

Syllabus for DPAT 2026

Programmes:

1. Master of Pharmacy (Pharmaceutics)
2. Master of Pharmacy (Pharmacology)
3. Master of Pharmacy (Pharmaceutical Quality Assurance)

PHYSICAL CHEMISTRY

1. Composition & physical states of matter

Intermolecular forces & their impact on state of the matter. Various physical properties of matter, dipole moment, dielectric constant, Van Der waal's equation & critical phenomenon, liquefaction of gases, aerosols.

2. Colligative Properties

The liquid state, vapor pressure, ideal & real solutions. Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular weight based on colligative properties.

3. Thermodynamics

First, second & third law of thermodynamics. Thermochemical laws, isothermic & adiabatic processes, reversible processes, work of expansion, heat content, enthalpy, heat capacity. Gibb's & Helmholtz equation & chemical potential.

4. Chemical Equilibria.

5. Phase rule

One, two, & three component systems along with their applications. Solid- solid, solid - liquid, & liquid-liquid systems. Distillation of binary systems, azeotropic mixtures, steam, vacuum, & fractional distillation.

6. Refractive index

Refractive index, specific refractivity, molar refractivity, refractometers.

7. Solutions

Solubility, factors affecting solubility, solubility curves. Types of solutions, effect of co-solvency, pH & other factors on solubility. Solubility of gases in liquids, liquids in liquids, & solids in liquids, critical solution temperature, law of partitioning & its applications. Solute solvent interactions. Expression of concentration of pharmaceutical solutions & calculations. Molarity, molality, mole fraction & percentage expressions.

8. Electrochemistry

Properties of electrolyte solutions, electrolysis. Faraday's law of electrolysis, electron transport, electrical cell, single electrode potential, concentration cells, half-cells & half cell potential, types of half cells, sign convention, Nerst equation, salt bridge, electromotive series, standard potential, SHE. Measuring the relative voltage of half cells, Calculation of standard potential. Reference & indicator electrodes. Standard oxidation-reduction potential.

9. Ionic equilibrium

Theory of conductivity, equivalent conductance, mobility of ions, specific conductance.

10. Kinetics Order of reactions, derivation & internal form of rate laws, molarities of reaction, derivation of rate constants.

PHYSICAL PHARMACY

1. Matter, properties of matter

States of matter, change in the state of matter, latent heat and vapor pressure, sublimation-critical point, eutectic mixtures, gases, aerosols- inhalers, relative humidity, liquid complexes, liquid crystals, glasses state, solid crystalline and amorphous polymorphism.

2. Micromeritics and powder rheology

Particle size and distribution, average particle size number and weight distribution, particle number, method of determining particle size and volume, optical microscopy, sieving, sedimentation, determining surface areas, permeability, adsorption, derived properties of powders, porosity, packing arrangement densities, bulkiness and flow properties.

3. Surface and interfacial phenomenon

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

4. Viscosity and rheology

Newtonian systems, law of flow, kinematics viscosity, effect of temperature, non Newtonian systems, pseudoplastics, dilatant, plastic, thixotropy in formulations, determination of viscosity and thixotropy by capillary, falling ball, rotational viscometer, application of rheology in pharmacy

5. Dispersion systems

- Colloidal dispersions: Definition, types, properties of colloids, protective colloids, application of colloids in pharmacy.
- Suspensions and emulsions: Interfacial properties of suspended particles settling in suspension, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, significance of electrical properties in dispersions, controlled flocculation, flocculation in structured vehicles, rheological considerations, emulsions: types, theories, physical stability.

6. Complexation

Classification of complexes, methods of preparations and analysis, applications.

7. Buffer

Buffer equations and buffer capacity in general. Buffers in pharmaceutical systems preparations and stability, buffered isotonic solutions. Measurements of tonicity calculations and methods of adjusting isotonicity.

8. Solubility

a. Miscibility-influence of foreign substances

- three component systems
- dielectric constant and solubility,
- solubility of solids in liquids
- ideal and non-ideal solutions
- solvation and association in solutions
- solubility of salts in water
- solubility of slightly soluble and weak electrolyte
- calculating solubility of weak electrolytes as influenced by pH, influence of solvents on the solubility of drugs
- combined effect of pH and solvents, distribution of solutes between immiscible solvents, effect of ionic dissociation and molecular association on partition, extraction, preservatives action of weak acids in emulsions, drug action and distribution co-efficient.

b. Concepts of dissolution and diffusion.

ORGANIC CHEMISTRY

1. General principles

A brief review of classification & sources of organic compounds, sp^3 , sp^2 , sp hybridization, sigma & pi- bonds, bond lengths, bond angles & bond energies along with their significance in reactions should be carried out. An overview of bond polarization, hydrogen bonds, inductive effects, resonance, and hyper conjugation be taken. Concept of homolytic & heterolytic bond fission, acidity & basicity with different theories should be covered briefly. Ease of formation & order of stabilities of electron deficient & electron rich species along with the reasons for the same should be covered. Relationships between energy content, stability, reactivity & their importance in chemical reactions should be covered. Calculations for determining empirical & molecular formula should be covered.

2. Different classes of compounds

The following classes of compounds should be taught in detail with respect to their IUPAC / systematic nomenclature, industrial [wherever applicable] & laboratory methods of preparations, physical properties & chemical reactions with emphasis on reaction mechanisms [arrow based] & stereochemistry [wherever applicable].

- Alkanes [including cyclic compounds]
- Alkenes [including cyclic compounds]
- Alkynes [only open chain compounds]
- Aliphatic hydroxyl compounds
- Alkyl halides
- Aldehydes & ketones
- Carboxylic acids
- All functional derivatives of carboxylic acids.
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3. Protection & deprotection of groups

Introduction to protection & deprotection of functional groups. Two examples each for amino, hydroxyl, & carbonyl groups. The significance of these in syntheses should be explained.

4. Aromaticity & aromatic chemistry

Concept of aromaticity, Huckel's rule & its use in determining the aromatic / non-aromatic character of a compound. A brief coverage of structure of benzene. Detailed coverage of electrophilic & nucleophilic aromatic substitution reactions. Reactivity & orientation in these reactions. Reactivity & orientation in mono- & disubstituted benzenes. Benzyne mechanism.

5. Different aromatic classes of compounds

The following classes of compounds with respect to their IUPAC / systematic nomenclature, industrial [wherever applicable] & laboratory methods of preparations, physical properties & chemical reactions with emphasis on reaction mechanisms [arrow based] & stereochemistry [wherever applicable].

- Aromatic hydrocarbons.
- Phenolic compounds.
- Aromatic & aliphatic amines.
- Diazonium salts.
- Aromatic nitro- compounds, aryl halides, & ethers.

6. Polycyclic aromatic hydrocarbons

Syntheses & reactions with mechanisms of bi & tricyclic fused carbocyclic rings like naphthalene, anthracene, & phenanthrene.

7. Carbonyl Chemistry

Carbonyl chemistry involving group conversions & their reaction mechanisms along with stereochemistry wherever applicable.

- a. Wolf-Kishner reduction & Huang-Minlong modification.
- b. Reduction of arylsulfonyl hydrazine / hydrazones to alkanes.
- c. Bamford Steven reaction.
- d. DCC Oxidation of alcohol.
- e. Michael addition / 1,4-addition / conjugate addition.
- f. Mannich condensation / reaction.
- g. Robinson annulation.
- h. Stobbe condensation.
- i. Darzen's glysidic ester synthesis.
- j. Beckmann rearrangement.
- k. Baeyer Villiger rearrangement.
- l. Curtius, Wolff, & Lossen rearrangements.
- m. Willgerodt rearrangement.
- n. Pinacol-pinacolone rearrangement.
- o. Methylene transfer reactions. Use of diazomethane & sulphurylides in the same.
- p. Mono- & dialkylations in 1,3-dicarbonyl compounds.
- q. Formation & use of enol ethers, enol acetates & enamines as protective groups in regiospecific alkylations.

8. Heterocyclic Chemistry

IUPAC Nomenclature of heterocyclic rings [3-10 membered] containing O, S, & N atoms. Nomenclature of above rings containing mono-, di-, & multiple [same or different] heteroatoms should also be covered. Nomenclature of 2 & 3 fused rings containing mono-, di-, & multiple heteroatoms [same or different] should also be covered. Syntheses & reactions of three to six membered rings in detail. Syntheses of five & six membered rings containing mono- or any di- heteroatoms [O, S, & N]. Syntheses of quinoline, isoquinoline, benzoxole, benzthiole, & benzazole, benzodiazole, benzoxazole, & benzthiazole.

9. Bridged rings

Bridged ring systems & their nomenclature.

10. Kinetic & thermodynamic control

Kinetic & thermodynamic control of sulfonation, enolate anion formation & alkylation of enamine reactions.

11. Stereochemistry

Stereochemistry. Chirality & asymmetry [introduction of the same to S, P, & N]. Definition & classification [different types of isomerisms]. Enantiomers, diastereomers. Enantiomerism & diastereomerism. Meso compounds & their optical activity. Stereochemistry in acyclic compounds. Newman projection formulae & their significance. Conformational analysis of n-butane. Absolute & relative configuration. Assigning R & S configuration based on Cahn Ingold & Prelog system. Racemic mixture- its definition & resolution. Definitions of terms stereoselective, stereospecific, Enantiomeric excess & diastereomeric excess. Stereochemistry in cyclic systems. Conformations of cyclohexane. Cis - trans relationship in cyclohexane. Prediction of stability of different conformations of 1, 2- 1,3- & 1,4- disubstituted cyclohexanes. Effect of multiple substitutions on the stability of cyclohexane conformations. Chair conformations of cis-, & trans-decalins, perhydrophenanthrenes, & a tetracyclic steroidal nucleus. An introduction to atropisomerism.

12. Carbohydrates

Carbohydrates. Definition & classification. D & L nomenclature in sugars. Different ways of drawing / representing a sugar molecule [including cyclic Structure], interconversion of these representations. Anomers & epimers. Mutarotation. Reactions of glucose. Chain extension & chain reduction of a sugar.

13. Amino acids & proteins

Amino acids & proteins. Definition & classification. D & L Amino acids, natural, essential, & non-essential amino acids. Denaturation, Strecker, Gabriel phthalamide methods for the preparation of amino acids. Peptide bond & its formation. Two protective groups each, for -NH₂ & -COOH functionalities during protein synthesis. Sequencing of a protein by chemical & enzymatic methods.

14. Organometallic chemistry

Organometallic chemistry [preparation & few reactions] of Cu & Boron.

15. Pericyclic reactions

Pericyclic reactions. Concept of HOMO & LUMO. Drawing of HOMO & LUMO of 1, 3-butadiene, allylic cation, radical & anion, & 1, 3, 5-hexatriene. Meaning of conrotatory & disrotatory. Allowed & disallowed thermal & photochemical reactions. Introduction to sigmatropic, electrocyclic & $(4n + 2)$ cycloaddition reactions. Cope, oxy-cope [Claisen rearrangement], Diel's-Alder & retro Diel's Alder reaction.

PHARMACEUTICAL CHEMISTRY

1. Pharmaceutical Impurities

Impurities in pharmaceutical substances, sources, types & effects of impurities. Limit tests for heavy metals like lead, iron, arsenic, mercury & for chloride & sulphate as per Indian Pharmacopoeia [I. P.].

2. Monographs

Monograph & its importance, various tests included in monographs as per I. P. A study of the following compounds with respect to their methods of preparation, assay, & pharmaceutical uses: sodium citrate, calcium carbonate, copper sulphate, light & heavy kaolin, ammonium chloride & ferrous gluconate.

3. Isotopes

Isotopes- stable & radioactive, mode & rate of decay. Types & measurement of radioactivity. Radiopharmaceuticals & their diagnostic & therapeutic applications in pharmacy & medicine such as ^{125}I , ^{32}P , ^{51}Cr , ^{60}Co , ^{59}Fe , $^{99}\text{Tc-M}$. Radiocontrast media, use of BaSO_4 in medicine.

4. Therapeutic classes of drugs

The following topics should be dealt with covering nomenclature [including stereochemical aspects], biological activity [including side & toxic effects], mode of action, structure activity relationship [where ever applicable] & syntheses of reasonable molecules.

1. Dentifrices, desensitizing agents, & anticaries agents.
2. General anesthetics.
3. Local anesthetics.
4. Antiseptics, disinfectants, sterilants, & astringents.
5. Purgatives, laxatives & antidiarrhoeal agents.
6. Diagnostic agents.
7. Coagulants, anticoagulants & plasma expanders.

5. Drug metabolism

Introduction to drug metabolism based on the functional groups.

6. Various classes of therapeutic agents

A detailed study of the following classes with respect to drug nomenclature, classification, physicochemical properties, mode of action [MOA], structure activity relationships [SAR], wherever applicable, synthesis of simple & prototype molecules,

drug metabolism, therapeutic uses & side effects. Drug resistance, wherever applicable, should be covered in respective classes of drugs.

- a. Antiamoebic agents.
- b. Anthelmintic agents.
- c. Antibacterial sulpha drugs [only].
- d. Quinolone antibacterials.
- e. Antimycobacterial drugs.
- f. Antifungal agents.
- g. Antiviral agents including HIV & anti-HIV drugs.
- h. Thyroid & anti thyroid drugs.
- i. Antiallergic agents.
- j. Antiulcer agents & Proton Pump Inhibitors.
- k. Hypoglycemic agents.
- l. Antimalarials

7. Different classes of therapeutic drugs

A detailed study of the following classes with respect to drug nomenclature, classification, physicochemical properties, mode of action [MOA], structure activity relationships [SAR], wherever applicable, synthesis of simple & prototype molecules, drug metabolism, therapeutic uses & side effects. Drug resistance, wherever applicable, should be covered in respective classes of drugs.

- a) Sedative-hypnotics
- b) Antiepileptic agents.
- c) Neuroleptics.
- d) Anti-anxiety drugs.
- e) Diuretics.
- f) Antibiotics. Penicillins, cephalosporins & other beta- lactam antibiotics like imipenam & aztreonam. Beta-lactamase inhibitors such as clavulanic acid & sulbactam. Chloramphenicol. Tetracyclines. Aminoglycoside antibiotics. Macrolide antibiotics. Lincomycins. Polypeptide antibiotics. Anticancer antibiotics.
- g) Steroids. Corticosteroids [gluco- & mineralocorticoids] & anti-inflammatory steroids. Sex steroids. Male & female contraceptive agents. Anabolic steroids. Anticancer agents.

8. Different classes of therapeutic drugs

A detailed study of the following classes with respect to drug nomenclature, classification, physicochemical properties, mode of action [MOA], biosynthesis, structure activity relationships [SAR], wherever applicable, synthesis of simple & prototype molecules, drug metabolism, therapeutic uses & side effects. Drug resistance, wherever applicable, in respective classes of drugs.

- a) Narcotic [centrally acting] analgesics [analgetics]. Morphine & all its structural modifications [peripheral & nuclear]. Narcotic agonists & antagonists [dual & pure]. Non-narcotic analgesics [NSAIDS]. Difference between narcotic & non-narcotic agents.
- b) Adrenergic drugs. Neurotransmitters & their role. General & specific adrenergic agonists & antagonists [up to alpha-2 & beta-2 only].
- c) Cholinergic agents. Muscarinic & nicotinic cholinergic agonists & antagonists [up to M2 & N2]. Neuronal [transmission] blockers.

- d) Drugs used in neuromuscular disorders. Drugs used in the treatment of Parkinson's disease. Central & peripheral muscle relaxants.
- e) Hypertensive, antihypertensive, & antianginal agents.
- f) Eicosanoids. Prostaglandins, prostacyclins, & thromboxanes. Their biochemical role, biosynthesis, & inhibitors.
- g) Introduction to quantitative structure activity relationship. [QSAR]. Linear free energy relationship. Hammett's equation. Use of substituent constants such as π , σ , E_s , & physicochemical parameters such as pK_a , partition coefficient, R_m , chemical shifts, molar refractivity, simple & valance molecular connectivity to indicate electronic effects, lipophilic effects, & steric effects. Introduction, methodology, advantages & disadvantages / limitations of Hansch analysis.
- h) Asymmetric synthesis. Chirality, chiral pool, sources of various naturally available chiral compounds. Eutomers, distomers, eudismic ratio. Enantioselectivity & enantiospecificity. Enantiomeric & diastereomeric excess. Prochiral molecules. Asymmetric synthesis of captopril & propranolol.
- i) Combinatorial chemistry. Introduction & basic terminology. Databases & libraries. Solid phase synthesis technique. Types of supports & linkers, Wang, Rink, & dihydropyran derivatized linkers. Reactions involving these linkers. Manual parallel & automated parallel synthesis. Houghton's tea bag method, micromanipulation, recursive deconvolution. Mix & split method for the synthesis of tripeptides. Limitations of combinatorial synthesis. Introduction to throughput screening.

PHARMACEUTICS

1. Pharmacy Profession

Pharmacy as a career, evaluation of Pharmacy, earlier period middle to modern ages.

2. Introduction to Pharmaceuticals

Definition, importance of pharmaceuticals, areas concerned, scope of Pharmaceutics, history and development of profession of Pharmacy and Pharmaceutical industry in India. A brief review of present Indian Pharma. Industry in global perspective.

3. Introduction to dosage form

Definition of drug. New drug and dosage form. The desirable properties of a dosage form, the need of dosage form. Ideas about available type of dosage forms and new drug delivery system.

4. Route of administration

Route of administration with respect to dosage form design, physiological consideration for various routes of administration.

5. ADME

Scheme of fate of dosage form after its administration. Definition and introduction to concept of absorption, distribution, biotransformation and elimination of drug. Introduction to bioavailability and various equivalences referring plasma time profile of drug.

6. Sources of drug information

Introduction to Pharmacopoeia with reference to IP, BP, USP and International Pharmacopoeia. Study of structure / features (index) general notice and compartment of monographs of excipients, drug and drug product. Other sources. Textbooks, journals, internet (drug information system, online database, patient/ consumer information and non- print material. Classification of information, primary, secondary and tertiary. Nomenclature of drug.

7. Allopathic dosage form

Merits / demerits, importance, formulation development - vehicles / excipients with examples for the dosage form: liquid dosage form: monophasic liquid dosage form. Aromatic waters, syrup, elixir, linctus, lotion, liniment, glycerites, solutions, spirits, ENT preparations, mixtures, paints, mouthwash.

8. Crude extract

Infusion, decoction, maceration, percolation, tincture and extract. Methods of preparations of dry, soft and liquid extract.

9. Allergenic extract

Types of allergens, preparation of extract, testing and standardization of extracts.

10. Ayurvedic system of medicine

Theory, basic concept, diagnosis, various branches of treatment in ayurveda, types of drug formulation in Ayurveda and important Ayurvedic drugs and their uses, formulation of asavas, arishtas, watika, churna, tailas, ghruta, lep.

11. Homeopathic system of medicine

Theory, basic concept, diagnosis, treatment, source of homeopathic medicines and important homeopathic drugs and their uses.

12. Biological products

Absorbable and non-absorbable material types, sutures and ligatures, processing, manufacturing, sterilization, packing, QC tests of materials like catgut and nylon.

13. GMP

Introduction to GMP, QC and QA.

14. Pharmaceutical Plant, location, layout

Plant location and lay out of an industry. Various factors affecting locational aspects of chemical and pharmaceutical plants. Layout of plant building and importance of flow sheet, difference between scientific process and technological process, layout of various departments, equipments, and product lay out v/s process layout.

15. Dosage Form Necessities and Additives

Antioxidants, preservatives, coloring agents, flavoring agents and diluting agents, emulsifying agents, suspending agents, ointment bases, solvents, and others.

16. Powders

Advantages and limitations as dosage form, manufacturing procedure and equipments, special care and problems in manufacturing powders, powders of IP, effervescent granules and salts.

17. Capsules

Hard gelatin capsules, shell formulation and manufacturing, capsule sizes, storage, filing, cleaning process general formulation contents and evaluation. Soft gelatin capsules, shell formulation, formulation contents, filing, sealing and storage. Microencapsulation, advantages, encapsulation materials, methods of microencapsulation, I.P. formulations

18. Tablets

Types, ideal requirement, classification, granulation methods, general formulation, compression machines, different types of tooling's, difficulties in tableting, trouble shooting aspects, evaluation, sugar coating, compression coating, film coating, problems in tablet coatings and their trouble shooting aspects. IP formulations.

19. Parenterals - product requiring sterile packaging

Definition, types advantages and limitations, general formulation, vehicles, production procedure, production facilities, controls, tests, selected IP injections, sterile powders, implants, emulsions, suspensions.

20. Suspensions

Formulation of deflocculated and flocculated suspension, manufacturing procedure, evaluation methods, IP suspensions.

21. Emulsions

Types, emulsifying agents, general formulation, manufacturing procedure, evaluation methods, IP emulsions.

22. Suppositories

Ideal requirements, bases, manufacturing procedure, evaluation methods, IP products.

23. Semisolids

Definitions, bases, general formulation, manufacturing procedure, evaluation methods, IP products.

24. Liquids (solutions, syrups, elixirs, spirits, aromatic water, liquid for external uses)

Definition, types, general formulation, manufacturing procedure, evaluation methods, IP products.

25. Pharmaceutical Aerosols

Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications. Impacts of propellants on environment.

26. Ophthalmic preparations

Requirement, formulation, methods of preparation, containers, evaluation, IP products.

27. Preformulations

Consideration of Importance, physical properties, physical forms, particle size, crystal forms, bulk control, solubility, wetting, flow cohesiveness, compressibility, organoleptic

properties and its effect on final product consideration of Chemical properties, hydrolysis, oxidation, racemization, polymerization, isomerization, decarboxylation, enzymatic decomposition, formulation additives, stabilizers, suspending and dispersing agents dyes, solid excipients etc. and its effect on quality of finished product.

28. Radio Pharmaceuticals

Therapeutic uses, diagnostic uses, facilities and work area, preparation of radio pharmaceuticals, radio pharmaceuticals used in medicines.

29. Stability of formulated products

Requirements, drug regulatory aspects, pharmaceutical products stability, self life, overages, containers, closures.

30. Kinetic Principles and Stability Testing

Reaction rate and order, acid base catalysis, de stabilization and accelerated stability testing.

31. Prolonged Action Pharmaceuticals

Benefits, limitations, oral products, terminology, drug elimination rate, types and construction of implants products, product evaluation, parenteral products, absorption and evaluation.

32. Novel Drug delivery system

Critical fluid technology, transdermal drug delivery system, controlled drug delivery system, multiple emulsion, nano particles, targeted drug delivery system, aerosols, inhalation & new products reported etc.

33. Cosmetics

Formulation and preparation of dentifrices, hair creams, lipsticks, face powders, shaving preparations, skin creams, shampoos, hair dyes, depilatories, manicure preparations etc.

34. Packaging Materials

Role and features of Pharmaceutical packing materials. Glass, plastic, rubber, metal and paper as pharmaceutical packaging material. General quality control of pharmaceutical packages. Primary, secondary and tertiary packaging materials. Child resistant and pilfer proof packaging.

35. GMP and Validation

Concept and need of good manufacturing practice guidelines.

Elements of GMP covering controls of area and processes and product. Regulations related to GMP. Introduction of validation process. Types of validation. Brief methodology of process, equipments and instrument validation.

36. Pilot plant scale up techniques

Need, organization and layout, scale up techniques for solid and liquid dosage forms. Technology transfer.

PHARMACOLOGY

1. General Pharmacology

Introduction to Pharmacology- Definition, scope and source of drugs, dosage form and routes of drug administration. Pharmacodynamics-Mechanism of drug action, Receptors, classification and drug receptors interaction, combined effect of drugs, factors modifying drug action.

Pharmacokinetics-Mechanism and principle of Absorption, Distribution, Metabolism and Excretion of drugs. Principles of basic and clinical pharmacokinetics. Pharmacogenetics. Adverse drug reactions.

Discovery and development of new drugs-Preclinical and clinical studies.

2. Pharmacology of peripheral nervous system

Neurohumoral transmission (Autonomic and somatic).

Parasympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics, Ganglionic stimulants and blockers. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).

Local anesthetic agents. Drugs used in Myasthenia Gravis.

3. Pharmacology of cardiovascular system

Introduction of hemodynamic and Electrophysiology of heart.

Anti-hypertensive drugs, Anti-anginal agents, Anti-arrhythmic drugs. Drugs used in congestive heart failure. Anti-hyperlipidemic drugs.

Drugs used in the therapy of shock.

Haematinics, anticoagulants and haemostatic agents. Fibrinolytics and antiplatelet drugs.

Blood and plasma volume expanders.

4. Drugs acting on urinary system

Diuretics and anti-diuretics.

5. Drugs acting on Respiratory system

Anti-asthmatic drugs, Mucolytics and nasal decongestants, tussives and expectorants. Respiratory stimulants

Anti-

6. Pharmacology of central nervous System

Neurohumoral transmission in the C.N.S with special emphasis on Pharmacology of various neurotransmitters. General anesthetics. Alcohols and disulfiram. Sedatives, hypnotics and centrally acting muscle relaxants, Psychopharmacological agents: Antipsychotics, antidepressants, antianxiety agents, anti-manics and hallucinogens.

Anti-epileptic drugs. Anti-parkinsonism drugs. Nootropics.

Narcotic analgesics, drug addiction, drug abuse, tolerance and dependence.

7. Pharmacology of Endocrine system

Basic concepts in endocrine pharmacology. Hypothalamic and pituitary hormones.

Thyroid hormones and ant thyroid drugs, Parathormone, Calcitonin and vitamin-D. Insulin, oral hypoglycemic agents and glucagon. ACTH and corticosteroids. Androgens and anabolic steroids. Estrogens, progesterone and oral contraceptives. Drugs acting on the uterus.

8. Chemotherapy

General principals of chemotherapy. Sulphonamides and co-trimoxazole. Antibiotics- Penicillins, cephalosporins, chloramphenicol, Macrolides, quinolones and fluoroquinolones, quinolones. Tetracyclines. Aminoglycosides and miscellaneous antibiotics. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, AIDS, protozoal diseases, worm infections, urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy.

9. Autacoids and their Antagonists

Histamine, 5-HT and their antagonists. Prostaglandins, thromboxanes and leukotrienes. pentagastrin, cholecystokinin, angiotensin, bradykinin and substance P. Analgesic, anti-pyretic, anti-inflammatory and anti-gout drugs.

10. Pharmacology of drug acting on the gastrointestinal tract

Antacids, anti-secretory and antiulcer drugs. Laxatives and antidiarrheal drugs. Appetite stimulants and suppressants. Digestants and carminatives. Emetics and antiemetics.

11. Chronopharmacology

Definition of rhythm and cycles. Biological clock and their significance leading to chronotherapy.

12. Immunopharmacology

Immunostimulants and immunosuppressants.

13. Chemotherapy of malignant diseases

Basic principal of chemotherapy. Drugs used in cancer chemotherapy.

14. Peptides and proteins as mediators

General Principal of peptide pharmacology Biosynthesis and regulation of peptides Peptide antagonists. Protein and peptide as drugs.

15. Nitric oxide

Biosynthesis of nitric oxide and its physiological role. Therapeutic use of nitric oxide and nitric oxide donors. Clinical condition in which nitric oxide may play a part.

16. Vitamins & Minerals

Vitamin deficiency diseases and their management. Role of minerals in health & diseases.

17. Principles of toxicology

Definition of poison. General principles of treatment of Poisoning. Treatment of

poisoning due to Heavy metals, insecticides, opioids and other addict forming drugs. Study of acute, sub acute and chronic toxicity as per OECD guidelines. Genotoxicity, Carcinogenicity, teratogenicity and mutagenicity studies.

PHARMACEUTICAL ANALYSIS

1. Acid-base titrations

Definitions of acids & bases according to Arrhenius & Lewis theory. Definitions of normality, molarity, molality, & equivalent weight. Primary & secondary standards with examples & differences between them. Standardization of strong acids & bases using primary & secondary standards. Preparation of standard solutions of & calculations of equivalent weights of oxalic acid, potassium acid phthalate, calcium chloride dihydrate, & sodium carbonate. Calculation of factors involved in standardization of sodium hydroxide, hydrochloric acid, & oxalic acid. Direct, back & differential titrations. Application of direct & back titrations to preparations like boric acid & borax in a mixture, ammoniated mercury, milk of magnesia, & zinc oxide ointment.

Law of mass action, acid-base equilibria, pH scale, pH & hydronium ion concentrations in aqueous systems, calculations of pH for weak acids & weak bases. Use & applications of pH meter. Hydrolysis of salts. Strengths of acids & bases, dissociation constant.

Theory of acid –base indicators. Neutralization [titration] curves.

Definition, different types of buffers [chemical & biological], & their composition. Buffer capacity, buffered isotonic solutions. Calculations involving preparation of various buffer capacity solutions. Biological & pharmaceutical applications of buffers.

2. Oxidation- reduction titrations

Definition of oxidation, reduction, oxidizing & reducing agent. Equivalent weight, concept of half reactions. Systematic balancing of half reactions with respect to:

- a. Oxalic acid-KMnO₄,
- b. FeSO₄-ceric nitrate, &
- c. I₂-sodium thiosulphate solution titrations.

Calculation of equivalent weight of oxalic acid, KMnO₄, FeSO₄, permanganate & I₂ from half reactions. Calculation of factors for titrations mentioned in a, b & c.

- a) Redox titrations:
KMnO₄ as self indicator, its preparation, standardization, & use in the assay of ferrous gluconate tablets, H₂O₂, & NaNO₂ solution.
- b) Iodimetric & iodometric titrations. Definitions & difference between iodimetry & iodometry. Preparation, standardization of iodine solution. Assay of ascorbic acid & sulphur ointment by iodimetry. Assay of copper sulphate & ferric chloride by iodometry.
- c) Bromometric titrations.
- d) Iodate titrations. Definition. Preparation, standardization & use of KIO₃ in the assay of ascorbic acid & KI.
- e) Cerimetric titrations. Preparation, standardization & use of ceric solutions in the assay of paracetamol tablets. Its advantages over permanganate solutions.
- f) Bromine titrations. Preparation, standardization & use of bromine solution in the assay of phenol & isoniazide tablets.
- g) Potassium dichromate titrations. Preparation, standardization & use of potassium dichromate solution in the assay of ferrous ammonium sulphate.

Titrimetric & indicators used in Mohr's, Volhard's, & Fajan's methods. standardization of silver nitrate & ammonium thiocyanate solutions. Assay of sodium chloride by Mohr's method, use of nitrobenzene in the assay of halides, ammonium chloride, & thiourea by

Volhard's method. Calculation of factors in argentimetric titrations. Titration curve method. General applications of precipitation titrations.

1. Complexometric titrations

Difference between double salts & co-ordinate compounds. Definitions of co-ordination number of metal ions, ligands- uni-, bi-, & multidentate. Complexing, chelating, & sequestering agents with respective examples. Structure of complexes of platinum with ammonia. Ethylene diamine tetraacetate [EDTA] as a multidentate ligand in complexometry. Co- ordinate compounds of EDTA with bi-, tri-, & tetravalent metal ions. Stability of complexes & factors affecting it, use of buffers in EDTA titrations. Selective analysis of ions based on pH adjustments, use of masking & demasking agents, pM or metal ion indicators. Standardization of EDTA solution, titration curves, and examples of assays carried out by direct & back titrations & by replacement of one complex by the other. Applications of complexometry in the assays of calcium gluconate, milk of magnesia, zinc undecenoate ointment, & aluminium hydroxide gel. Assay of NaF by indirect titration.

2. Gravimetry

Principles of gravimetry. Factors affecting precipitation, formation, & properties of precipitate. Colloidal state. Impurities in precipitate, conditions of precipitation. Precipitation from homogenous solutions, washing, drying, & ignition of precipitate. Experimental techniques of drying & ignition. Applications of gravimetry in pharmacy.

3. Extraction techniques

Liquid-liquid extraction, separation of mixtures by extraction. Distribution law. Successive & multiple extraction [Craig method], continuous counter- current extraction. Effect of temperature & pH on extraction. Inert solute, associate ion pair formation, emulsion problem in extractions. Applications in pharmacy.

4. Potentiometry

Theory, ion selective electrodes, measurement of potential, red-ox titration curve, pH measurement, relation of pH to potential. Applications in pharmacy.

5. Miscellaneous methods of analysis

Diazotization titrations. Kjeldahl nitrogen estimation. Karl Fisher titrations. Liquid gelenicals. Oxygen flask Determination of alcohol content in liquid gelenicals. Oxygen flask combustion method.

6. Calibration

Calibration of instruments.

standardization of silver nitrate & ammonium thiocyanate solutions. Assay of sodium chloride by Mohr's method, use of nitrobenzene in the assay of halides, ammonium chloride, & thiourea by Volhard's method. Calculation of factors in argentimetric titrations. Titration curve method. General applications of precipitation titrations.

7. Complexometric titrations

Difference between double salts & co-ordinate compounds. Definitions of co-ordination number of metal ions, ligands- uni-, bi-, & multidentate. Complexing, chelating, & sequestering agents with respective examples. Structure of complexes of platinum with ammonia. Ethylene diamine tetraacetate [EDTA] as a multidentate ligand in

complexometry. Co- ordinate compounds of EDTA with bi-, tri-, & tetravalent metal ions. Stability of complexes & factors affecting it, use of buffers in EDTA titrations. Selective analysis of ions based on pH adjustments, use of masking & demasking agents, pM or metal ion indicators. Standardization of EDTA solution, titration curves, and examples of assays carried out by direct & back titrations & by replacement of one complex by the other. Applications of complexometry in the assays of calcium gluconate, milk of magnesia, zinc undecenoate ointment, & aluminium hydroxide gel. Assay of NaF by indirect titration.

8. Gravimetry

Principles of gravimetry. Factors affecting precipitation, formation, & properties of precipitate. Colloidal state. Impurities in precipitate, conditions of precipitation. Precipitation from homogenous solutions, washing, drying, & ignition of precipitate. Experimental techniques of drying & ignition. Applications of gravimetry in pharmacy.

9. Extraction techniques

Liquid-liquid extraction, separation of mixtures by extraction. Distribution law. Successive & multiple extraction [Craig method], continuous counter- current extraction. Effect of temperature & pH on extraction. Inert solute, associate ion pair formation, emulsion problem in extractions. Applications in pharmacy.

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11. Miscellaneous methods of analysis

Diazotization titrations. Kjeldahl nitrogen estimation. Karl Fisher titrations. Liquid gelenicals. Oxygen flask Determination of alcohol content in liquid gelenicals. Oxygen flask combustion method.

12. Calibration

Calibration of instruments.

13. General principles of spectroscopy

Wave-particle duality, wave properties, particulate properties. Line & band spectrum. Electromagnetic spectrum. Absorption & emission spectroscopy. Understanding of terms such as absorbance, transmittance, absorptivities, molar absorptivity, $E_{1cm 1\%}$, λ_{max} , effect of solvent & pH on λ_{max} .

14. Ultraviolet-visible Spectrometry

Different electronic transitions. Auxochromes & their effects, auxochromic, bathochromic & hypsochromic shifts [red & blue shifts]. Beer-Lambert law, its derivation, deviations in Beer's law. Single & double beam spectrophotometers covering sources of radiations, different monochromators, detectors such as barrier cell, photocell, photomultiplier tube. Photodiode array detector. Applications of this technique in qualitative & quantitative estimations giving emphasis on problem solving. Fieser-Woodward rules for calculations of theoretical λ_{max} values.

15. Spectrofluorimetry

Principle, definitions & types of luminescence. Mechanism of fluorescence & phosphorescence. Singlet & triplet states & intersystem crossing. Fluorescence yield & factors affecting it. Quenching of fluorescence & fluorescence quenchers. Structure & fluorescence. Brief discussion of instrumentation. Applications of fluorimetry in pharmacy.

16. Flame photometry & atomic absorption spectrometry

Principle & instrumentation with emphasis on working & importance of different components. Temperature, flame absorption & emission profiles. Interferences & their avoidance. Quantitative estimations & applications.

17. Infrared spectrometry

Infrared region in EM spectrum. Principle, different stretching & bending vibrations. Components [& their working] of a dispersive instrument. Fourier transform [FT] technique, FT instruments & their comparison with dispersive instruments. Sample handling techniques. Functional group & finger print regions in the spectrum. Functional groups identification & their use in characterization of compounds. Problems based on identification of functional groups from spectra of unknown compounds.

18. Proton nuclear magnetic resonance spectrometry

Principle involved in the technique. Knowledge about fundamental terms involved such as quantized absorption, flipping of nucleus, spin number, magnetic moment, magnetogyric ratio, relaxation, etc. Equations relating these terms to frequency of radiation & magnetic field [without derivation of the equations]. Types of relaxation processes. Low & high resolution instruments. A brief discussion on the low resolution instrumentation [60 MHz]. Quantitative knowledge of relationship between MHz & magnetic field. An introduction to superconductivity magnets. Solvents & reference standards used. Setting up of a NMR scale. Sample preparation. Shielding & deshielding of a proton & its effect on chemical shifts. Discussion on & importance of equivalent & non equivalent protons [number of signals], chemical shifts [position of signal] & their calculation from the spectrum, chemical shifts of different H's, splitting [multiplicity] of a signal, coupling constants [J values] , integration [area under the signal] . Importance of these terms in identification [or confirmation] of different functional groups. Significance & contribution of J value in stereochemistry. Prediction [expected theoretical values] of chemical shifts & multiplicities for all protons from simple structures containing up to 12-15 carbons. An introduction to FT-technique & its significance in ^{13}C -NMR spectrometry.

19. Mass spectrometry

Principle. Low & high resolution instruments. Components & importance of each in brief. Different types of mass spectrometric techniques. Brief knowledge of Chemical Ionization mass spectrometry. Calculations of hydrogen deficiency index [HDI] or unsaturation index [UI]. Base or parent peak, molecular ion, $M + 1$, $M + 2$ peaks. Calculations of molecular weight based on $M + 1$ & $M + 2$ peaks. Formation of molecular ion & further fragmentation. Rearrangements in mass spectrometry. Major modes of fragmentations of hydrocarbons, hydroxyl compounds, halogen compounds, aldehydes, ketones, carboxylic acids, and amines. Introduction [only] to recent advances in MS.

20. Polarography.

Principle & instrumentation. Ilkovich equation [no derivation] & its importance. Dropping mercury electrode [DME], saturated calomel electrode. Liquid-liquid junction potential, polarographic cell. Explanation of origin of S-shaped C-V curve. Applications

of this technique. Amperometric titrations, principles, instrumentation, & applications.

21. Nephelometry & Turbidimetry

Principles, Tyndall effect. Duboscq turbidimeter. Eeel's nephelometer. Applications.

22.Chromatography.

Principle, rate & plate theory, Van Deemter equation & the parameters affecting separation/band broadening. Classification of chromatography, retention factor. A detailed study of thin layer chromatography [TLC], preparative TLC, paper chromatography [PC], column chromatography, gas chromatography [GC / GLC]. Qualitative & quantitative applications of the above techniques. An introduction to high performance TLC [HPTLC], comparison of TLC & HPTLC. A brief introduction to high pressure / performance liquid chromatography [HPLC].

23.Miscellaneous

An introduction to electrophoresis. An introduction to lasers & masers. Statistical treatment to experimental data. Sampling techniques & applications in pharmaceutical industry.

BIOCHEMISTRY

1. Cell

Revision of ultra structure of cell, functions of various cellular constituents. Applications of biochemical principles to pharmacy.

2. Carbohydrates

Types of carbohydrates, their functions, digestion, & absorption. Aerobic & anaerobic oxidation with energetics. Glycogenesis, glycogenolysis, & gluconeogenesis. Hexose monophosphate shunt [HMP shunt]. Diseases associated with carbohydrate metabolism.

3. Proteins

Different types of proteins. Their functions, digestion & absorption. Denaturation & its effect on biological activity. Renaturation of proteins. Urea formation, urea cycle, creatinine formation. Transamination & deamination. Proteins as enzymes.

4. Lipids

Different types of lipids. Their functions, digestion, absorption & metabolism. (Beta-Oxidation of fatty acids with energetics. Biosynthesis of cholesterol [from acetate], adrenocorticoids, androgens, progesterone, estrogens, & bile acids / salts. Ketone bodies, their formation & biochemical significance. Diseases associated with lipid metabolism.

5. Vitamins

Definition. Classification, structures [except B12] biochemical role, sources, daily requirements, & deficiency symptoms. Vitamins as co-factors in biochemical reactions.

6. Biological oxidations & reductions

Oxidation reduction systems in the body their role. Oxidative phosphorylation & Electron transport chain. Cytochromes & inhibitors of the same.

7. Enzymes

Classification & their various roles. Enzyme co-factors. Enzyme kinetics. Michaelis-Menton equation along with its transformations. Double reciprocal plot. Factors affecting enzyme action. Enzyme inhibition, competitive & noncompetitive, & kinetics.

8. Nucleic acids

Different types of nucleic acids [NAs] & their composition. Purine & pyrimidine bases, sugars, & phosphoric acid. Nucleosides & nucleotides. Formation of NAs & their back bone. Different ways of representing DNA & RNA molecules. Physico-chemical properties of NAs. Their stability in acidic & basic solutions. Isolation, purification & identification, buoyant density, sedimentation coefficient, & Svedberg constant of NAs. De-novo biosynthesis of NAs. DNA & the Watson-Crick model & its features. DNA as the bearer of genetic information. Central dogma of molecular genetics & the processes

defined in the same. Replication of DNA. Different types of RNAs with their special features & functions. Minor or rare bases. Transcription & translation. Different post translational modifications of proteins. Triplet codon & the codon dictionary. Mutations. An introduction to different types of mutations. Their nature & repair.

9. Hereditary diseases.

Eliptocytosis, spherocytosis, HNPCC, diabetes insipidus.

PATHOPHYSIOLOGY

1. Basic principles of cell injury and adaptation

Causes, pathogenesis and morphology of cell injury. Abnormalities in lipoproteinemia, glycogen infiltration and glycogen storage disease.

2. Basic mechanisms of inflammation and repair

Pathogenesis of inflammation. Chemical mediators in inflammation. Pathogenesis of chronic inflammation. Repair of wounds in the skin, factors influencing healing of wounds.

3. Hypersensitivity

Hypersensitivity type I, II, III, IV. Biological significance of hypersensitivity. Allergy due to food, chemicals and drugs.

4. Auto-immunity & diseases of immunity

Mechanism of autoimmunity. Classification of autoimmune diseases in man. Transplantation and allograft reactions, mechanism of rejection of allograft. Acquired Immune Deficiency Syndrome (AIDS). Amyloidosis.

5. Neoplastic diseases

Disturbances of growth of cells. General biology of tumors, differences between benign and malignant tumors. Classification of tumors. Historical diagnosis of malignancy. Etiology and pathogenesis of cancer. Invasions, metastasis, patterns of spread of cancer. Environmental carcinogenesis.

6. Shock

Types, mechanisms, stages and management.

7. Biological effects of radiation

Nuclear radiation, UV, X-ray and other radiations.

8. Protein calorie malnutrition, vitamins, obesity, starvation

Deficiency of vitamins, study of various syndromes due to obesity and starvation.

9. Pathophysiology of common diseases

Parkinsonism. Schizophrenia. Depression and mania. Stroke (ischemic and hemorrhage). Hypertension. Angina. Myocardial infarction, CCF. Atherosclerosis. Diabetes mellitus. Peptic ulcer and inflammatory bowel disease. Cirrhosis and alcoholic liver diseases. Acute and chronic renal failure. Asthma and chronic obstructive airway

diseases.

10. Infectious diseases

Hepatitis - Infective hepatitis.

Sexually transmitted diseases (syphilis, gonorrhea, HIV). Pneumonia, typhoid, urinary tract infections. Tuberculosis. Leprosy. Malaria. Dysentery (Bacterial and amoebic). Viral oncogenesis.

BIOPHARMACEUTICS AND PHARMACOKINETICS

1. Bio-pharmaceutics

- a) Fate of drug after drug absorption, various mechanisms for drug absorption, drug concentration in blood, biological factors in drug absorption, physicochemical factors, dosage form consideration for gastrointestinal absorption.
- b) Drug Absorption:
 - Gastrointestinal absorption-biological considerations.
 - Gastrointestinal absorption - physicochemical considerations.
 - Gastrointestinal absorption-role of the dosage form.
 - Pharmacokinetics. Compartmental and non-compartmental pharmacokinetics. Biotransformation, drug disposition - distribution, drug disposition - elimination. Variability-Body weight, age, sex and genetic factors. Pharmacokinetic variability-diseases. Pharmacokinetic variability-drug interactions. Individualization and optimization of drug dosing regimens.

2. Bio-availability & Bio-equivalence

Quality parameters of dosage forms. Assay methods & its validation.

Physico - chemical properties of drugs & added substances and its effect on preparations and biological availability of dosage forms. Pharmaceutical properties of dosage forms, disintegration, dissolution rate. Biological, pharmacological effects of dosage forms. Factors affecting Bioavailability, Determination of bioavailability. Significance of bio-equivalence studies. Statistical analysis of bioequivalence studies. Development, scale up & post approval changes [SUPAC] & *in vitro* [dissolution] *in vivo* [plasma concentration profile] correlation or IV/IV correlation (IVIVC). Multi stage - Bioequivalence studies. Therapeutic equivalence. Titration design for clinical rationales. New Drug Application [NDA].

3. Bio- pharmaceutical statistics

Post Marketing Surveillance. Process Validation.

CLINICAL PHARMACY AND THERAPEUTICS

1. General Principles, preparation, maintenance, analysis of observational records in clinical Pharmacy.
2. Clinical trials, type and phases of clinical trials, placebo, ethical and regulatory issues including Good clinical practice in clinical trials.
3. Therapeutic drug monitoring, adverse drug reaction (ADR), types of ADR, Mechanism of ADR. Drug interaction, Monitoring and reporting of ADR and its significance.
4. Drug information services, Drug interactions.
5. Drug interaction in pediatric and geriatric patients, drug treatment during pregnancy, lactation and menstruation.
6. Pharmacovigilance, Therapeutic drug monitoring, Neutraceuticals, essential drugs and rational drug usage.
7. Age related drug therapy: concept of posology, drug therapy for neonates, pediatrics and geriatrics. Drugs used in pregnancy and lactation.
8. Drug therapy in gastrointestinal, hepatic, renal, cardiovascular and respiratory Disorders.
9. Drug therapy for neurological and psychological disorders.
10. Drug therapy in infections of respiratory system, urinary system, infective meningitis, TB, HIV, malaria and filaria.
11. Drug therapy for thyroid and parathyroid disorders, diabetes mellitus, menstrual cycle disorders, menopause and male sexual dysfunction.
12. Drug therapy for malignant disorders like leukemia, lymphoma and solid tumors.
13. Drug therapy for rheumatic, eye and skin disorders.

ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION

1. Cell physiology

Cell, Cell junctions, transport mechanisms, homeostasis, ion channels, secondary messengers.

2. The Blood

Composition and functions of blood, RBC, WBC, platelets. Homeostasis, blood groups, mechanism of clotting. Introduction to disorders of blood.

3. Gastrointestinal tract

Structure of the gastrointestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal structures and their role in the digestion and absorption of food.

4. Respiratory System

Structure of respiratory organs, functions of respiration mechanism and regulation of respiration, respiratory volumes and vital capacity.

5. Autonomic nervous system

Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in ANS.

6. Sense organs

Structure and physiology of eye (vision), ear (hearing), taste buds, nose (smell) and skin.

7. Skeletal System

Structure and function of skeleton. Articulation and movement. Disorders of bones and joints.

8. Central Nervous system

Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain, cranial nerves and their functions.

9. Urinary System

Various parts Structure and functions of the kidney and urinary tract. Physiology of urine formation and acid base balance. Brief Introduction to disorders of kidney.

10. Endocrine Glands

Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenal glands and pancreas. Local hormones. Brief introduction to disorders of various endocrine glands.

11. Reproductive System

Structure and functions of male and female reproductive system. Sex hormones, physiology of menstrual cycle, and various stages of pregnancy and parturition.

12. Cardio vascular system

Anatomy of heart and blood vessels, physiology of blood circulation, cardiac cycle, conducting system of heart, heart sound, electrocardiogram, blood pressure and its regulation.

13. Lymphatic system

Composition, formation and circulation of lymph. Spleen and its functions.

PHARMACEUTICAL JURISPRUDENCE

1. Historical background Drug legislation in India, Code of Ethics for Pharmacists.
 2. The Pharmacy Act 1948 (inclusive of recent amendments).
 3. Drugs and Cosmetics Act 1940, Rules 1945, including New Drug applications.
 4. Narcotic Drugs and Psychotropic Substances Act, and Rules there under.
 5. Drugs and Magic Remedies (Objectionable Advertisements) Act 1954.
 6. Introduction to Intellectual Property Rights and Indian Patent Act 1970.
- Prevention of Food Adulteration Act 1954 and Rules