Syllabus for GPAT - 2013

PHARMACEUTICS

Introduction to Physical pharmacy

Matter, Properties of Matter:

State of matter, change in the state of matter, latent heats and vapor pressure, sublimation-critical point, Eutectic mixtures, gases, aerosols-inhalers, relative humidity, liquid. Complexes, liquid crystals, glassy state, solids- crystalline, amorphous and polymorphism.

Micromeretics and Powder Rheology:

Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, methods of determining particle size- optical microscopy, sieving, sedimentation; measurements of particle shape, specific surface area; methods for determining surface area; permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

Surface and Interfacial Phenomenon:

Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid-gas and solid-liquid interfaces, complex films, electrical properties of interface.

Viscosity and Rheology:

Newtonian systems, Law of flow, kinematic viscosity, effect of temperature; non-Newtonian systems: pseudoplastic, dilatant, plastic; thixotropy, thixotropy in formulation, negative thixotropy, determination of viscosity, capillary, falling ball, rotational viscometers.

Dispersion Systems:

Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian motion, sedimentation of flocculated particles, sedimentation

parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations; Emulsions-types, theories, physical stability.

Complexation:

Classification of complexes, methods of preparation, analysis, & applications.

Kinetics and Drug Stability:

General considerations & concepts, half-life determination, Influence of temperature, light, solvent, catalytic species and other factors, Accelerated stability study, expiration dating.

Importance of microbiology in pharmacy

Structure of bacterial cell; Classification of microbes and their taxonomy:

Actinomycetes, bacteria, rickettsiae, spirochetes and viruses.

Identification of Microbes:

Stains and types of staining techniques, electron microscopy; Nutrition, cultivation, isolation of bacteria, actinomycetes, fungi, viruses, etc; microbial genetics and variation.

Control of microbes by physical and chemical methods:

Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation;.

Sterilization:

Different methods, validation of sterilization methods &equipments; Sterility testing of all pharmaceutical products. Microbial assays of antibiotics, vitamins & amino acids.

Immunology and Immunological Preparations:

Principles, antigens and heptans, immune system, cellular/humoral immunity, immunological tolerance, antigen-antibody reactions and their applications. Hypersensitivity, active and passive immunization. Vaccines and sera: their preparation, standardization and storage.

Genetic Recombination:

Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications.Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as Activase, Humulin, Humatrope, HB etc.

Antibiotics:

Historical development of antibiotics. Antimicrobial spectrum and methods used for their standardization. Screening of soil for organisms producing antibiotics, fermenter, its design, control of different parameters. Isolation of mutants, factors influencing rate of mutation. Design of fermentation process. Isolation of fermentation products with special reference to penicillins, streptomycins, tetracyclines and vitamin B12.

Introduction to pharmaceutical jurisprudence & ethics

Pharmaceutical Legislations:

A brief review; Drugs & Pharmaceutical Industry - A brief review; Pharmaceutical Education

An elaborate study of the followings:

Pharmaceutical Ethics; Pharmacy Act 1948; Drugs and Cosmetics Act 1940 and Rules 1945; Medicinal & Toilet Preparations (Excise Duties) Act 1955; Narcotic Drugs & Psychotropic Substances Act 1985 & Rules; Drugs Price Control Order.

A brief study of the following Acts with special reference to the main provisions and the latest amendments:

Poisons Act 1919; Drugs and Magic Remedies (Objectionable Advertisements) Act 1954; Medical Termination of Pregnancy Act 1970 & Rules 1975; Prevention of Cruelty to Animals Act 1960; States Shops & Establishments Act & Rules; Insecticides Act 1968; AICTE Act 1987; Factories Act 1948; Minimum Wages Act 1948; Patents Act 1970.

A brief study of the various Prescription/Non-prescription Products. Medical/Surgical accessories, diagnostic aids, appliances available in the market.

Introduction to dispensing and community pharmacy

Prescription:

Handling of prescription, source of errors in prescription, care required in dispensing procedures including labeling of dispensed products. General dispensing procedures including labeling of dispensed products; Pharmaceutical calculations: Posology, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipes percentage solutions, alligation, alcohol dilution, proof spirit, isotonic solutions, displacement value etc.

Principles involved and procedures adopted in dispensing of :

Typical prescriptions like mixtures, solutions, emulsions, creams, ointments, powders, capsules, pastes, jellies, suppositories, ophthalmic, pastilles, lozenges, pills, lotions, liniments, inhalations, paints, sprays, tablet triturates, etc.

Incompatibilities:

Physical and chemical incompatibilities, inorganic incompatibilities including incompatibilities of metals and their salts, non-metals, acids, alkalis, organic incompatibilities. Purine bases, alkaloids, pyrazolone derivatives, amino acids, quaternary ammonium compounds, carbohydrates, glycosides, anesthetics, dyes, surface active agents, correction of incompatibilities. Therapeutic incompatibilities.

Community Pharmacy:

Organization and structure of retail and whole sale drug store-types of drug store and design, legal requirements for establishment, maintenance and drug store-dispensing of proprietary products, maintenance of records of retail and wholesale, patient counseling, role of pharmacist in community health care and education (First aid, communicable diseases, nutrition, family planning).

Organization and Structure of hospital pharmacy:

Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist, Pharmacy and therapeutic committee, Budget preparation and Implementation.

Hospital Formulary:

Contents, preparation and revision of hospital formulary.

Drug Store Management and Inventory Control:

Organization of drug store, Types of materials stocked, storage conditions; Purchase and Inventory Control principles, purchase procedures, Purchase order, Procurement and stocking.

Drug distribution Systems in Hospitals:

Out-patient dispensing, methods adopted; Dispensing of drugs to in-patients. Types of drug distribution systems. Charging policy, labeling; Dispensing of drugs to ambulatory patients; Dispensing of controlled drugs, Dispensing of ancillary supplies.

Central Sterile Supply Unit and their Management:

Types of materials for sterilization, Packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.

Manufacture of Sterile and Non-sterile Products:

Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, Master formula Card, production control, Manufacturing records.

Drug Information Services:

Sources' of Information on drugs, disease, treatment schedules, procurement of information, Computerized services (e.g., MEDLINE), Retrieval of information, Medication error- types of medication errors, correction and reporting.

Records and Reports:

Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases. Pharmacoeconomics: Introduction to pharmacoeconomics, different methods of pharmacoeconomics, application of pharmacoeconomics.

Pharmacoepidemiology: Definition and scope, method to conduct pharmacoepidemiological studies, advantages & disadvantages of pharmacoepidemiological studies.

Nuclear Pharmacy:

Methods of handling radioisotopes, radioisotope committee.

Importance of unit operations in manufacturing, Stoichiometry:

Unit processes

Material and energy balances, molecular units, mole fraction, tie substance, gas laws, mole volume, primary and secondary quantities, equilibrium state, rate process, steady and unsteady

states, dimensionless equations, dimensionless formulae, dimensionless groups, different types of graphic representation, mathematical problems.

Fluid Flow:

Types of flow, Reynold's number, Viscosity, Concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.

Heat transfer:

Concept of heat flow, applications of Fourier's law, forced and natural convection, surface coefficients, boiling liquids, condensing vapors, heat exchangers, heat interchangers, radiation, black body, Stefan Boltzmann equation, Kirchoff's law.

Evaporation:

Basic concept of phase equilibria, factor affecting evaporation, evaporators, film evaporators, single effect and multiple effect evaporators, Mathematical problems on evaporation.

Distillation:

Roult's law, phase diagrams, volatility; simple steam and flash distillations, principles of rectification, Mc-Cabe Thiele method for calculations of number of theoretical plates, Azeotropic and extractive distillation.

Drying:

Moisture content and mechanism of drying, rate of drying and time of drying calculations; classification and types of dryers, dryers used in pharmaceutical industries and special drying methods.

Size Reduction:

Definition, objectives of size reduction, mechanisms of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mills including ball mill, hammer mill, fluid energy mill. Size separation: Different techniques of size separation, sieves, sieve shakers, sedimentation tank, cyclone separators, bag fillers Etc.

Mixing:

Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments.

Filtration and Centrifugation:

Theory of filtration, continuous and batch filters, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, Etc. Factors affecting filtration, filtration, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, and centrifugal sedimenters.

Crystallization:

Characteristics of crystals like-purity, size, shape, geometry, habit, forms size and factors affecting them, Solubility curves and calculation of yields. Material and heat balances around Swenson Walker Crystallizer. Supersaturation, theory and its limitations, Nucleation mechanisms,

crystal growth.Study of various types of Crystallizers, tanks, agitated batch, Swenson Walker, Single vacuum, circulating magma and Krystal Crystallizer, Caking of crystals and its prevention. Numerical problems on yields;

Dehumidification and Humidity Control:

Basic concepts and definition, wet bulb and adiabatic saturation temperatures, Hygrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations;

Refrigeration and Air Conditioning:

Principle and applications of refrigeration and air conditioning;

Material of Construction :

General study of composition, corrosion, resistance, Properties and applications of the materials of construction with special reference to stainless steel and glass.

Material Handling Systems:

Liquid handling - Different types of pumps, Gas handling-Various types of fans, blowers and compressors, Solid handling-Bins, Bunkers, Conveyers, Air transport.

Corrosion:

Classification, mechanism of corrosion, factors affecting, prevention and control.

Plant location:

Layout, utilities and services.

Industrial Hazards and Safety Precautions:

Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, Accident records Etc.

Automated Process Control Systems:

Process variables, temperature, pressure, flow, level and vacuum and their measurements; elements of automatic process control and introduction to automatic process control systems; elements of computer aided manufacturing (CAM). Reactors and fundamentals of reactors design for chemical reactions.

Dosages Forms, designing & evaluation

Liquid Dosages Forms:

Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors and others, manufacturing packaging, labeling, evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia;

Semisolid Dosage Forms:

Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging;

Suppositories:

Ideal requirements, bases, displacement value, manufacturing procedure, packaging and evaluation;

Extraction and Galenical Products:

Principle and method of extraction, preparation of infusion, tinctures, dry and soft liquid extracts;

Blood Products and Plasma Substitutes:

Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, foam plasma substitutes, -ideal requirements, PVP, dextran Etc. for control of blood pressure as per I.P.;

Pharmaceutical Aerosols:

Definition, propellants, general formulation, manufacturing' and packaging methods, pharmaceutical applications;

Ophthalmic Preparations:

Requirements, formulation, methods of preparation, labeling, containers, evaluation;

Cosmeticology and Cosmetic Preparations:

Fundamentals of cosmetic science, structure and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin, hair, dentifrice and manicure preparations like nail polish, nail polish remover, Lipsticks, eye lashes, baby care products Etc.

Capsules:

Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, formulation, method of capsule filling, soft gelatin, capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

Micro-encapsulation:

Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, coacervation, multi-orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.

Tablets:

Advantages and disadvantages of tablets, Application of different types of tablets, Formulation of different types of tablets, granulation, technology on large-scale by various techniques, different

types of tablet compression machinery and the equipments employed, evaluation of tablets. Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating, coating process, evaluation of coated tablets. Stabilityk inetics and quality assurance.

Parenteral Products:

Pre-formulation factors, routes of administration, water for injection, and sterile water for injection, pyrogenicity, non- aqueous vehicles, isotonicity and methods of its adjustment, Formulation details, Containers and closures and selection, labeling; Pre-filling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products; Aseptic Techniques-source of contamination and methods of prevention, Design of aseptic area, Laminar flow bench services and maintenance. Sterility testing of pharmaceuticals.

Surgical products:

Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc., bandages, adhesive tape, protective cellulosic hemostastics, official dressings, absorbable and non-absorbable sutures, ligatures and catguts.

Packaging of Pharmaceutical Products:

Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influence choice of containers, legal and official requirements for containers, package testing.

Designing of dosage forms:

Pre-formulation studies, Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant. Solubility, dissolution and organoleptic properties 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. Study of pro-drugs in solving problems related to stability, bioavailability and elegancy of formulations. Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions. Stabilization and stability testing protocol for various pharmaceutical products.ICH Guidelines for stability testing of formulations.

Performance evaluation methods:

In-vitro dissolution studies for solid dosage forms methods, interpretation of dissolution data. Bioavailability studies and bioavailability testing protocol and procedures. In vivo methods of

evaluation and statistical treatment.GMP and quality assurance, Quality audit. Design, development, production and evaluation of controlled/sustained/extended release formulations.

Biopharmaceutics & Pharmacokinetics

Introduction to biopharmaceutics:

Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion, ion-pair formation and pinocytosis); Factors influencing absorption- biological, physico-chemical, physiological and pharmaceutical; Drug distribution in the body, plasma protein binding.

Pharmacokinetics:

Significance of plasma drug concentration measurement. Compartment model- Definition and Scope. Pharmacokinetics of drug absorption - Zero order and first order absorption rate constant using Wagner-Nelson and residual methods. Volume of distribution and distribution coefficient. Compartment kinetics- One compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route. Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance. Extraction ratio, hepatic clearance, biliary excretion, extra-hepatic circulation. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration.

Clinical Pharmacokinetics:

Definition and scope: Dosage adjustment in patients with and without renal and hepatic failure; Design of single dose bio-equivalence study and relevant statistics; Pharmacokinetic drug interactions and their significance in combination therapy.

Bioavailability and bioequivalence:

Measures of bioavailability, Cmax, tmax, K_{eli} and Area Under the Curve (AUC); Design of single dose bioequivalence study and relevant statistics; Review of regulatory requirements for conducting bioequivalent studies. Biopharmaceutical Classification System (BCS) of drugs.

PHARMACEUTICAL CHEMISTRY

Inorganic pharmaceutical & medicinal chemistry

Importance of inorganic compounds in pharmacy and medicine;

An outline of methods of preparation, uses, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any, of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia:

Gastrointestinal Agents:

Acidifying agents, Antacids, Protectives and Adsorbents, Cathartics;

Major Intra- and Extra-cellular Electrolytes:

Physiological ions. Electrolytes used for replacement therapy, acid-base balance and combination therapy;

Essential and Trace Elements:

Transition elements and their compounds of pharmaceutical importance, Iron and haematinics, mineral supplements; Cationic and anionic components of inorganic drugs useful for systemic effects;

Topical Agents:

Protectives, Astringents and Anti-infectives.

Gases and Vapors:

Oxygen, Anesthetics (inorganic) and Respiratory stimulants;

Dental Products:

Dentifrices, Anti-caries agents; Complexing and chelating agents used in therapy;

Miscellaneous Agents:

Sclerosing agents, Expectorants, Emetics, Inorganic poisons and antidotes.

Pharmaceutical Aids Used in Pharmaceutical Industry:

Anti-oxidants, Preservatives, Filter aids, Adsorbents, Diluents, Excipients, Suspending agents, Colorants;

Acids, Bases and Buffers:

Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

Inorganic Radiopharmaceuticals:

Nuclear reaction, radioisotopes, radiopharmaceuticals, Nomenclature, Methods of obtaining their standards and units of activity, half-life, measurement of activity, clinical applications, dosage, hazards and precautions.

Physical Chemistry and its importance in pharmacy

Importance of basic fundamentals of physical chemistry in pharmacy:

Behavior of Gases, Kinetic theory of gases, deviation from ideal behavior and explanation.

The Liquid State:

Physical properties (surface tension, parachor, viscosity, refractive index, dipole moment);

Solutions:

Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement, Debye Huckel theory;

Thermodynamics:

First, Second and Third laws, Zeroth law, Concept of free energy, enthalpy and entropy, absolute temperature scale;

Thermochemical equations; Phase rule; Adsorption:

Freudlich and Gibbs adsorption, isotherms, Langmuir's theory of adsorption.

Photochemistry:

Consequences of light absorption, Jabolenski diagram, Quantum efficiency;

Chemical Kinetics:

Zero, First and Second order reactions, complex reactions, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid base and enzyme catalysis;

Quantum Mechanics :

Postulates of quantum mechanics, operators in quantum mechanics, the Schrodinger wave equation.

Organic Chemistry and its importance in pharmacy

Importance of fundamentals of organic chemistry in pharmaceutical sciences; Structure and Properties:

Atomic structure, Atomic orbitals, Molecular orbital theory, wave equation, Molecular orbitals, Bonding and Anti-bonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, Structure and physical properties, Intermolecular forces, Acids and bases;

Stereochemistry:

Nomenclature, isomerism, stereoisomerism, conformational and configurational isomerism, optical activity, specification of configuration, Reactions involving stereoisomers, chirality, conformations;

Stereoselective and stereospecific reactions; Structure, Nomenclature, Preparation and Reactions of:

Alkanes, Alkenes, Alkynes, Cyclic analogs, Dienes, Benzene, Polynuclear aromatic compounds, Arenes, Alkyl halides, Alcohols, Ethers, Epoxides, Amines, Phenols, Aldehydes and ketones, Carboxylic acids, Functional derivatives of' carboxylic acids, a,ß-Unsaturated carbonyl compounds, Reactive intermediates- carbocations, carbanions, carbenes and nitrenes;

Nucleophilic and Electrophilic Aromatic Substitution Reactions:

Reactivity and orientation;

Electrophilic and Nucleophilic Addition Reactions; Rearrangements

(Beckman, Hoffman, Benzilic acid, pinacole-pinacolone and Bayer-Villager).

Elimination reactions; Conservation of Orbital Symmetry and Rules:

Electrocyclic, Cycloaddition and Sigmatropic reactions;

Neighboring group effects; Catalysis by transition metal complexes; Heterocyclic Compounds:

Nomenclature, preparation, properties and reactions of 3, 4, 5, 6 & 7-membered heterocycles with one or two heteroatoms like 0, N, S. Chemistry of lipids, Carbohydrates and Proteins.

Biochemistry

Biochemistry in pharmaceutical sciences:

The concept of free energy, Determination of change in free energy - from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance;

Enzymes:

Nomenclature, enzyme kinetics and their mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.

Co-enzymes:

Vitamins as co-enzymes and their significance. Metals as cofactors and their significance; Carbohydrate Metabolism: Conversion of polysaccharides to glucose-1-phosphate, Glycolysis, fermentation and their regulation, Gluconeogenesis and glycogenolysis, Metabolism of galactose and galactosemia, Role of sugar nucleotides in biosynthesis, and Pentose phosphate pathway;

The Citric Acid Cycle:

Significance, reactions and energetics of the cycle, Amphibolic role of the cycle, and Glyoxalic acid cycle;

Lipids Metabolism :

Oxidation of fatty acids, ß-oxidation & energetics, biosynthesis of ketone bodies and their utilization, biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids & eicosanoids (prostaglandins, thromboxanes and leukotrienes), phospholipids, and sphingolipids, Biosynthesis of eicosanoids, cholesterol, androgens, progesterone, estrogens corticosteroids and bile acids.

Biological Oxidation:

Redox-potential, enzymes and co-enzymes involved in oxidation reduction & its control, The respiratory chain, its role in energy capture and its control, energetics of oxidative phosphorylation. Inhibitors of respiratory chain and oxidative phosphorylation, Mechanism of oxidative phosphorylation.

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 sulphur containing amino acids.

Purine biosynthesis:

Purine nucleotide inter-conversions.

Pyrimidine biosynthesis and formation of deoxyribounucleotides.

Biosynthesis of Nucleic Acids:

Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Biosynthesis of DNA and its replications.

Mutation:

Physical & chemical mutagenesis/carcinogenesis, DNA repair mechanism. Biosynthesis of RNA;

Genetic Code and Protein Synthesis:

Genetic code, Components of protein synthesis and Inhibition of protein synthesis.

Medicinal Chemistry

Basic Principles:

Physico-chemical and stereoisomeric (Optical, geometrical) aspects of drug molecules and biological action, Bioisosterism, Drug-receptor interactions including transduction mechanisms;

Drug metabolism and Concept of Prodrugs; Principles of Drug Design (Theoretical Aspects):

Traditional analog and mechanism based approaches, QSAR approaches, Applications of quantum mechanics, Computer Aided Drug Designing (CADD) and molecular modeling.

Synthetic Procedures, Mode of Action, Uses, Structure Activity Relationships including Physicochemical Properties of the Following Classes of Drugs:

Drugs acting at synaptic and neuro-effector junction sites: Cholinergics, anti-cholinergics and cholinesterase inhibitors, Adrenergic drugs, Antispasmodic and anti-ulcer drugs, Local Anesthetics, Neuromuscular blocking agents.

Autacoids:

Antihistamines, Eicosanoids, Analgesic-antipyretics, Anti-inflammatory (non-steroidal) agents.

Steroidal Drugs:

Steroidal nomenclature (IUPAC) and stereochemistry, Androgens and anabolic agents, Estrogens and Progestational agents, Oral contraceptives, Adrenocorticoids;

Drugs acting on the central nervous system:

General Anesthetics, Hypnotics and Sedatives, Anticonvulsants, Anti-Parkinsonian drugs, Psychopharmacological agents (Neuroleptics, Anti-depressants, Anxiolytics), Opioid analgesics, Anti-tussives, CNS stimulants.

Diuretics; Cardiovascular drugs:

Anti-hypertensives, Anti-arrythmic agents, anti-anginal agents, Cardiotonics, Anti-hyperlipedemic agents, Anticoagulants and Anti-platelet drugs.

Thyroid and Anti thyroid drugs; Insulin and oral hypoglycemic agents:

Chemotherapeutic Agents used in bacterial, fungal, viral, protozoal, parasitic and other infections, Antibiotics: ß-Lactam, macrolides, tetracyclines, aminoglycosides, polypeptide antibiotics, fluoroquinolones,

Anti-metabolites (including sulfonamides); Anti-neoplastic agents; Anti-viral agents (including anti–HIV); Immunosuppressives and immunostimulants; Diagnostic agents; Pharmaceutical Aids.

Microbial Transformations:

Introduction, types of reactions mediated by micro-organisms, design of biotransformation processes, selection of organisms, biotransformation process and its improvements with special reference to steroids.

Enzyme Immobilization:

Techniques of immobilization, factors affecting enzyme kinetics, Study of enzymes such as hyaluronidase, penicillinase, streptokinase, amylases and proteases, Immobilization of bacteria and plant cells.

Pharmaceutical Analysis

Different techniques of pharmaceutical analysis, Preliminaries and definitions:

Significant figures, Rules for retaining significant digits, Types of errors, Mean deviation, Standard deviation, Statistical treatment of small data sets, Selection of sample, Precision and accuracy.

Fundamentals of volumetric analysis:

Methods of expressing concentration, primary and secondary standards:

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, Henderson-Hasselbach equation, Buffer solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, Mixed indicators, Polyprotic systems, Polyamine and amino acid systems, Amino acid titrations.

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, Cell representations, Measurement of electrode potential, Oxidation-reduction curves, Iodimetry and Iodometry, Titrations involving cerric ammonium sulphate, potassium iodate, potassium bromate, potassium permanganate; titanous chloride, stannous chloride and Sodium 2,6-dichlorophenolindophenol.

Precipitation Titrations:

Precipitation reactions, Solubility product, Effect of acids, temperature and solvent upon the solubility of a precipitate, Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, indicators, Methods of end point determination (GayLussac method, Mohr’s method, Volhard's method and Fajan's method).

Gravimetric Analysis:

Precipitation techniques, The colloidal state, Supersaturation, Co-precipitation, Post-precipitation, Digestion, washing of the precipitate, Filtration, Filter papers and crucibles, Ignition, Thermogravimetric curves, Specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic precipitants.

Non-aqueous titrations:

Acidic and basic drugs, Solvents used, Indicators.

Complexometric titrations:

Complexing agents used as titrants, Indicators, Masking and demasking;

Miscellaneous Methods of Analysis:

Diazotization titrations, Kjeldahl method of nitrogen estimation, Karl-Fischer aquametry, Oxygen flask combustion method, Gasometry.

Extraction procedures including separation of drugs from excipients; Potentiometry:

Standard redox potential, Nernst equation, Half-cell potential, Standard and indicating electrodes, potentiometric titrations;

Conductometry:

Specific and equivalent conductance, conductometric titrations.

Coulometry:

Coulomb's law, Coulometric titrations at fixed potential/current.

Polarography:

Decomposition potential, Half-wave potential, Diffision/migration/migration current, Ilkovic equation, Cathodic/anodic polarography, Dropping mercury electrode, Graphite electrode, Organic polarography.

Amperometry:

Rotating platinum electrode, Amperometric titrations.

Chromatography:

Theory of chromatography, plate theory, Factors affecting resolution, van Deemter equation. The following chromatographic techniques (including instrumentation) with relevant examples of Pharmacopoeial products: TLC, HPLC, GLC, HPTLC, Paper Chromatography and Column Chromatography.

The Theoretical Aspects, Basic Instrumentation, Elements of Interpretation of Spectra, and Applications (quantitative and qualitative) of the Following Analytical Techniques:

Ultraviolet and visible spectrophotometry, Fluorimetry, Infrared spectrophotometry, Nuclear Magnetic Resonance spectroscopy [proton technique only], Mass Spectrometry (EI & CI only),

Flame Photometry, Atomic Absorption Spectroscopy, X-ray Diffraction Analysis, Radioimmunoassay.

Quality assurance:

GLP, ISO 9000, TQM, Quality Review and Quality documentation, Regulatory control, regulatory drug analysis, interpretation of analytical data, Validation, quality audit: quality of equipment, validation of equipment, validation of analytical procedures.

PHARMACOLOGY

Pathophysiology of common diseases; Basic Principles of Cell Injury and Adaptations:

Causes of Cellular injury, pathogenesis, morphology of cell injury, adaptations and cell death.

Basic Mechanisms involved in the process of inflammation and repair:

Vascular and cellular events of acute inflammation, chemical mediators of inflammation, pathogenesis of chronic inflammation, brief outline of the process of repair.

Immunopathophysiology:

T and B cells, MHC proteins, antigen presenting cells, immune tolerance, pathogenesis of hypersensitivity reactions, autoimmune diseases, AIDS, Amyloidosis.

Pathophysiology of Common Diseases:

Asthma, diabetes, rheumatoid arthritis, gout, ulcerative colitis, neoplasia, psychosis, depression, mania, epilepsy, acute and chronic renal failure, hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, congestive heart failure, peptic ulcer, anemias, hepatic disorders, tuberculosis, urinary tract infections and sexually transmitted diseases. Wherever applicable the molecular basis should be discussed.

Fundamentals of general pharmacology:

Dosage forms and routes of administration, mechanism of action, combined effect of drugs, factors modifying drug action, tolerance and dependence; Pharmacogenetics; Principles of Basic and Clinical pharmacokinetics, absorption, Distribution, Metabolism and Excretion of drugs, Adverse Drug Reactions; Bioassay of Drugs and Biological Standardization; Discovery and development of new drugs, Bioavailability and bioequivalence studies;

Pharmacology of Peripheral Nervous System:

Neurohumoral transmission (autonomic and somatic), Parasympathomimetics, Parasympatholytics, Sympathomimetics, Adrenergic receptor and neuron blocking agents, Ganglion stimulants and blocking agents, Neuromuscular blocking Agents, Local anesthetic Agents.

Pharmacology of Central Nervous System:

Neurohumoral transmission in the C.N.S., General Anesthetics, Alcohols and disulfiram, Sedatives, Hypnotics, Anti-anxiety agents and Centrally acting muscle relaxants, Psychopharmacological agents (anti-psychotics), anti-maniacs, and hallucinogens, Antidepressants, Anti-epileptics drugs, Anti-Parkinsonian drugs, Analgesics, Antipyretics, Narcotic analgesics and antagonists, C.N.S. stimulants, Drug Addiction and Drug Abuse.

Pharmacology of Cardiovascular System:

Drugs used in the management of congestive cardiac failure, Antihypertensive drugs, Anti-anginal and Vasodilator drugs, including calcium channel blockers and beta adrenergic antagonists, Anti-arrhythmic drugs, Anti-hyperlipedemic drugs, Drugs used in the therapy of shock.

Drugs Acting on the Hemopoietic System:

Hematinics, Anticoagulants, Vitamin K and hemostatic agents, Fibrinolytic and anti-platelet drugs, Blood and plasma volume expanders.

Drugs acting on urinary system:

Fluid and electrolyte balance, Diuretics.

Autacoids:

Histamine, Antihistaminic drugs, 5-HT- its agonists and antagonists, Prostaglandins, thromboxanes and leukotrienes, Angiotensin, Bradykinin and Substance P and other vasoactive peptides, non-steroidal anti-inflammatory and anti-gout agents.

Drugs Acting on the Respiratory System:

Anti-asthmatic drugs including bronchodilators, Anti-tussives and expectorants, Respiratory stimulants.

Drugs acting on the Gastrointestinal Tract:

Antacids, Anti-secretory and Anti-ulcer drugs, Laxatives and anti-diarrhoeal drugs, Appetite Stimulants and Suppressants, Emetics and anti-emetics, Miscellaneous: Carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.

Pharmacology of Endocrine System:

Hypothalamic and pituitary hormones, Thyroid hormones and anti-thyroid drugs, parathormone, calcitonin and Vitamin D, Insulin, glucagons, incretins, oral hypoglycemic agents and insulin analogs, ACTH and corticosteroids, Androgens and anabolic steroids, Estrogens, progesterone and oral contraceptives, Drugs acting on the uterus.

Chemotherapy:

General Principles of Chemotherapy, Bacterial resistance; Sulfonamides and cotrimoxazole, Antibiotics- Penicillins, Cephalosporins, Aminoglycosides, Chloramphenicol, Macrolides, Tetracyclines, Quinolones, fluoroquinolones and Miscellaneous antibiotics; Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, HIV and AIDS, urinary tract infections and

sexually transmitted diseases, malaria, amoebiasis and other protozoal infections and Anthelmentics. Chemotherapy of malignancy and immunosuppressive agents.

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.

Basic Concepts of Pharmacotherapy:

Clinical Pharmacokinetics and individualization of Drug therapy, Drug delivery systems and their Biopharmaceutic s & Therapeutic considerations, Drugs used during infancy and in the elderly persons (Pediatrics & Geriatrics), Drugs used during pregnancy, Drug induced diseases, The basics of drug interactions, General principles of clinical toxicology, Common clinical laboratory tests and their interpretation.

Important Disorders of Organs, Systems and their Management:

Cardio-vascular disorders- Hypertension, Congestive heart failure, Angina, Acute myocardial infarction, Cardiac arrhythmias.

CNS Disorders:

Epilepsy, Parkinsonism, Schizophrenia, Depression.

Respiratory disease-

Asthma.

Gastrointestinal Disorders-

Peptic ulcer, Ulcerative colitis, Hepatitis, Cirrhosis.

Endocrine Disorders-

Diabetes mellitus and Thyroid disorders.

Infectious Diseases-

Tuberculosis, Urinary tract infections, Enteric infections, Upper respiratory infections.

Hematopoietic Disorders- Anemias,

Joint and Connective tissue disorders-

Rheumatic diseases, Gout and Hyperuricemia.

Neoplastic Diseases-

Acute Leukaemias, Hodgkin's disease. Therapeutic Drug Monitoring, Concept of Essential Drugs and Rational Drug use.

PHARMACOGNOSY

Sources of Drugs:

Biological, marine, mineral and plant tissue cultures as sources of drugs;

Classification of Drugs:

Morphological, taxonomical, chemical and pharmacological classification of drugs;

Study of medicinally important plants belonging to the families with special reference to:

Apocynacae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, Papaveraceae.

Cultivation, Collection, Processing and Storage of Crude Drugs:

Factors influencing cultivation of medicinal plants, Types of soils and fertilizers of common use. Pest management and natural pest control agents, Plant hormones and their applications, Polyploidy, mutation and hybridization with reference to medicinal plants.

Quality Control of Crude Drugs:

Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods and properties.

Introduction to Active Constituents of Drugs:

Their isolation, classification and properties.

Systematic pharmacognostic study of the followings:

CARBOHYDRATES and derived products:

agar, guar gum acacia, Honey, Isabagol, pectin, Starch, sterculia and Tragacanth.

Lipids:

Bees wax, Castor oil, Cocoa butter, Codliver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice Bran oil, Shark liver oil and Wool fat.

RESINS:

Study of Drugs Containing Resins and Resin Combinations like Colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of Tolu, balsam of Peru, benzoin, turmeric, ginger.

TANNINS:

Study of tannins and tannin containing drugs like Gambier, black catechu, gall and myrobalan.

VOLATILE OILS:

General methods of obtaining volatile oils from plants, Study of volatile oils of Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood;

Phytochemical Screening:

Preparation of extracts, Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts.

FIBERS:

Study of fibers used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.

Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs.

GLYCOSIDE CONTAINING DRUGS:

Saponins :

Liquorice, ginseng, dioscorea, sarsaparilla, and senega.

Cardioactive glycosides:

Digitalis, squill, strophanthus and thevetia,

Anthraquinone cathartics:

Aloe, senna, rhubarb and cascara,

Others:

Psoralea, gentian, saffron, chirata, quassia.

ALKALOID CONTAINING DRUGS:

Pyridine-piperidine:

Tobacco, areca and lobelia.

Tropane:

Belladonna, hyoscyamus, datura, duboisia, coca and withania.

Quinoline and Isoquinoline:

Cinchona, ipecac, opium.

Indole:

Ergot, rauwolfia, catharanthus, nux-vomica and physostigma.

Imidazole:

Pilocarpus.

Steroidal:

Veratrum and kurchi.

Alkaloidal Amine:

Ephedra and colchicum.

Glycoalkaloid:

Solanum.

Purines:

Coffee, tea and cola. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.

Studies of Traditional Drugs:

Common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Amla, Kantkari, Satavari, Tylophora, Bhilawa, Kalijiri, Bach, Rasna, Punamava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi, Adusa, Atjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gymnema, Shilajit, Nagarmotha and Neem. The holistic concept of drug administration in traditional systems of medicine.Introduction to ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Chumas, Lehyas and Bhasmas.

General Techniques of Biosynthetic Studies and Basic Metabolic Pathways/Biogenesis:

Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance.

Terpenes:

monoterpenes, sesquiterpenes, diterpenes, and triterpenoids.

Carotenoids:

a-carotenoids, ß-carotenes, vitamin A, Xanthophylls of medicinal importance.

Glycosides:

Digitoxin, digoxin, hecogenin, sennosides, diosgenin and sarasapogenin.

Alkaloids:

Atropine and related compounds, Quinine, Reserpine, Morphine, Papaverine, Ephedrine, Ergot and Vinca alkaloids.

Lignans, quassanoids and flavonoids. Role of plant-based drugs on National economy:

A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Utilization and production of phyto-constituents such as quinine, calcium sennosides, podophyllotoxin, diosgenin, solasodine, and tropane alkaloids. Utilization of aromatic plants and derived products with special reference to sandalwood oil, mentha oil, lemon grass oil, vetiver oil, geranium oil and eucalyptus oil. World-wide trade in medicinal plants and derived products with special reference to diosgenin (disocorea), taxol (Taxussps) digitalis, tropane alkaloid containing plants, Papain, cinchona, Ipecac, Liquorice, Ginseng, Aloe, Valerian, Rauwolfia and plants containing laxatives. Plant bitters and sweeteners.

Plant Tissue Culture:

Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy.

Marine pharmacognosy:

Novel medicinal agents from marine sources.

Natural allergens and photosensitizing agents and fungal toxins. Herbs as health foods. Herbal cosmetics. Standardization and quality control of herbal drugs, WHO guidelines for the standardization of herbal drugs.