. Enzymes: Nomenclature and classification, structure of enzymes, mechanism of enzyme action, mode of enzyme action, factors affecting enzyme action, enzyme inhibition, regulation of enzyme activity, allosteric enzymes and pharmaceutical application.

2. Co-enzymes: Metals and vitamins as coenzymes and their significance.

3. Carbohydrates metabolism: Glycolysis, gluconeogenesis and glycogenolysis, citric acid cycle, pentose phosphate pathway, uronic acid pathway, metabolism of galactose and galactosemia.

4. Lipid metabolism: Transportation and absorption of fats, role of liver in fat metabolism, oxidation of fatty acids, ketosis, biosynthesis of saturated and unsaturated fatty acids, control of lipid metabolism, essential fatty acids and eicosanoids, metabolism of cholesterol.

5. Biological oxidation: Redox potential, enzymes and co-enzymes involved in oxidation reduction and its control, the respiratory chain, its role in energy capture and its control, energetic of oxidative phosphorylation, inhibitors of respiratory chain and oxidative phosphorylation, mechanism of oxidative phosphorylation.

6. Metabolism of ammonia and nitrogen containing monomers: Nitrogen balance, biosynthesis of amino acids, catabolism of amino acids, conversion of amino acids to specialized products, assimilation of ammonia, urea cycle, metabolic disorders of urea cycle, metabolism of sulfur containing amino acids, porphyrin biosynthesis, formation of bile pigment, hyperbilirubinemia, purine biosynthesis, purine nucleotide interconversion, pyrimidine biosynthesis, and formation of deoxyribonucleotides.

7. Genetic code and protein synthesis: Genetic code, components of protein synthesis and inhibition synthesis.

PHARMACOGNOSY II

1. Classification, cultivation, collection, commercial varieties, chemical constituents, substitutes, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides:

a. Saponins - Liquorice, ginseng, dioscorea, and senega.

b. Cardio active sterols- Digitalis, squill, strophanthus and thevetia.

c. Anthraquinone cathartics - Aloe, senna, rhubarb and cascara.

d. Others - Psoralea, ammi majus, ammi visnaga, gentian, saffron, chirata, and quassia.

2. Volatile oils: General method of obtaining volatile oils from plants, study of following volatile oil containing drugs as mentha, coriander, cinnamon, cassia, lemon grass, citronella, caraway, dill, clove, fennel, nutmeg, eucalyptus, chenopodium, cardamom, musk, palmrosa, gultheria and sandal wood.

3. Plant bitters and sweeteners.

4. Studies of following drugs: Amla, Shatavari, Tylophora, Bhilwa, Bach, Punarnava, Chitrak, Apamarga, Gokhru, Shankhpushpi, Brahmi, Adusa, Arjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gynmema and Shilajit.

5. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, Papain, Pepsin, Trypsin and Pancreatin.

PHARMACEUTICAL JURISPRUDENCE & ETHICS

1. Introduction a) Pharmaceutical Legislations – A brief review. b) Drugs and pharmaceutical industry with special reference to India c) Code of pharmaceutical ethics – A brief review. 2. An elaborate study of the following: a) Pharmacy Act 1948. b) Drugs and Cosmetics Act 1940 and Rules 1945. c) Medicinal & Toilet Preparations (excise duties) Act 1955. d) Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.

e) Drugs Price Control Order 1995. f) Drug Policy 2002. 3. A brief study of the following with special reference to the main provisions. a) Poisons Act 1919. b) Drugs and Magic Remedies (objectionable advertisements) Act 1954. c) Medical Termination of Pregnancy Act 1970 & Rules 1975. d) Prevention of Cruelty to Animals Act 1960. e) States Shops & Establishments Act & Rules. f) Insecticides Act 1968.

g) AICTE Act 1987. h) Factories Act 1948. i) Minimum Wages Act 1948. j) Introduction to Intellectual Property Rights and Indian Patent Act 1970 with patents rules 1972.

4. A brief study of the various marketed pharmaceutical products from the following categories: (i) Antibiotics (ii) Vitamins (iii) Antihypertensive (iv) Anti-diabetics (v) NSAIDs

PHARMACEUTICS- VI (COSMETIC TECHNOLOGY)

Fundamental of cosmetic science. Formulation considerations, preparation, packaging and evaluation of the following cosmetic preparation:

1. Face Preparation: Face powder, Compact powder, Talcum powder, Face packs and Masks.

2. Colored make-up preparations: Lipsticks, Rouge, Mascara and Eye-liner.

3. Skin preparation: Skin creams, Vanishing creams, Cold creams, All purpose cream, Cleansing creams, Emollient, Anti-perspirant/ deodorant, Moisturizing and foundation formulation, Bleaching creams, Night and massage creams, Anti-wrinkle preparation, Hand creams, Protective skin tonics, Skin moisturizers, Sun-screen preparation.

4. Shaving preparation: Lather shaving stick, Lather shaving creams, Shaving foams, Shaving gels, Pre-and after shave lotions.

5. Shampoos: Clear liquid shampoos, Acid-balanced shampoos, Egg shampoos, Anti-dandruff shampoos.

6. Hair Preparations: Hair tonics, Hair conditioners, Hair lotions, Hair sprays, Hairdressings, Hair setting lotions and creams, Hair dyes, bleaches, Hair waving, Hair straighteners and Hair strengtheners.

7. Dental Preparation: Tooth powders, Tooth pastes, Dentifrice, Cleansers and Mouthwashes.

8. Manicure Preparation: Nail polish, Nail lacquers and Nail bleaches.

9. Herbal Cosmetics: Cosmetics containing Aloe, Babul, Brahmi, Chandan, Cucumber, Haldi, Jatamansi, Khus, Mehandi, Neem, Reetha, Shikakai, Tulsi, Arnica, Bhringraj And Volatile Oils.

10. Cosmetic for babies: Baby cream, lotion and powders.

PHARMACEUTICS-VII (PHARMACEUTICAL TECHNOLOGY-I)

1. Liquid Dosage Forms: Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors and others, manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions.

2. Semisolid Dosage Forms: Definition, types and mechanisms of drug penetration. Factors influencing penetration. Semisolid bases and their selection. General formulation of semisolids, clear gels, manufacturing procedure, evaluation and packaging.

3. Suppositories: Ideal requirements, bases, manufacturing procedures, packaging and evaluation.

4. Solid Dosage Forms: Tablets: a. Formulation of different types of tablets, granulation technology on large scale by various techniques, different types of tablet compression, machinery and the equipments involved, evaluation of tablets. b. Coating of tablets: Types of tablet coating, film forming materials, formulation of coating solutions, equipments of coating, coating process, evaluation of coated tablets.

5. Solid Dosage Forms: Capsules: Advantages and disadvantages of capsules dosage form, material for production of hard gelatin capsules, size of capsules, methods of capsule filling and sealing, soft gelatin capsule, capsule shell and capsule content, importance of base adsorption and minimum per gram factors in soft gelatin capsules, quality control, stability studies and testing of capsule dosage form.

6. Pharmaceutical aerosols: Definition, propellants, and general formulation, manufacturing and packaging methods and pharmaceutical applications.

7. A brief introduction of blood products, plasma substitutes and surgical products.

PHARMACEUTICAL CHEMISTRY-V (MEDICINAL CHEMISTRY-I)

1. Introduction and basic principles of Medicinal Chemistry: Historical perspectives of Medicinal Chemistry, Drug discovery, Physico-chemical, stereochemical (optical and geometrical) properties and bioisosterism in relation to biological action, receptors and drug action, theories and drug receptor interactive forces, Enzymes and drug action, Drug metabolism, Phase I and Phase II reactions

Classification, synthesis of selective drugs, Structure activity relationship, pharmacological/biochemical mechanism of action, Therapeutic uses of following category of agents: (special emphasis should be given to specified drugs)

2. Drugs affecting neurotransmission: a. Drug acting on cholinergic neurotransmission: Neurochemistry and stereochemistry of acetylcholine, Cholinergic, anti-cholinergic, anti-cholinesterase agents and neuromuscular blocking agents (Acetylcholine chloride, Carbachol chloride, Atropine,

Pyridostigmine bromide, Succinyl choline chloride and Tropicamide). b. Drug acting on adrenergic neurotransmission: Neurochemistry and stereochemistry of Norepinephrine, Adrenergic agents, Sympathomimetic agents, Adrenergic receptor antagonists (Ephedrine, Epinephrine, Isoprenaline, Phenylpropanolamine hydrochloride and Propranolol). c. Drug acting on serotonergic neurotransmission: Neurochemistry and stereochemistry of

Serotonin, Serotonergic agonists and antagonistic agents.

d. Local Anesthetic agents: Benzocaine, Procaine hydrochloride, Lignocaine hydrochloride,

Bupivacaine hydrochloride, and Dibucaine hydrochloride.

3. Drugs affecting the Immune System: Non-steroidal anti-inflammatory agents, analgesics and anti-pyretic: Chemistry of inflammatory mediators, Prostaglandins, Leukotrienes and Thromboxanes (Aspirin, Acetaminophen, Indomethacin, Ibuprofen, Naproxen, Piroxicam, Phenylbutazone, Oxyphenbutazone and Celecoxib). Antihistamines, anti-allergic and anti-ulcer agents: Neurochemistry and stereochemistry of histamine, Dual acting anti-histaminics, H₂ and H₃ antagonists (Diphenhydramine Hydrochloride, Bromodiphenhydramine Hydrochloride, Chlorcyclizine Hydrochloride, Promethazine Hydrochloride, Phenindamine Tartrate and Chlorpheniramine Maleate).

4. Drugs affecting the Respiratory System: Anti-asthmatics, Expectorants and Anti-tussive agents (Salbutamol, Terbutaline, Acetylcysteine, Bromhexine Hydrochloride, Guaifensin and Levopropoxyphene Napsylate).

5. Miscellaneous agents: a. Diagnostic and Medicinal dyes (Congo Red, Evans Blue, Erythrosine Sodium, Iodipamide Meglumine, Phenolsulphonphthalein, Indocyanin Green And Fluorescein Sodium). b. Pharmaceutical aids.

PHARMACOGNOSY III

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following Alkaloid containing drugs:

a. Tropane: Belladonna, hyoscyamus, datura, coca and withania.

b. Quinoline and isoquinoline: Cinchona, ipecac and opium.

c. Indole: Ergot, rauwolfia, catharanthus, nux-vomica, physosüigma.

d. Steroidal: Veratrum and kurchi.

e. Steroidal amine: Ephedra and colchicum.

f. Purines: Coffee, tea and cola.

2. A brief account of plant-based industries and institutions involved in work on medicinal and aromatic plants in India, utilization and production of phytoconstituents such as Quinine, Calcium sennosides, Podophyllotoxin, Diosgenin, Solasodine and Tropane Alkaloids.

3. Utilization of aromatic plants and derived products with special reference to Sandalwood oil, Mentha oil, Lemon grass oil, Vetiver oil, Gentium oil and Eucalyptus oil.

4. Marine pharmacognosy novel medicinal agents from marine sources.

5. Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.

6. Holistic concept of drug administration in traditional systems of medicine, introduction to ayurvedic preparations like arishtas, asavs, gutikas, tailas, churans, lehyas and bhasmas.

PHARMACOLOGY-I

1. General Pharmacology

a. Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, combined effects of drugs, factors modifying drug action, tolerance and dependence, pharmacogenetics.

b. Absorption, distribution, metabolism and excretion of drugs, principle of basic and clinical pharmacokinetics adverse drug reactions and treatment of poisoning, ADME drug interactions, receptors, bioassay of drugs and biological standardization, discovery and development of new drugs. Introduction to clinical trials, bioavailability and bioequivalence studies.

2. Pharmacology of peripheral nervous system
a. Neurohumoral transmission (autonomous and somatic)
b. Parasympathomimetic, parasympatholytic and sympathomimetics.
c. Adrenergic receptors and neuron blocking agents, ganglionic stimulants.

and blocking agents.

d. Neuromuscular blocking agents.
e. Local anaesthetic agents.

3. Pharmacology of drugs acting on gastrointestinal tract

a. Antacids, anti-secretory and anti-ulcer drugs (pathophysiology of ulcer).

b. Laxatives and anti-diarrhoeal drugs.

c. Appetite stimulants and suppressants.

d. Emetics and anti-emetics.

e. Carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.

4. Autacoids:

a. Histamine, bradykinin, 5-HT and their antagonists.

b. Prostaglandins, leukotrienes and platelet activating factors.

c. Pentagastrin, cholecystokinin, angiotensin, bradykinin and substance P

5. Analgesic, antipyretic, anti-inflammatory (vascular and cellular events of acute inflammation, chemical mediators of inflammation, pathogenesis of chronic inflammation), anti-gout and anti rheumatic drugs (pathophysiology of gout and rheumatoid arthritis)

6. Pharmacology of drugs used for respiratory system: Anti-asthmatic drugs (pathophysiology of asthma) including bronchodilators, antitussives, expectorants and respiratory stimulants.

PHARMACEUTICS - VIII (PHARMACEUTICAL TECHNOLOGY-II)

1. Microencapsulation: Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, co-precipitation, multiorifice centrifugal, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of microcapsules.

2. Parenteral products:

a. Preformulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles, and isotonicity.
b. Aseptic techniques: Sources of contamination and methods of prevention, design of aseptic area, laminar flow bench services and maintenance.

c. Formulation details, containers and closures and their selection.

d. Pre-filling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization and preparation of sterile powders, equipments for large-scale manufacture and evaluation of parenteral products.

3. Design, development, production and evaluation of controlled released formulations.

4. Novel drug delivery systems: Drawbacks and deficiencies of conventional drug delivery systems, introduction to novel drug delivery systems, e.g., transdermal drug delivery patches, ocular inserts and osmotic pumps, introduction of liposomes and prodrugs.

5. Ophthalmic preparations: Requirements, formulation and methods of preparations, containers, and evaluation.

PHARMACEUTICAL BIOTECHNOLOGY

1. Introduction, historical perspective, genomics, proteonomics and other biotechnology related techniques, scope and future of pharmaceutical biotechnology.

2. Enzyme immobilization: Introduction, factor affecting enzyme kinetics, Technique of immobilization of enzymes, immobilization of plant and bacterial cell, study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylase and protease, therapeutic applications of enzyme immobilization.

3. rDNA technology: Introduction, transformation, conjugation, transduction, protoplast fusion and plasmid mediated gene transfer, gene cloning including enzymes acting on DNA, cloning vectors, insertion of target DNA into vector, transformation and growth of cells, selection of recombinant clones and their applications, techniques of genetic engineering, study of drugs produced by biotechnology such as activase, humulin, human tropic, HB etc.

4. Vaccine technology: Introduction, immunological principles, conventional vaccines, modern vaccine technologies, development of hybridoma for monoclonal antibodies and monoclonal antibody based pharmaceuticals, pharmaceutical considerations of vaccines.

5. Fermentation: Introduction to fermentation, fermenters and types of fermenters, factors affecting design of fermenter, the fermentation process and its optimization with special reference to ethyl alcohol, riboflavin, cephalosporin and ascorbic acid.

6. Production and downstream processing of biotech products: Introduction, production, downstream processing, issues to consider in production and purification of proteins, formulation of biotech products and its biopharmaceutical considerations, pharmacokinetics and pharmacodynamics of peptide and protein drugs.

7. Plant tissue culture: Introduction, laboratory requirements, cellular totipotency, types of cultures, protoplast fusion and somatic hybridization, transgenic plants and application of transgenic plants, cryopreservation and application of PTC in Pharmacy.

PHARMACEUTICAL CHEMISTRY-VI (MEDICINAL CHEMISTRY-II)

Classification, synthesis of selective drugs, Structure-activity relationship, Pharmacological/Biochemical mechanism of action, Therapeutic uses of following category of agents: (special emphasis should be given to specified drugs)

1. Drugs affecting central nervous system:

General Anesthetics: Thiopental sodium, Ketamine Hydrochloride, Methohexital Sodium, Paraldehyde and Tribromoethanol. Sedatives and Hypnotics: phenobarbital, methylphenobarbital, allobarbital, butobarbitone, amobarbital, hexobarbital, pentobarbital sodium, cyclobarbital. Nitrazepam and Glutethimide. Antiepileptic or anticonvulsant agents: Phenytoin Sodium, Trimethadione, Phensuximide, Ethosuximide, Valproic Acid and Primidone. Opioid Analgesics: Morphine, Diamorphine Hydrochloride, Codeine, Levorphanol Tartrate, Dextromethorphan Hydrobromide, Pentazocine, Pethidine Hydrochloride, Fentanyl Citrate, Methadone Hydrochloride, Nalorphine Hydrochloride, and Naloxone Hydrochloride.

Antiparkinsonian agents and Spasmolytic agents: Biperiden Hydrochloride, Trihexyphenidyl Hydrochloride, Benztropine Mesylate, Orphenadrine Citrate, Chlorphenoxamine Hydrochloride and Levodopa. CNS Stimulants: Caffeine, Theobromine, Nikethamide, Etamivan, Pentetrazol, Bemegrade, and Methylphenidate. Psychopharmacological Agents: Neuroleptics, antidepressant and anxiolytic agents

(Nikethamide, Doxapram Hydrochloride, Dextroamphetamine Sulphate, Pentylenetetrazole, Amitriptyline Hydrochloride, Imipramine Hydrochloride, Doxepin Hydrochloride, Phenylidine, Tetrahydrocannabinol, Chlorpromazine Hydrochloride, Triflupromazine, Thioridazine Hydrochloride, Prochlorperazine Maleate, Trifluoperazine Hydrochloride, Thiothixene, Haloperidol, Droperidol, Resperidone, Chlordiazepoxide, Diazepam, Oxazepam, Lorazepam, Halazepam, Flurazepam and Alprazolam).

2. Drugs affecting Hormonal System:

a. Thyroid hormones and Antithyroid agents: Biosynthesis of thyroid hormones Propylthiouracil, Methimazole, Carbimazole and I131. b. Insulin and Oral Hypoglycaemic agents: Chemistry of Insulin and its preparations (Chlorpropamide, Tolbutamide, Glimepride, Glipizide, Rosiglitazone, Pioglitazone, Metformin, Phenformin, Acarbose, Miglitol, Repaglinide). c. Steroidal agents: Steroidal nomenclature, Stereochemistry, Biosynthesis, Interconversions of androgens, estrogens, progesterones and adrenocorticoids. Androsterone, testosterone, estrone, estriol, estradiol, diethylstilbesterol, progesterone, cortisone, prednisolone and Dexamethasone. Drugs affecting Haematopietic System: Antithrombotic, Thrombolytic and Anticoagulant agents (Warfarin Sodium, Protamine Sulphate, Dicoumarol, Phenindione and Anisindione).

4. Chemistry and physiological importance of water & lipid soluble Vitamins.

PHARMACEUTICS -IX (PACKAGING TECHNOLOGY)

1. Packaging of pharmaceutical dosage form: Introduction, Definition and function, Regulatory requirements, Nature of package evaluation, Types of packaging.

2. Packaging of solid oral dosage form: Scope, Packaging, stability and shelf life of containers and closures, Unit dosage packaging.

3. Packaging of semisolids and topical: Scope, regulatory requirements, containers and closures.

4. Glass packaging materials: Containers and closures, Glass as a packaging material, composition and types.

5. Plastic packaging materials: Containers and closures, introduction, classification of plastic materials.

6. Metal packaging materials: Containers and closures, Introduction, Modern packaging metal, Tinplate and associated materials aluminium.

7. Tamper-resistant packaging: Introduction, Film wrapper, Blister package, Strip package, Bubble pack, foil, pouches, bottle seals and tape seals.

8. Child resistant package.

PHARMACOLOGY-II

1. Pathophysiology of CNS diseases and pharmacology of drugs used to treat them a. Neurohumoral transmission in CNS: Cholinergic pathways, Dopaminergic pathways, Serotonergic pathways, Noradrenergic pathways.b. General anesthetics, alcohol and disulfiram.c. Hypnotics, sedatives, anti-anxiety agents, and centrally acting muscle relaxants.d. Psychopharmacological agents: Antipsychotics, Antidepressants, Anti-manics andHallucinogens.e. Antiepileptic drugsf. Narcotic analgesics and antagonistsg. Drugs used in neurodegenerative diseases: Parkinson's disease and Alzheimer's disease h. Drug addiction and drug abuse: Alcohol, Nicotine and Cannabis.i. CNS stimulants

2. Pathophysiology of diseases of endocrine system and pharmacology of drugs used fortheir treatment.

a. Hypothalamic and pituitary hormones.b. Thyroid hormones and anti thyroid drugs.c. Insulin, oral hypoglycemic agents and glucagons.d. Corticosteroids.e. Androgens, anabolic steroids and drugs for erectile dysfunction.f. Estrogens, progestins and oral contraceptives.g. Oxytocin and drugs acting on the uterus.h. Parathormone, calcitonin and vitamin D, ACTH and corticosteroids.

3. Drug acting on Haematopietic system a. Haematinics (pathophysiology of anaemia) b. Anticoagulants c. Fibrinolytic and antiplatelet drugs d. Blood and plasma volume expanders.

PHARMACEUTICS-X (BIOPHARMACEUTICS AND PHARMACOKINETICS)

Biopharmaceutics

1. Introduction: Definition and significance of Biopharmaceutics in formulation development.

2. Gastrointestinal absorption of Drugs: Passage of drugs across biological membranes nature of biological membranes, gastrointestinal absorption mechanism.
3. Factor affecting Drug absorption: Physiological factors, dietary factors, physicochemical factors, pH partition hypothesis, and dosage form factors.
4. Methods of studying gastrointestinal absorption: *In vitro* and *in vivo* methods.
5. Drug Disposition: Distribution in blood, cellular distribution, plasma protein binding, tissue protein binding.
6. Drug Excretion: Routes of drug excretion, renal excretion of drugs, factors affecting renal excretion, biliary and salivary excretion of drugs.
7. Drug Biotransformation: Pathways of drug metabolism, drug metabolizing, enzymes, and factors affecting drug metabolism, inhibition and stimulation of drug metabolism.

Pharmacokinetics

1. Definition and need of pharmacokinetic and clinical pharmacokinetics.
2. Introduction to pharmacokinetic parameters, biological half-life, volume of distribution, clearance, rate constants for elimination.
3. One compartment model: Single dosing-intravenous injection and oral absorption, determination of pharmacokinetic parameters from plasma and urine data, measurements of C_{max}, T_{max}, and AUC.
4. Bioavailability and Bioequivalence: Definition and detailed protocol, Significance of Bioavailability and Bioequivalence studies. Regulatory requirements.

PHARMACEUTICAL CHEMISTRY-VII (MEDICINAL CHEMISTRY-III)

1. Drug Design and Development: Relationship of functional groups to pharmacological activity, Prodrug Design, Analog Design, Topliss Tree Approach, Craig's Plot, Quantitative Structure Activity Relationship (QSAR), Hansch Analysis, Free Wilson Analysis, Fujita Ban Approach, Topological QSAR, Introduction to Computer Aided Drug Design, Molecular Mechanics, Quantum Mechanics, De-Novo Design, 3D QSAR Approaches, Ligand based design, Structure based drug design, applications and case study related to QSAR.
2. Modern Medicinal Chemistry: Introduction to Combinatorial Chemistry, High throughput screening, Green Chemistry and Microbial biotransformation. Classification, synthesis of selective drugs, Structure-activity relationship, Pharmacological/Biochemical mechanism of action, Therapeutic uses of following category of agents: (special emphasis should be given to specified drugs)
3. Drugs affecting the Cardiovascular System:
 - a. Anti-anginal and Vasodilators: Amylnitrate, Nitroglycerin, Isosorbide Dinitrate, Verapamil, Diltiazem, Nifedipine, Amlodipine, Digoxin, and Digitoxin.
 - b. Anti-arrhythmic agents: Quinidine Sulphate, Procainamide Hydrochloride, Lidocaine Hydrochloride and Phenytoin Sodium.
 - c. Antihypertensive agents: Captopril, Enalapril, Quinapril Hydrochloride, Losartan, Reserpine, Guanethidine, Clonidine Hydrochloride, Hydralazine Hydrochloride, Sodium Nitroprusside and Minoxidil.
 - d. Antihyperlipidemic agents: Clofibrate, Gemfibrozil, Atorvastatin, Lovastatin, Dextrothyroxine Sodium, Cholestyramine Resin, Niacin and Probucol.
4. Drugs affecting the Urinary System: Diuretics: Chlorothiazide, Hydrochlorothiazide, Cyclothiazide, Cyclopenthiiazide, Methylclorthiazide, Trichlormethiazide, Acetazolamide, Methazolamide, Ethozolamide, Furosemide, Ethacrynic Acid and Triamterene.
5. Chemotherapeutic agents:
 - I Antibiotics and Antibacterial agents. Sulphonamides: Sulphanilamide, Sulphapyridine, Sulphathiazole, Sulphadiazine, Sulphamerazine, Sulphadimidine and Dapsone.
 - a. Antibiotics: Penicillin V, Cloxacillin Sodium, Cephazolin Sodium, Chloramphenicol, Aminoglycosides (Streptomycin, Neomycin and Kanamycin), Macrocyclics (Erythromycin, Clarithromycin and Roxithromycin), Tetracyclines, Vancomycin, Valinomycin, Polymyxin and Flouroquinolones.
 - II Antiparasitic agents: Antiprotozoal and Anthelmintic agents.
 - III Antiamoebic agents: Metronidazole, Tinidazole and Diloxanide Furoate.
 - IV Antimalarial drugs: Chloroquine Phosphate, Amodiaquine, Pamaquine, Pentaquine Phosphate, P-Chloroguanil Hydrochloride, Cycloguanil Embonate, Pyrimethamine and Trimethoprim.

V Antifungal agents: Fluconazole, Tolnaftate, Clotrimazole, Miconazole, Ketoconazole, Fluconazole, Amphotericin-B, and Griseofulvin.

VI Antimycobacterial agents: Pyrazinamide, Rifampin, Ethambutol Hydrochloride, Isoniazid and Ethionamide.

VII Anticancer agents, Immunosuppressants and Immunostimulants : Cyclophosphamide, Chlorambucil, Busulfan, Methotrexate, Azothiopurine, Cytarabine, Fluorouracil, Methotrexate, Dactinomycin, Daunorubicin Hydrochloride, Doxorubicin Hydrochloride, Etoposide, Vinblastin Sulphate, Vincristin Sulphate and Cisplatin.

VIII Antiviral including anti-HIV agents: Amantadine Hydrochloride, Rimantadine Hydrochloride, Idoxuridine Trifluoride, Acyclovir, Gancyclovir, Zidovudine and Ritonavir.

PHARMACOLOGY-III

1. Pathophysiology of microbial diseases (Tuberculosis, leprosy, fungal diseases, urinary tract infections, sexually transmitted diseases) and pharmacology of drugs used for their treatment

a. General principles of Chemotherapy, b. Sulfonamides and cotrimoxazole, c. Antibiotics: Penicillins, Cephalosporins, Aminoglycosides, Chloramphenicol, Macrolides, Tetracyclines, Quinolones, fluoroquinolones and Miscellaneous antibiotics, d. Anti-mycobacterial drugs, e. Anti-viral and anti-HIV drugs, f. Anti-malarial drugs, g. Drugs for amoebiasis and other protozoal infections, h. Anthelmintics

2. Pathophysiology of Cardiovascular diseases (Hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction) and pharmacology of drugs used for their treatment. a. Cardiac glycosides, b. Antiarrhythmic drugs, c. Antianginal drugs, d. Antihypertensive drugs, e. Anti-hyperlipidemic drugs

3. Anti-neoplastic drugs (pathophysiology of cancer), immunostimulants and immunosuppressive agents.

4. Drugs acting on urinary system: Diuretics

PHARMACOLOGY-IV

1. Principles of Clinical Pharmacology: Dose individualization, Clinical pharmacokinetics, influence of disease on pharmacokinetics and pharmacodynamics, Population pharmacokinetics.

2. Drugs used during infancy, neonates, in the elderly persons and their bio-pharmaceutics.

3. Drugs used during pregnancy and drug induced diseases.

4. The principles, mechanism and clinical evaluation of drug interactions.

5. Common clinical laboratory tests and their interpretation.

6. General principles of Clinical toxicology.

7. Therapeutic Drug Monitoring, Concept of Essential Drugs and Rational Drug use.

8. Principles of Toxicology: Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning, Heavy metals and heavy metal antagonists.

PHARMACEUTICAL INDUSTRIAL MANAGEMENT AND ACCOUNTANCY

1. **Concept of Management:** Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/Morale), Principles of Management (Co-Ordination, Communication, Motivation, Decisionmaking, Leadership, Innovation, Creativity, Delegation of Authority/Responsibility, Record Keeping), Identification of Key Points to give maximum thrust for development and perfection.

2. **Economics:** Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labour welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.

3. **Materials Management:** A brief exposure or basic principles of materials management major areas, scope, purchase, stores, inventory control, an evaluation of material management.

4. **Production Management:** A brief exposure of the different aspects or Production, Management-Visible and Invisible inputs, Methodology of Activities, Performance Evaluation Technique, Process-Flow, Process Know-how, Maintenance Management.

5. **Accountancy:** Principles of Accountancy, Ledger posting and book entries, preparation of trial balance, columns of a cash book, bank reconciliation statement, rectification of errors, Profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques, bills of exchange, promissory notes and Hundies, documentary bills.

PHARMACEUTICAL ANALYSIS- IV (QUALITY ASSURANCE)

1. Quality assurance: Concept, Scope, quality control, auditm, total quality management.
2. Development of new analytical methods.
3. Validation: Definition, types, validation of manufacturing and analytical equipments, validation of analytical procedures, importance and limitations of validation, organization for validation.
4. Pharmaceutical manufacturing documentation (PMD): Introduction, guidelines for designing and implementation of PMD programs.
5. Documentation: Protocols, forms and maintenance of records in pharmaceutical industries, preparation of documents for new drug approval and export registration to United States, United Kingdom, Europe and Africa.
6. Patent processing and its applications.
7. Requirement of GMP, GLP, ISO 9000, WHO and U.S. F.D.A.
8. In-process quality control tests, IPQC problems in pharmaceutical industries, sources and control of quality variation, total quality management.
9. Sampling plans, sampling and operating characteristics curves, interpretation of analytical data.
10. Regulatory control and regulatory drug analysis.

ELECTIVE

1. Drug Design 2. Pharmaceutical Sales and Marketing 3. Food Science Technology

1. DRUG DESIGN

1 Drug Discovery, Design and Development: Introduction to drug design and development, stages of drug design and development, finding a lead, optimizing target interactions, optimizing access to target.

2 Quantum Mechanics and Molecular Dynamics: Introduction to quantum mechanics, Postulates of quantum mechanics, electronic structure, AB initio, semi-empirical, density functional and molecular orbital theories. Introduction to molecular mechanisms, Vander Waal interaction, electrostatic interaction, force field and energy minimization. Introduction to Molecular Dynamics, Conformational searching, Systematic search and applications.

3 Ligand Based Drug Design: Introduction to QSAR, lead molecule, linear and nonlinear modeled QSAR equations, statistics used in QSAR, physicochemical parameter and molecular descriptors, Hansch approach, Fujita-Ban approach, Hybrid QSAR, Graph Theory, Topological QSAR, 3D-QSAR, MSA, RSA, CoMFA, CoMSIA, Pharmacophore mapping and applications of QSAR in drug discovery, Case study: Tubulin polymerization inhibitors

4 Structure Based Drug Design: Methods to derive 3D structures, X-ray crystallography and NMR spectroscopy, pharmacophores, molecular docking, De novo design, Free energies and salvation, electrostatic and non-electrostatic contribution to free energies, 3D data base searching and virtual screening, molecular similarity and similarity searching, combinatorial libraries – generation and utility and further applications on the design of new molecule, Case study: Thymidylate synthase inhibitors and HIV protease inhibitors.

5 Comparative Protein Modeling: Modeling by Homology-the alignment, construction of frame work, selecting variable regions, side chain placement and refinement, validation of protein models– Ramchandran plot, threading and AB initio modeling, Case study: p38 kinase.

PHARMACEUTICAL SALES AND MARKETING

1. Introduction to Pharmaceutical Marketing Management
2. Marketing Task: Demand States & Marketing task, Scope of Marketing and Different Markets
3. Concept of Marketing: Definition of marketing, Distinction between marketing & Selling, Core Marketing Concept, Marketing Place, Marketing Space, Target Market, Segmentation of Market, Needs, Wants & Demands, Product offering, value & satisfaction, Relationship net work, Supply chain

competition, Marketing environment, marketing mix (4 P Components), Other concept's name under marketing activities.

4. Marketing Opportunities Market Oriented Strategic Planning: SWOT Analysis, Strategic Formulation and Product Planning. Gathering Information and Measuring Demand: MIS, Market Research, Behavioural Research, Marketing Research, Forecasting & Demand Measurement. Analyzing Consumer Markets & Buyer Behavior: Influencing Buyer Behavior, Buying Decision Process, Motivation of Physician towards Brand. Dealing With The Competition - Identifying Competitors, Analyzing Competitors, Strategies, Strength & Weakness, Designing Competitive Strategies.

5. Developing Market Strategies & Marketing Mix, Product Strategy Positioning & Differentiating the Market Offering (Product): Positioning to Promote Product Life Cycle Marketing Strategies. New Market Offering: Which markets to Enter, How to Enter the Market, Product Development, Market Testing.

Setting the Product Strategy: Product & Product Mix, Product Line Analysis, Brand Decision, Packaging & Labeling.

6. Managing & Delivering Marketing Programs.

Value Net-Work & Marketing Channels: Channel Functions, Channel Levels, Channel Management, Decisions, Selecting, Training, Motivating & Evaluating Channels Members, Channel Dynamics, Conflicts, Co- Operation & Competitions. Managing Retailing, Wholesaling & Market Logistics: Types of Retailing, Types of Wholesaling. Managing Advertising, Sales Promotion & Public Relations: Advertising Objective, Choosing the Advertising Message, Measuring Effectiveness of Advertisement, Sales Promotion & Purpose, Public Relations. Managing Sales Force: Recruitment & Selecting Representative, Training Sales Representative, Supervising, Norms for Customer Calls, Motivating Sales Representative, Evaluating Sales Representative.

FOOD SCIENCE TECHNOLOGY

1. Food Chemistry: Food quality characteristics, Composition and nutritive value of common foods, structure, properties and metabolic function of food constituents like water, carbohydrates, lipids, proteins, enzymes, vitamins, minerals, pigments, colors and flavoring substances; Undesirable constituents in food, Changes in food constituents during processing and storage.

2. Food Microbiology: Microbial groupings and identification, Nutrient requirements for bacterial culture, Growth and inactivation kinetics, Harmful and beneficial effects of microbes, microbes in food industry, Food spoilage, poisoning and intoxication.

3. Food Process Principles: Basic principles and techniques of food preservation and processing.

4. Food Technology: Technological process for industrial manufacture of selected foods of commercial importance like Jelly, Pickles, Carbonated beverages, Fruit beverages, Bakery and Confectionary products and Dairy products.

5. Food laws and standards: Food additives, Food packaging, Quality control in food industry.