SYLLABUS FOR CUCET M.PHARMA ENTRANCE EXAM

PHARMACEUTICS-I (INTRODUCTION TO PHARMACEUTICS)
1. History of pharmaceutical practice through ages, pharmacy as a career.
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.
7. Emulsions: Types of emulsion, theories of emulsification (monomolecular adsorption multimolecular 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)
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, oxymercuration-demercuration, 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 (antimarkonikov 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, Cannizzaro’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).
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, Bayer’s theorem, probability theorems, probability distributions, elements of binomial and poison 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)


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.


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 (Hantzch-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, Tetrazole 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, Benzo[... ]
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, Thiouyl chloride, n-Bromosuccinimide, Raney nickel, Platinum, Palladium, Lead tetra acetate, Osmium tetraoxide, 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. 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.

   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.

**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.


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.


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, Mc. Cabe 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.


**PHARMACEUTICS I (DISPENSING, COMMUNITY AND HOSPITAL PHARMACY)**
1. Prescription: Parts, types and handling of prescription, knowledge of commonly user 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 wholesale 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, 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, Handerson-Hesselbach 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, cerric ammonium sulphate, potassium iodate, potassium bromate, iodometry and iodimetry, pharmaceutical applications, preparation and standardization of redox titrants like potassium permanganate, cerric ammonium sulphate, potassium dichromate, potassium iodate, potassium bromate, iodine, sodium thiosulphate.

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 magnesumpyrophosphate.

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, Hydonocarpus oil, Kokum butter, Codliver oil, Woolfat.
   c) Resins and Tannins, and drugs of these classes like: Podophyllum, Balsams, Turmeric, Ginger, Ipomea and Myrobalan.
   d) Pharmaceutical aids like: Tale, Kaolin, Bentonite, Gelatin, Cotton and ViscoseRayon.

ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION – II
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.
8. Sense Organs: Basic anatomy and physiology of the eye (vision), ear (hearing), tastebuds, nose (smell) and skin (superficial receptors).

PHARMACEUTICS -V (DOSAGE FORM DESIGN)
1. Preformulation studies: Study of physical properties of drug like physical form, particlesize, 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.

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, Illkovic equation and factors affecting it, dropping mercury electrode, instrumentation, polarographic methods of analysis, pharmaceutical applications.
4. Amperometry: Principle, amperometric titration curves, applications.
6. Radioimmunoassay: Principle, procedure, pharmaceutical applications.

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

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.


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.
      e) Drugs Price Control Order 1995.
   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.
      e) States Shops & Establishments Act & Rules.
      f) Insecticides Act 1968.
      g) AICTE Act 1987.
      h) Factories Act 1948.
   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)**

1. 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.
   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.
   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.

**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.
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 minim 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)
   d. Local Anesthetic agents: Benzocaine, Procaine hydrochloride, Lignocaine hydrochloride, Bupivacaine hydrochloride, and Dibucaine hydrochloride.

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: Belladona, hyoscyamus, datura, coca and withania.
   b. Quinoline and isoquinoline: Cinchona, ipecac and opium.
   c. Indole: Ergot, rauwolfia, catharanthus, nux-vomica, physosuigma.
   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, asavas, 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 (autonomic 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-ematics.
   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-accervation, 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.


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

**PHARMACEUTICAL BIOTECHNOLOGY**

1. Introduction, historical perspective, genomics, proteomics 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, penicillillinase, streptokinase and steptodornase, amylase and protease, therapeutic applications of enzyme immobilization.

3. rDNA technology: Introduction, transformation, conjugation, transduction, protoplasmic 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, humantrone, 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:

2. Drugs affecting Hormonal System:
   a. Thyroid hormones and Antithyroid agents: Biosynthesis of thyroid hormones Propythiouracil, Methimazole, Carbimazole and I131.
   b. Insulin and Oral Hypoglycaemic agents: Chemistry of Insulin and its preparations (Chlorpropamide, Tolbutamide, Glimepride, Glipizide, Rosiglitazone, Pioglitazone, Metformin, Phenformin, Miglitol, Repaglinide).
   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.

**PHARMACOLOGY -II**

   c. Hypnotics, sedatives, anti-anxiety agents, and centrally acting muscle relaxants.
   e. Antiepileptic drugs.
   f. Narcotic analgesics and antagonists.
   g. 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 for their 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 Haematopoietic 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.


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 Cmax, Tmax, and AUC.

4. Bioavailability and Bioequivalence: Definition and detailed protocol, Significance of Bioavailability and Bioequivalence studies. Regulatory requirements.

PHARMACEUTICAL CHEMISTRY-VII (MEDICINAL CHEMISTRY-III)


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)


5. Chemotherapeutic agents:


a. Antibiotics: Penicillin V, Cloxacillin Sodium, Cephazolin Sosium, Chloramphenicol, Aminoglycosides (Streptomycin, Neomycin and Kanamycin), Macrocyclies (Erythromycin, Clarithromycin and Roxithromycin), Tetracyclines, Vancomycin, Valinomycin, Polymyxin and Flouroquinolones.

II Antiparasitic agents: Antiprotozoal and Anthelmintic agents.

III Antiamoebic agents: Metronidazole, Tinidazole and Diloxyamide Furoate.

IV Antimalarial drugs: Chloroquine Phosphate, Amodiaquine, Pamaquine, Pentaquine Phosphate, P-Chloroproguanil Hydrochloride, Cycloguanyil 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.

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
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
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.
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.

**PHARMACEUTICAL ANALYSIS-IV (QUALITY ASSURANCE)**

1. Quality assurance: Concept, Scope, quality control, auditin, 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.
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.
7. Requirement of GMP, GLP, ISO 9000, WHO and U.S. F.D.A.
8. In-process quality control tests, IQC 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**

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.


**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.