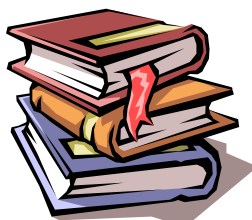




**SCHOOL OF STUDIES IN
PHARMACEUTICAL SCIENCES**

JIWAJI UNIVERSITY

GWALIOR



*Syllabus
For*

BACHELOR OF PHARMACY

BACHELOR OF PHARMACY

(w. e. f. 2011)

First Examination for the Degree of Bachelor of Pharmacy
(Four year integrated course)

| Sr. No. | Subject | Max. Marks | | Total | Mini. Marks for passing |
|-----------------------------|--|------------|--------------------|-------|-------------------------|
| | | Sessional | Paper or Practical | | |
| <u>THEORY PAPERS</u> | | | | | |
| 1-T1 | Pharmaceutics –I (General and dispensing) | 30 | 70 | 100 | 45 |
| 1 –T2 | Pharmaceutical Chemistry –I (Organic) | 30 | 70 | 100 | 45 |
| 1 –T3 | Pharmaceutical Chemistry –II (Inorganic) | 30 | 70 | 100 | 45 |
| 1 –T4 | Pharmacology –I (Physiology and Anatomy) | 30 | 70 | 100 | 45 |
| 1 –T5 | Pharmacognosy and Phytochemistry –I | 30 | 70 | 100 | 45 |
| 1–T6 | Mathematics Statistics and Computer application | 30 | 70 | 100 | 45 |
| <u>PRACTICALS</u> | | | | | |
| 1 –P1 | Pharmaceutics –I | 40 | 60 | 100 | 50 |
| 1 –P2 | Pharmaceutical Chemistry -I | 40 | 60 | 100 | 50 |
| 1 –P3 | Pharmaceutical Chemistry -II | 40 | 60 | 100 | 50 |
| 1 –P4 | Pharmacology -I | 40 | 60 | 100 | 50 |
| 1 –P5 | Pharmacognosy and Phytochemistry –I | 40 | 60 | 100 | 50 |

NOTES: -

1. In order to pass, the examinee must obtain minimum pass marks as above.
2. The Sessional marks will be based on three tests conducted during the academic year by the teachers and in PRACTICALS on evaluation of the experiments done during the academic year and a test conducted by the teacher.

PHARMACEUTICS –I **(General and Dispensing)**

1 –T1)

(60 Hours per year)

Introduction: Historical background and development of profession of pharmacy and pharmaceutical industry in brief.

Pharmaceutical Literature and Ethics: Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as B.P., U.S.P., European Pharmacopoeia, Extra Pharmacopoeia and National Formulary. General introduction to code of pharmaceutical ethics and Pharmacist's oath.

Dosage form: Introduction to dosage forms, classification and definitions. Routes of administration.

Prescription: Prescription and its parts, handling of prescription, labeling and packing, containers and closures.

Latin terminology: Preliminary knowledge of important Latin terms useful in the interpretation of prescription and their translation in to English.

Posology : Definition, Posology tables, maximum dosage for drugs, factors affecting doses of different drugs, calculation of doses for children and infants.

Weight & Measures: Different types of weights and measures, calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.

Galenicals: Definition, equipments for different extraction processes like infusion, decoction, maceration and percolation, methods of preparation of spirits, tinctures and extracts.

Surgical aids: Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.

Powders and granules: Classification, advantages and disadvantages, preparation of simple, compound powders, insufflations, dusting powders, Eutectic and explosive powders, tooth powders and effervescent granules.

Monophasic dosage forms: Theoretical aspects including commonly used vehicles, essential adjuvants like stabilizers, colorants, flavours with example. Study of following monophasic liquids like Aromatic water, Syrups, elixirs, gargles, mouth washes, throat paints, ear drops, nasal drops, liniments, lotions, enemas and collodions.

Biphasic dosage forms: Suspensions and emulsions, definition, advantages and disadvantages, classification, tests for the type of emulsion, formulation and evaluation.

Brief introduction of following dosage forms: Creams, ointments, pastes, inhalations, sprays, tablets and capsules.

Suppositories and pessaries: Definition, advantages and disadvantages, types of bases methods of preparation, displacement value, evaluation. Urethral and nasal bougies,

Incompatibilities: Introduction, classification and methods to overcome the same.

PHARMACEUTICAL CHEMISTRY –I

(Organic)

1 –T2)

(60 Hours per year)

Structure and properties: Molecular orbital theory, molecular orbitals, bonding and antibonding orbitals, intramolecular and intermolecular forces, bond length and bond dissociation energy, dipole moment, polarity of the bond, polarity of the molecule, electronegativity, inductive effects, resonance, hyper conjugation, melting point, boiling point and solubility.

Stereochemistry: Optical activity and Chirality, kinds of molecules displaying optical activity, absolute configuration, methods of determining configuration, molecules with more than one chiral centre, stereospecific and stereoselective synthesis, racemic modification, resolution, Cis-trans isomerism, conformational analysis and Baeyer's strain theory, Sacke-Mohr modification.

Structure, nomenclature, preparation and reaction mechanisms of : Alkanes, alkenes, alkynes, cycloalkanes, dienes, benzene, polyaromatic compounds, arenes, alkyl halides, alcohols, ethers, epoxides, amines nitro-compounds, phenols, aldehydes and ketones, carboxylic acids and their functional derivatives

Reactive intermediates: Carbocations, Carbanions, carbenes, nitrenes and nitronium ions - their generation, fate and applications.

Reaction mechanisms: Nucleophilic substitution reactions, Electrophilic substitution reactions, Electrophilic and free radical addition mechanism.

Mechanism and synthetic applications of: Aldol condensation, Claisen-Schmidt condensation, Cannizzaro reaction, Crossed aldol and Crossed Cannizzaro reactions, Benzoin condensation, Perkin condensation, Wittig reaction, Reformatsky reaction, Michael addition, Sandmeyer's reaction Hoffmann rearrangement, Kolbe and Reimer- Tiemann reactions.

A study of the specific uses of the following reagents in organic synthesis: Aluminium isopropoxide, Aluminium tertiary butoxide, N-bromosuccinimide, Diazomethane, Lithium aluminium hydride, Ozone, Periodic acid, Polyphosphoric acid, Sodamide, Sodium borohydride

PHARMACEUTICAL CHEMISTRY –II (Inorganic)

1 –T3)

(60 Hours per year)

Introduction: Symbols of elements, valency of elements, balancing the equation, Pharmacopoeia and monograph.

General method of preparation, physical property, assay, identification, storage condition, test for purity and use of inorganic compounds belonging to the following classes.

Gastrointestinal Agents: Definition, classification of the following subclasses.

Acidifiers: Indication. Dilute hydrochloric acid, Sodium acid phosphate, ammonium chloride.

Antacids: Definition, therapeutic use, qualities of an ideal antacid, classification, side effects, combination therapy, acid neutralizing capacity. Sodium bicarbonate, Potassium citrate, Aluminium hydroxide gel, Dried aluminium hydroxide gel, Aluminium phosphate, Magnesium oxide, Magnesium hydroxide, Magnesium carbonate. Tribasic calcium phosphate, Magnesium trisilicate.

Adsorbents and protectives: Definition, therapeutic uses. Light and heavy kaolin, Bismuth subnitrate, Bismuth subcarbonate. Activated charcoal, Talc.

Topical agents: Definition, classification of the following subclasses.

Protectives: Definition, indications. Talc, Zinc oxide, Calamine, Zinc stearate, Titanium dioxide, Kaolins, Silicone polymers.

Astringents: Definition, therapeutic uses. Alums, Aluminium sulphate, Zinc sulphate, Zinc chloride.

Antimicrobials: Classification, mechanism of action. Hydrogen peroxide, Sodium perborate, Potassium permanganate, Sodium hypochlorite, Iodine, Boric acid, Borax, Silver nitrate, Toughened Silver nitrate, Mild Silver protein, Sulphur, Selenium sulphide, Zinc undecenoate.

Dental products: Role of fluorides as anticaries agents. Sodium fluoride, Stannous fluoride.

Dentifrices: Definition, polishing agents, uses. Calcium carbonate, Dibasic calcium, calcium phosphate, Sodium metaphosphate, Strontium chloride

Oral antiseptics and astringents: Hydrogen peroxide, Sodium perborate, Zinc chloride, Zinc sulphate.

Cements and Fillers: Zinc oxide

Inhalations: Oxygen, Helium, Carbon dioxide, Nitrogen, Nitrous oxide.

Inorganic radiopharmaceuticals: Nuclear reactions, nomenclature, methods of obtaining standard and units of activity, measurement of activity, clinical applications, dosage, hazards and precautions.

Major intra and extra cellular electrolytes: Discussion on the physiological role of chloride, phosphate, bicarbonate, sodium, potassium, calcium, magnesium. Electrolytes used for replacement therapy. Sodium chloride, Potassium chloride, Calcium chloride, Calcium lactate, Calcium gluconate, dibasic calcium phosphate, tribasic calcium phosphate, magnesium chloride

Physiological acid base balance, its importance. Electrolytes used in acid base therapy. Sodium acetate, Potassium acetate, sodium bicarbonate, potassium bicarbonate, Sodium citrate, Potassium citrate, Sodium lactate, Ammonium chloride. Electrolyte combination therapy, official combination electrolyte infusions, oral rehydration solutions.

Essential and trace ions: Definition, physiological role of iron, copper, zinc, chromium, manganese, molybdenum, selenium, sulphur, iodine,

Haematinics: Definition. Ferrous fumarate, Ferrous gluconate, Ferrous sulphate, Dried ferrous sulphate, Ferrous ammonium citrate. Zinc chloride, Potassium iodide, Sodium iodide.

2.

PHARMACOLOGY –I **(Physiology and Anatomy)**

1 –T4)

(60 Hours per year)

Introduction to the anatomical terms in relation to the parts of the body, various systems and organs.

Cellular Physiology: Transport across cell membranes and membrane potential: and cell division.

Tissues of the body: Properties and functions of Epithelial Connective, Muscular and Nervous tissue.

Nervous system: Neuron Synapse and neuroeffector junction, nerve impulse generation and transmission, reflex arc; general organization of central and peripheral system; Central nervous system (Parts and functions), Autonomic nervous system.

Blood and Cardiovascular system: Composition and functions of blood; Plasma proteins: Red blood cells, genesis and fate, anemia: White blood cells types and physiological role: Coagulation of blood: role of various factors involved. Blood groups; Blood disorders, structure of heart and circulation, cardiac cycle, impulse generation and transmission electrocardiogram: Blood pressure, its measurement, regulation and maintenance of blood pressure, Hypertension.

Respiratory system: Organs involved in respiration: Mechanics of respirations; chemistry of respiration (Gaseous exchange and transport in blood) respiratory volumes, vital capacity.

Digestive system: Gross anatomy of elementary canal digestion and absorption of carbohydrates, proteins and fats Gastro intestinal hormones Role of pancreas and liver.

Skeletal System: Elementary knowledge of the human skeleton.

Endocrine system: Physiology of endocrine glands and related disorders.

Renal system: Structure of kidney and urinary tracts: Nephron: Physiology of urine formation, micturition, diuresis.

Physiology of special senses (ear, eye, smell, taste, and pain) Structure and functions of skins.

Body temperature: Regulation of body temperature role of physical and chemical factors. Fever, antipyretic drugs.

PHARMACOGNOSY AND PHYTOCHEMISTRY –I **(Including Biology)**

1 –T5)

(60 Hours per year)

Nature and scope of biology: Basis and origin of life, living and nonliving, common feature of life processes. Plant tissues (meristematic and permanent). Biological classification.

Cell as unit of life: macro and micro molecules of cell, enzymes, cell membranes, structural organization of cell, differences between plant and animal cell and cellular respiration.

Morphology and anatomy of flowering: Morphology of plant parts like root, stem, leaf and their modifications. Inflorescence, flower and its pollination. Morphology of fruits and seeds. Absorption and movement of water, minerals and nitrogen. Plant nutrition, photosynthesis, reproduction in flowering plants growth and development of flowering plants.

Pharmacognosy: Definition Historical development and scope of Pharmacognosy.

Classification of crude drugs: Alphabetical, morphological, pharmacological, chemical and biogenetic classification, their merits and demerits.

Study of drugs: A study of general methods of morphological and anatomical characters of organized drugs. Microscopic techniques used for preparation of drugs for examination.

Sources of important medicinal plants from different families and their products: Cruciferae, Papaveraceae, Umbelliferae, Labiatae, Compositae, Apocynaceae, Solanaceae, Liliaceae, Rubiaceae, Scrophulariaceae, Zingiberaceae.

Systematic study of crude drugs including English, Indian name their synonyms, official, biological and geographical sources, preparation identification chemical constituents chemical and microchemical tests, uses adulteration and evaluation of Carbohydrates and derived products:- Study of acacia, agar, tragacanth, guar gum, isapghol, honey, starches, and pectin and Alginates.

Introduction to Ayurveda: Indian system of medicines, ayurvedic dosage forms as Churna, Avleha, Bhasma, Arishta

MATHEMATICS, STATISTICS AND COMPUTER APPLICATION

1 –T6

(60 Hours per year)

Part-I: Mathematics

Differential calculus: Continuity and limit, Differentiation, derivability and derivative and L.H. derivatives, Differentials General theorems of derivation, derivation of trigonometric functions (excluding inverse trigonometric and hyperbolic functions), Logarithmic differentiation, Partial differentiation, Maxima and minimum (elementary).

Integral Calculus: Integration as inverse process of differentiation, definite integral, Integration by substitution by parts, Integration of algebraic functions of ex. Evaluation of area and volume in simple cases.

Differential equations: Formation of a differential equation, order and degree, derivation of a differential equation. Differential equation of first order and first degrees, Linear equation with constant co-efficient. Homogeneous linear equation (first method of solution only). Simultaneous differential equations which are linear and of the first order. Laplace transforms, solution of ordinary and partial differential equations by transformations methods.

Part-II: Statistics

Definition, frequency, distribution, general graphical representation of the data, histogram, frequency curve and frequency polygon and ogive.

Measures of central tendency, arithmetic mean, geometric mean, harmonic mean, median and mode.

Measures of dispersion, range, quartile deviation, mean deviation, standard deviation, variance, coefficient of variation and coefficient skewness.

Correlation, regression, linear correlation, coefficient of correlation, Karlpearsons formula and rank method, curve fitting by the method of least squares, linear equations only, regression lines, regression equation of 'Y' on 'X' and 'X' on 'Y' .

Part-III: Computer Science

Introduction to Computers: History, evolution, generation of computers. Introduction to computer and associated terms. Basic organization (CPU, ALU, I/O, Memory) components of computer, hardware, software, operating systems and windows.

Windows Applications: Notepad, file handling and directory handling.

MS Word: Basics of MS Word like editing and formatting.

MS-Power Point: Features and working with objects.

MS-Excel: Identification of parts, creating, editing, graphic objects and charts.

Introduction to computer Networks: LAN, WAN and Internet.

Internet Applications: Mail, chat, discussion groups and library access.

Publishing information on Internet.

PRACTICALS

PHARMACEUTICS – I

1 – P1)

(3 Hrs / Week)

Preparation of the dosages forms covered in 1T – 1 Pharmaceutics –I theory syllabus.

PHARMACEUTICAL CHEMISTRY – I

1 – P2)

(3 Hrs / Week)

1. Preparation of simple organic compound.
2. Systematic identification of unknown organic compounds, based on element detection, solubility, functional groups, physical constants and derivatives.

PHARMACEUTICAL CHEMISTRY – II

1 – P3)

(3 Hrs / Week)

Standardization of volumetric apparatus and standard solutions, accuracy and error, volumetric estimations involving assays based on theory syllabus.

PHARMACOLOGY – I **(Anatomy & Physiology)**

1 – P4)

(3 Hrs / Week)

Histology, Haematology (RBC/WBC/DO/DLC) Physiological experiments on muscle nerve preparation. Demonstration of measurement of blood pressure and respiratory function. Study of bones and organs (specimen), Bleeding time, clotting time, Hbcontent, Body temperature, pulse rate.

PHARMACOGNOSY AND PHYTOCHEMISTRY – I
(Including biology)

1 – P5)

(3 Hrs / Week)

1. Morphological characters of organized drugs – leaves-senna, vasaka, datura; Woodquassia; Bark – Cinnamon, Flower – cloves; Fruit – Cardamom, Bael, Fennel, Coriander; Seed – Linseed, Nux vomica; Root and Rhizomes – Ginger, Rauwolfia, ipecac.
2. Anatomical characters of dicot – leaf, stem and root.
3. Microscopic preparation: Staining, Surface Preparations, Maceration techniques.
4. Study of diagnostic characters of medicinal plants of the families mentioned in the theory.
5. Diagnostic and chemical examination of carbohydrate drugs dealt in syllabus.
6. Isolation of starch.
7. Study of starches, gums and mucilages.
8. Determination of swelling factors.

Reference Books

FIRST YEAR

PHARMACEUTICS –I

(General and Dispensing)

1. M. E. Aulton, Pharmaceutical Practice, ELBS London.
2. Rawlins, Bentley's T. B. of Pharmaceutics, ELBS London.
3. Davis, Bentley's T. B. of Pharmacy.
4. Cooper & Gunn, Dispensing of Pharmaceutical Students.
5. Cooper & Gunn, General Pharmacy.
6. Indian Pharmacopoeia.
7. British Pharmacopoeia.
8. The Pharmaceutical Codex.
9. Ansel, Pharmaceutical Calculations, Lea and Febiger.
10. Joel Zatz, Pharmaceutical Calculations, Wiley Interscience.
11. Jain and Sharma, A. T. B. of Professional Pharmacy, Vallabh Prakashan.

PHARMACEUTICAL CHEMISTRY –I

(Organic)

1. P. Sykes, A Guide book in to mechanisms in organic chemistry orient, Longman New Delhi.
2. J. D. Roberts and M. C. Caserio, Basic principles of organic chemistry, W. A. Benjamin Inc. N. Y.
3. R. F. Doerge, Wilson and Gisvolds, T. B. of organic medicinal and pharmaceutical chemistry, Lippencatt. Co.
4. J. B. Hendrichson, D.J. Gram and C.S. Hammond, Organic chemistry, Mc. Graw Hill.
5. Organic Chemistry by Robert T. Morrison & R. N. Boyd, "*" Prentice-Hall of India Pvt. Ltd., M-97, ConnaughtCircus, New Delhi -110001.
6. Organic Chemistry by I. L. Finar Vol. I & II, ELBS, Longman, London.
7. Organic Chemistry by Francis A. Carey, University of Virginia Vth Edn. 2002. (TATA McGraw -Hill Edn.)
8. Reaction Mechanisms in Organic Chemistry by S. M. Mukherji and S. P. Singh, Rajiv Beri for Macmillan India Ltd., 2/10, Ansari Road, New Delhi - 110 002.
9. Bentley and Driver's Text book of Pharmaceutical Chemistry, Oxford University Press, Ely House, London.
10. I.P. 2007, Govt. of India, Ministry of Health, The Controller of Publications, Civil Lines, Delhi - 110054.
11. Reactions and Reagents, O. P. Agarwal, Goel Publishing House Subhash Bazar, Meerut, (U.P.) India.

PHARMACEUTICAL CHEMISTRY –II

(Inorganic)

1. Bentley and Driver's Text Book of Pharmaceutical Chemistry, Oxford University Press, Ely House, London.
2. Inorganic, Medicinal and Pharmaceutical Chemistry. by J. H. Block, E. B. Roche, T. O. Soine, C. O. Wilson.
3. Roger's Inorganic Pharmaceutical Chemistry - Soine, Wilson.
4. Practical Pharmaceutical Chemistry by A. H. Beckett and J. B. Stenlake. Vol. I.
5. Indian Pharmacopoeia 2007 Ed., The Controller of Publications, Civil Lines, Delhi-100 054.

PHARMACOLOGY –I

(Physiology and Anatomy)

1. A.C. Guyton, Textbook of medical.
2. A.J. Vander, J.H. Sharma and D.S. Lucian: Human physiology.
3. Keele and Neil: Samson wrights applied physiology.
4. Gerard J. Tortora Nicholas P.: Principals of anatomy and physiology, Harper and Row New York.
5. William F. Ganong: Review of medical physiology, Prentice Hall International, Inc.
6. De. Robertes: Cell and molecular biology, Lea and Febiger.

PHARMACOGNOSY AND PHYTOCHEMISTRY –I

(Including biology)

1. G.E. Trease and Evans: Textbook of Pharmacognosy.
2. S.C. Dutta: Textbook of botany for degree students.
3. Clause and Tyler: Pharmacognosy.
4. Kokate C. K., Practical Pharmacognosy, Vallabh Prakashan, Delhi.
5. Wallis T. E. Analytical Microsc py, J. A.Churchill Ltd., London
6. Iyengar M. A. and Nayak S. K., Anatomy of Crude Drugs, Manipal Press Ltd., Manipal

MATHEMATICS, STATISTICS AND COMPUTER APPLICATION

1. N. Diskunov: Differential and integral calculus Vol. I and II Mr Publisher Moscow.
2. D.S. Philps: Basic statistics for health sciences students, N.H. Freeman and company.
3. V. Rajaraman, Computer programming in Pascal, Prentice Hall of India, New Delhi.
4. H. Hunt & J. Shelley: Computer and commonsense, Prentice Hall of India, New Delhi.
5. K. Jensen & H. Wirth: Pascal user manual and report, Harose Publishing House, New Delhi.
6. H. Wirth: Systematic programming an introduction, Englewood cliffs, New Delhi.
7. P. Grogone: Programming in Pascal, Addition Wesley Publication, New Delhi.
8. Fundamentals of Computers - V. Rajaraman, Prentice Hall.
9. "Teach Yourself" Series on Introduction to Computers, MS-DOS, Windows, MS Office, Internet, BPP books.
10. Basics of Computers and Applications by Rajan Hongal, Eastern Book Promoters, Belgaum.
11. A Text Book of Statistics by Raj Mohan, Benaka Books, Udupi.
12. Fundamental of Statistics by S. C. Gupta, S. Chand Publications, New Delhi.
13. S.C. Dutta: Textbook of botany for degree students

**Second Examination for the Degree of Bachelor of Pharmacy
(Four year integrated course)**

| Sr. No. | Subject | Max. Marks | | Total | Mini. Marks for passing |
|-----------------------------|---|------------|--------------------|-------|-------------------------|
| | | Sessional | Paper or Practical | | |
| <u>THEORY PAPERS</u> | | | | | |
| 2-T1 | Pharmaceutics –II (Pharmaceutical engineering) | 30 | 70 | 100 | 45 |
| 2 –T2 | Pharmaceutical Chemistry–III (Organic) | 30 | 70 | 100 | 45 |
| 2 –T3 | Pharmaceutical Chemistry –IV (Analysis) | 30 | 70 | 100 | 45 |
| 2 –T4 | Pharmaceutical Biochemistry | 30 | 70 | 100 | 45 |
| 2 –T5 | Pharmacognosy and Phytochemistry –II | 30 | 70 | 100 | 45 |
| 2 –T6 | Pharmaceutical Jurisprudence | 30 | 70 | 100 | 45 |
| <u>PRACTICALS</u> | | | | | |
| 2 –P1 | Pharmaceutics –II | 40 | 60 | 100 | 50 |
| 2 –P2 | Pharmaceutical Chemist 0020ry -III 50 | 40 | 60 | 100 | 100 |
| 2 –P3 | Pharmaceutical Chemistry -IV | 40 | 60 | 100 | 50 |
| 2 –P4 | Pharmaceutical Biochemistry | 40 | 60 | 100 | 50 |
| 2 –P5 | Pharmacognosy and Phytochemistry –II | 40 | 60 | 100 | 50 |

NOTES: -

1. In order to pass, the examinee must obtain minimum pass marks as above.
2. The Sessional marks will be based on three tests conducted during the academic year by the teachers and in practicals on evaluation of the experiments done during the academic year and a test conducted by the teacher.

PHARMACEUTICS –II **(Engineering)**

2 –T1)

(60 hours per year)

Heat Transfer: Mechanisms of heat transfer, Fourier's law, resistance in services, heat flow through cylinder, convection-natural convection, forced convection, surface coefficients, overall heat transfer coefficient, heat transfer in boiling liquids and condensing vapours.

Evaporation: Pharmaceutical factors affecting evaporation, study of pan, forced, circulation, film, vacuum and multiple evaporators.

Distillation: Raoult's and Henry's law, theory of distillation of binary mixtures of miscible, immiscible and partially miscible liquids. Study of distillation equipments used for simple, vacuum, steam reflux and molecular distillation.

Drying: Definition, purpose of drying, theory of drying, loss on drying, moisture content and equilibrium moisture content. Classification of dryers, study of tray, vacuum, fluidized/bed, freeze, spray and flash dryers.

Mixing: Fundamentals, factors influencing the selection of mixers, mixing mechanism. Study of solid-solid, solid-liquid and liquid-liquid mixers used in pharmaceutical industry.

Size reduction: Theory of size reduction, energy for size reduction, factors influencing size reduction. Importance of size reduction in pharmacy. Study of hammer mill, ball mill, fluid energy mill, colloid mill, roller mill.

Crystallization: Introduction, importance, theory of nucleation and crystal growth, Miers theory, principles underlying the design and operation of Swenson-Walker.

Filtration: Theory of filtration, Kozeny's equation, filter aids, selection of filters, study of filter press, rotary drum filter, membrane filters.

Size separation: Introduction, types of screening equipment, air separation methods. Cyclone separators, simple and mechanical classifiers, size separation by setting.

Humidification, air conditioning and refrigeration: Definitions wet-bulb theory, determination of humidity.

PHARMACEUTICAL CHEMISTRY –III (Organic)

2 –T2)

(60 hours per year)

Bonding: Introduction, types, structure. Hydrogen bond and hydrophobic bonds in organic molecules.

Structure reactivity of organic acids and basis: Electronegativity, inductive effect, resonance, hyper conjugation, steric effects and field effect in structure reactivity.

Heterocyclic compounds: General classification of heterocyclic compounds and nomenclature. Chemistry, synthesis and properties of the following heterocyclic systems and their derivatives.

- a) Pyrrole, Furan and Thiophen
- b) Pyridine, Pyrimidine, Pyrazine, Pyridazine
- c) Pyrazole, Imidazole, Oxazole, Isoxazole
- d) Fused ring systems like Indole, Benzofuran, Quinoline, Isoquinoline, Acridine and Phenothiazine.

Carbohydrates: Classification, Glucose Fructose and their reactions, cyclic structure of D glucose, mutarotation and conformations, aminosugars, maltose, lactose, sucrose, starch, cellulose, dextrin, glycogen, simple glycosides like selicin, arbutin, Amygdalin.

Proteins: Structure, classification and hydrolysis of protein, classification, isolation, properties and analysis of amino acids, classification, isolation, purification and hydrolysis of peptides, leading to amino acid sequence.

Lipids: Classification and general chemistry of lipids, fats their properties and characterization, fatty acid and their reactions, waxes, phospholipids, triglycerides, lecithins, spingomyelins, glycolipids lipoproteins.

Polymer: Introduction to Polymers and polymerization , pharmaceutical applications.

PHARMACEUTICAL CHEMISTRY –IV (Analysis)

2 –T3)

(60 hours per year)

Introduction: Introduction: Significance of quantitative analysis in quality control, different techniques of analysis, computation of analytical results, significant figures, concept of error, precision, accuracy, standard deviation, calibration of analytical equipments, fundamentals of volumetric analysis, methods of expressing concentrations, primary standard, secondary standard, absolute standard, derived standard. Quality control and quality assurance department in pharmaceutical industry

Limit tests: Sources of impurities, limit test for chloride, sulphate, iron, lead and arsenic.

Oxidation-Reduction Titrations: Nernst equation, calculation of standard potential, oxidation-reduction curves and red-ox indicators. Ferric ammoniumsulphate, Potassium iodate, Potassium bromate, Titanous chloride, Potassium iodide.

Gravimetric Analysis: Quantitative separation, solubility product, common organic and inorganic precipitants, thermogravimetric curves: practical aspects of gravimetry.

Non-aqueous Titration: Theoretical considerations, scope and limitations; Acidbase equilibria in non-aqueous media. Titration of weak acids and weak bases. Indicators in non-aqueous titrations.

Complexometric Titrations: Concept of complexation and chelation. Co-ordination number stability constant, titration curves, type of complexometric titrations.

Precipitation Titrations: Precipitation and complex forming reactions, argentometric titrations.

Polarimetry: Introduction, Optical and specific rotation, instrumentation and applications.

Refractometry: Refractive index, Refraction, instrumentation, and analytical application.

PHARMACEUTICAL BIOCHEMISTRY

2 –T4)

(60 hours per year)

Bio Energetics: Introduction, Free energy concept (ΔG), Relation between ΔG and k_{eq} (Equilibrium Constant). High energy compounds with examples. ATP structure and significance. Exergonic and endergonic reactions with examples.

Enzymes: Nomenclature and classification with examples. Enzyme Kinetics – Michealis Menton's equation (no derivation) an it's linear form, K_m , V_{max} . Liner weaver - Burk Plot. Factors affecting enzyme activity - pH, temperature and substrate concentration. Mechanism of enzyme action - Lock and key model, Induced fit model. Role of metal ions and coenzymes with examples. Enzyme inhibition with examples. Allosteric and covalent modification. Isoenzymes and their significance. Diagnostic enzyme.

Vitamins and coenzymes: Fat soluble vitamins- structure, biological role, disorders. Water soluble vitamins - structures, their coenzymes forms and their role in enzyme action (at least two examples each) and disorders.

Carbohydrate metabolism: Glycolysis and it's energetics, Gluconeogenesis, Glycogenesis, Glycogenolysis and regulation of glycogen metabolism, Pentose phosphate pathway, Metabolism of galactose, Uronic acid pathway, TCA cycle, Abnormalities of carbohydrate metabolism.

Proteins: Naming and classification of enzymes. Chemical kinetics, the Michaelis Menton equation. Factors governing enzyme activity, Isozymes. Structures and importance of essential and non-essential amino acids, proteolysis. The flow sheet of amino acids oxidations, Transamination, oxidative-deamination and Pathways leading to acetyl Co-A. Decarboxylation of amino acids, formation of nitrogenous excretion products. The urea cycle and ammonia excretion. The biosynthesis of essential and non-essential and aromatic amino acids. Regulation of amino acid biosynthesis and precursor functions of acids.

Lipids: Biosynthesis and oxidation of fatty acids, oxidation of odd carbon fatty acids and the fate of propionyl Co-A Ketone bodies and their oxidation. Regulation of lipid metabolism. Biosynthesis of cholesterol importance and its regulation.

Disorders: Brief knowledge of the following inborn errors of metabolism –

- (a) Pentosuria (b) Galctosuria (c) Alkaptusuria (d) Phenyl Ketonuria
(e) Niemann-pick disease.

Biological oxidation: Redox potential, Electron transport chain (ETC) and components, Arrangement of components of ETC, ATP producing sites (complexes) of ETC, Inhibitors and noncouplers, Chemiosmotic theory (Oxidative Phosphorylation), Shuttle mechanism, Difference between oxidative phosphorylation and substrate level phosphorylation with examples (at least two).

Biochemical Aspects of Hormone action: Hormone receptors and intracellular messengers. Adenylate cyclase, protein kinase and phosphodiesterase. Various endocrine and regulatory systems mediated by cyclic AMP.

General structure of the nucleotides. Pyridine and purine bases, nucleotides, nucleosides and nucleic acids. Genetic code transcription, translation and significance of cellular processes.

PHARMACOGNOSY AND PHYTOCHEMISTRY –II

2 –T5)

(60 hours per year)

Modern concept of Pharmacognosy, sources of drugs from biological, marine and plant tissue culture.

1. **Commerce in crude drugs:** Collection, preparation, drying and storage, of drugs, study of exogenous and endogenous factors affecting quality of drugs. Commercial production, export potential and world trade in oil of mentha, Eucalyptus oil and oleoresins from pinus species and lemon grass oil.
2. **Adulteration and evaluation of drugs:** Causes and types of adulteration and organoleptic, microscopic, biological chemical and physical methods of evaluation.
3. **Lipids:** Chemistry, classification & biogenesis, lipid containing drugs dealing with general methods of extraction & purification of fixed oils, biological source, chemical constituents, tests for identity and uses of the following: Arachis oil, Castor oil, Sesame oil, Cotton seed oil, Olive oil, Chaulmoogra oil, bees wax.
4. **Drugs of animal origin:** Shellac, Cochineal, cantharides, spermaceti, wool fat.
5. **Tannin containing drugs:** Catechu (Black & Pale), Tannic acid, Myrobalon, Katha industry in India.
6. **General study of formation of secondary metabolites:** Biogenesis of primary metabolites and importance of photosynthesis in formation of primary metabolites and their relationship to the formation of secondary metabolises (Calvine Cycle, TCA cycle, Shikimic acid pathway, Embden Merrhoffs pathway, Acetate hypothesis, Isoprenol compound biosynthesis).
7. **Study of volatile oil:** drugs with regard to the nature occurrence, chemistry and biogenesis. Pharmacognostic study of following drugs:
 - (1) Hydrocarbons: Pepper, turpentine. (2) Alcohol: Mentha, Coriander , Cardamom.
 - (3) Aldehyde: Cinnamon, Cassia, Lemon Peel, Lemon grass, Citronella, Cumin. (4) Ketone: Caraway, Dill, Spearmint. (5) Phenol: Clove (6) Phenolic ethers: Anise, Star Anise, Fennel, Nutmeg. (7) Oxides: Eucalyptus, Chenopodium.

8. **Nature, occurrence, chemistry, collection and preparation of drugs containing:**
(1) Balsams : (Tolu balsam; Peru balsam, Benzoin). (2) Acid resins: (Colophony). (3) Gum resin: Myrrh, Asafoetida . (4) Resins; Colocynth, Ginger, Turmeric, Capsicum, Cannabis, podophyllum.
9. Hallucinogens, narcotics and common poisonous plants of India.

PHARMACEUTICAL JURISPRUDENCE

2 –T6)

(60 hours per year)

Introduction to Pharmacy Legislation in India: Origin and nature of pharmaceutical legislation in India, its scope and objectives, report of Chopra, Bhore, Bhatia, Mudaliar and Hathi Committee.

Pharmacy Act, 1948: Introduction, objective, definitions, Education Regulations, approval, Registration of pharmacists, Central and State Councils and Amendments to the Pharmacy Act.

Drugs & Cosmetics Act, 1940 and Rules, 1945: Introduction, definitions, general study of the schedules, salient features of the import, manufacture, sale, labeling conditions of drugs, administration, provision for Ayurvedic, Unani drugs and cosmetics, as amended, provisions and maintenance of blood bank.

Medicinal and Toilet Preparations (Excise Duties) Act, 1955: Objectives, definitions, requirements of bonded and non bonded manufactory, Manufacturing of medicinal and toilet preparations in bonded and non bonded manufactory, manufacture and warehousing of alcoholic preparations, issue of spirit from spirit store, procedures, offences and penalties as amended.

Narcotic Drugs and Psychotropic Substances Act, 1985 and Rules: Introduction, objectives, definitions, prohibited and controlled operations, enforcement, offences and penalties, manufacture, cultivation of poppy plants, sales of opium, import and export of narcotics as amended.

Drugs (Price Control) Order 1995: Objectives, definitions, retail price of bulk drugs and formulations, pricing of formulations and bulk drugs, DPEA, New Drug Policy as amended.

Drugs and Magic Remedies (Objectionable Advertisements) Act, 1954: Definitions, prohibited and exempted advertisements, exempted advertisements under condition, offences and penalties; as amended periodically.

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

- Poisons Act, 1919,
- Insecticides Act 1968
- Medical Termination of Pregnancy Act, 1970 and Rules, 1975
- Prevention of Cruelty to Animals Act, 1960
- AICTE Act 1987
- Shops and Establishment Act and Rules
- Trademark registration Act
- Labour laws
- Factory Act, Industrial development Act and Industrial dispute Act

Intellectual Property Rights: Types of Intellectual Property Rights, process and product patents, criteria for getting patents, procedure for filing patent application, revocation of patents, restoration of patents.

PRACTICALS

PHARMACEUTICS –II **(Engineering)**

2 –P1)

(3 hours per week)

1. To find the drag coefficient for the particle setting in the fluid.
2. To study the effect of centrifugation speed on the cake volume.
3. To study the effect of centrifugation time on cake volume.
4. To find the % yield of boric acid and NaCl crystals with seeding and without seeding.
5. To study the effect of rate of cooling on the crystal growth.
6. To find the rate of sedimentation of a slurry and to utilize this data to design the thickener area.
7. To separate particles of different sizes by setting.
8. To carry out sieve analysis of certain pharmaceutical substances and calculate different diameters.
9. To study the effect of ball change on grinding process.
10. To determine the angle of nip.
11. To plot boiling point diagram for the given mixture.
12. To study the rate of drying of a material.
13. To calculate loss on drying and moisture content of the giving granules.
14. Engineering drawing sheets on preliminary knowledge of drawing of alphabets, numerical and geometric construction.

PHARMACEUTICAL CHEMISTRY –III **(Organic)**

2 –P2)

(3 hours per week)

1. Synthesis of organic compounds of pharmaceutical interest upto three steps.
2. Separation and identification of compounds of mixture of two organic compounds.

PHARMACEUTICAL CHEMISTRY –IV

(Analysis)

2 –P3)

(3 hours per week)

1. Preparation and standardization of ceric ammonium sulphate and potassium iodate. Assay based on use of ceric ammonium sulphate and potassium iodate.
2. Preparation and standardization of perchloric acid and sodium or lithium methoxide, Assays based on use of above solution.
3. Preparation and standardization of sodium EDTA, Assays based on use of EDTA solutions.
4. Preparation and standardization of silver nitrate and ammonium thiocyanate. Assays based on use of above reagents.
5. Gravimetric analysis: Preparation of Gooch Crucible, assays based on gravimetric methods.
6. Experiments based on limits test for chloride, sulphate, iron, arsenic, heavy metals.
7. Experiments based on the use of refractometer and polarimeter.
8. Semi- micro- Qualitative Analysis of inorganic mixture; containing five radicals (Acidic, basic and interfering).

PHARMACEUTICAL BIOCHEMISTRY

2 –P4)

(3 hours per week)

1. Calibration of standard curve for proteins.
2. Calibration of standard curve for glucose.
3. Calibration of standard curve for phosphorus.
4. Calibration of standard curve for cholesterol.
5. Estimation of blood glucose using GOD – POD method.
6. Estimation of blood urea.
7. Urine analysis – Physical examination, Qualitative examination of abnormal constituents and microscopic examination.
8. Semen analysis – Physical and Microscopic.

9. Handling and Management of Instruments.
10. Study of permanent slides.
11. Glucose tolerance test.
12. Estimation of serum electrolysis.
13. Blood testing for Malaria parasite.
14. Pregnancy test for urine.
15. Serum protein & A.G. Ratios.

PHARMACOGNOSY AND PHYTOCHEMISTRY –II

2 –P5)

(3 hours per week)

1. Microscopic study of drugs included in theory.
2. Surface analysis of leaf drugs.
3. Isolation of total glycosides from digitalis and senna.
4. Isolation of tannins and determination of tannins in catechu.
5. Estimation of balsamic acids.
6. Study of Balsam of Tolu and Balsam of Peru and Benzoin.

Reference Books

SECOND YEAR

PHARMACEUTICS –II

(Engineering)

1. Ganderson, Unit processes in pharmacy.
2. Lachman, Theory and practice of industrial pharmacy, Lea and Fabiger.
3. Gannaro, Remington's Pharmaceutical Science, Mack Publishing Company.
4. Rawlin's Bentley's, Textbook of pharmaceutics E.L.B.S., London.
5. Brown, Unit operation, Mc Graw Hill.
6. Cooper and Gunn, Tutorial pharmacy.
7. Badger and Banchemo, Introduction to chemical engineering, Mc Graw Hill.
8. Linger, Chemistry of engineering materials.
9. Mc Cabe, Smith, Unit operation in chemical engineering, Mc Graw Hill.

PHARMACEUTICAL CHEMISTRY –III

(Organic)

1. R.T. Morrison and R.N. Boyd: Organic Chemistry, PHI.
2. I.L. Finar: Organic chemistry Vol. I and II E.L.B.C. London.
3. Logowski and Katritzki: Heterocyclic chemistry.
4. R.N. Acheson: An introduction to the chemistry of heterocyclic compound, Interscience Publication, N. Y.
5. K.B.G. Torsell: Nature product chemistry, JohnWiley and sons, N. Y.
6. Wilson and Gisvolds: T.B. of organic medicinal and pharmaceutical chemistry, Lippincott Co.

PHARMACEUTICAL CHEMISTRY –IV

(Analysis)

1. G.L. Jenkins; J.E. Christian, G.P. Hager, Quantitative pharmaceutical chemistry, Mc Graw Hill Company Inc. N. Y.
2. A.H. Beckett and J.B. Stenlake; Practical pharmaceutical chemistry Part I and II, The Althlone Press, University of London, London.
3. J. Basset, R.C. Denney, G.H. Jeffery, J. Mentham, Vogel's; T.B. of Quantitative inorganic analysis including elementary instrumental analysis, The E.L.B.C. London.
4. L.M. Atherden, Bentley and Drivers T.B. of pharmaceutical chemistry, Oxford University Press, Delhi.
5. Pharmacopoeia of India, Govt. of India; Ministry of health.
6. L.G. Chatten, A.T.B. of pharmaceutical chemistry Vol. I and II, Marcel Dekker N. Y.
7. K.A. Connors; A.T.B. of pharmaceutical analysis, Wiley Interscience, N. Y.
8. G. Svelha Vogel's; T.B. of micro and semimicro qualitative analysis, Orient, Longmen, Hyderabad.

PHARMACEUTICAL BIOCHEMISTRY

1. Harold Harper; A review of physiological chemistry.
2. A.L. Lehninger; Biochemistry.
3. A.L. Lehninger; Principles of biochemistry.
4. L. Stryer Biochemistry, W.H. Freeman & Company San Francisco.
5. B. Harrow and A Mazur T. B. of Biochemistry, W.B. Saunders Co. Philadelphia.

PHARMACOGNOSY AND PHYTOCHEMISTRY –II

1. G.E. Trease and Evans; Textbook of Pharmacognosy.
2. S.C. Dutta; Textbook of botany for degree students.
3. Clause and Tyler; Pharmacognosy.
4. T.E. Wallis; Textbook of Pharmacognosy.
5. Finar organic chemistry Vol. II.

PHARMACEUTICAL JURISPRUDENCE

1. Govt. of India Publications on Bare Acts.
2. Text book of Forensic Pharmacy by B. M. Mithal, National Book Centre, Kolkata.
Text book of Forensic Pharmacy by N. K. Jain, Vallabh Prakashan, Delhi.
3. A Manual of Drugs & Pharmacy Laws in India by H. K. Bharathi, Sadhna Mandir Publications.
4. Intellectual Property Law by P. Narayanan, Eastern Law House.
5. IDMA bulletin

**Third Examination for the Degree of Bachelor of Pharmacy
(Four year integrated course)**

| Sr. No. | Subject | Max. Marks | | Total | Mini. Marks for passing |
|-----------------------------|--|------------|--------------------|-------|-------------------------|
| | | Sessional | Paper or Practical | | |
| <u>THEORY PAPERS</u> | | | | | |
| 3-T1 | Pharmaceutics –III (Physical Pharmacy) | 30 | 70 | 100 | 45 |
| 3 –T2 | Pharmaceutical Chemistry–V | 30 | 70 | 100 | 45 |
| 3 –T3 | Pharmaceutical Chemistry –VI (Analysis) | 30 | 70 | 100 | 45 |
| 3 –T4 | Pharmacology –III | 30 | 70 | 100 | 45 |
| 3 –T5 | Pharmaceutical Microbiology and Biotechnology | 30 | 70 | 100 | 45 |
| 3 –T6 | Biopharmaceutics | 30 | 70 | 100 | 45 |
| <u>PRACTICALS</u> | | | | | |
| 3 –P1 | Pharmaceutics –III | 40 | 60 | 100 | 50 |
| 3 –P2 | Pharmaceutical Chemistry -V | 40 | 60 | 100 | 50 |
| 3 –P3 | Pharmaceutical Chemistry –VI (Analysis) | 40 | 60 | 100 | 50 |
| 3 –P4 | Pharmacology -II | 40 | 60 | 100 | 50 |
| 3 –P5 | Pharmaceutical Microbiology and Biotechnology | 40 | 60 | 100 | 50 |

NOTES: -

1. In order to pass, the examinee must obtain minimum pass marks as above.
2. The Sessional marks will be based on three tests conducted during the academic year by the teachers and in practicals on evaluation of the experiments done during the academic year and a test conducted by the teacher.
3. Students will be send for industrial training for a period of 30 days after completion of all the examinations of third year of B.Pharmacy

PHARMACEUTICS –III **(Physical Pharmacy)**

3 –T1)

(60 hours per Year)

Kinetics and drug stability: Rate, Molecularity and Order of reaction. Zero order, first order, second order and complex reactions. Determination of order of reaction, factors affecting rate of reaction, physical and chemical degradation of medicinal agents and preventive measures. Accelerated stability study for shelf life determination.

Solubility and Distribution phenomena: Distribution of solute between immiscible liquids, ionic dissociations and molecular association influencing partitioning. Applications of distribution in pharmacy.

Interfacial Phenomena: Cohesion. Adhesion and spreading. Adsorption at solid and liquid interfaces, adsorption isotherms, adsorption in Medicine and Pharmacy. Electrical properties of interfaces. Origin of charge, electrical double layer, Nernst and Zeta potential, Effect of electrolyte.

Colloidal Dispersion: Properties of colloids-optical. Kinetic and electrical and their applications in determining molecular weight of polymer. Stability of colloidal systems, Mechanism of peptization, coacervation and protective action.

Micromeritics: Particle size, distribution, shape and surface area and their determination in heterogeneous systems. Porosity, density and packaging arrangements in flow properties and their influence on processing of solid dosage forms. Mechanism of Particle bonding and granule formation

Surface-active agent: Classification based on chemical nature and HLB scale determination of HLB. Micellar solubilization and its pharmaceutical significance.

Rheology: Types of flow behaviour thixotropy and thixotropic coefficient. Measurement of various rheological properties. Factors influencing Rheology of dispersed systems.

Suspension: Particle to particle interactions and behavior, Flocculation and deflocculation Sedimentation parameters, role of wetting controlled flocculation and structured vehicle in suspension formulation, Evaluation of suspension stability.

Emulsions: Types, Detection, Thermodynamic considerations, Mechanism of droplet stabilization, theory of emulsification, properties and stability of emulsions.

PHARMACEUTICAL CHEMISTRY –V

3 –T2)

(60 hours per Year)

Basic Principles of medicinal chemistry: Introduction, history and development of medicinal chemistry and fundamental principles of drug therapy.

Physicochemical and Stereochemical aspects of drugs including bioisosterism in relation to biological activity, Drug-Receptor interaction.

Conventional methods of drug design, Lead, Discovery of Lead, lead optimization

Vitamins: Water soluble and fat soluble vitamins

Introduction, Structure, Stereochemistry, Nomenclature, Synthesis of specified drugs (given in parenthesis), mode of action, Structure Activity Relationships (if any) uses and Physicochemical properties of the following classes of drugs:

Adrenergic hormones and drugs including biosynthesis, storage, release and metabolism of Catecholamine (Isoprenaline, Adrenaline, Salbutamol).

Cholinergic and Anticholinesterases including biosynthesis, storage, release and metabolism of acetylcholine (Neostigmine bromide, Pyridostigmine Bromide) **04**

Antispasmodic and Antiulcer drugs (Propantheline bromide, Dicyclomine hydrochloride)
Antiparkinsonism drugs (Apomorphine).

Neuromuscular blocking agents (Succinylcholine chloride, Gallamine triethiodide).

Antihistamines including Sodium Cromoglycate (Chlorpheniramine).

Prostaglandins and other Eicosanoids: Nomenclature, biosynthesis and biological activity.

Analgesic-antipyretics and Non-steroidal Anti-inflammatory agents: (Indomethacin, and Phenylbutazone).

PHARMACEUTICAL CHEMISTRY –VI

(Analysis)

3 –T3)

(60 hours per Year)

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

The theoretical aspects, basic instrumentation, elements of interpretation of results and pharmaceutical application of the following analytical techniques:

Chromatography: Paper chromatography, Thin Layer chromatography, Gas chromatography, High Pressure liquid chromatography, High Pressure Thin Layer chromatography and Ion exchange chromatography.

Electrometric methods: Potentiometry, Conductometry, Polarography and Amperometry

Spectroscopy: Absorption spectroscopy, Infrared spectroscopy, Fluorimetric analysis and Nephelometry & Turbidometric analysis.

Flame photometry: Theory, nebulisation, flame and flame temperature, interferences, flame spectrometric techniques, instrumentation and pharmaceutical applications.

NMR & ESR: Introduction, theoretical aspects and applications.

Mass Spectrometry: Fragmentation, types of ions produced mass spectrum and applications.

Phase Solubility Analysis: Theory, experimental procedures, applications in Pharmaceutical analysis.

Analysis of drugs with particular reference to instrumental methods as included in Indian Pharmacopoeia:

Antibiotics: Benzylpenicillin, tetracyclin, chloramphenicol.

Vitamins: Ascorbic acid, thiamine, vitamin A,

Barbiturates:, Phenobarbitone.

Sulphonamides: Sulphanilamide, Sulphadiazine.

PHARMACOLOGY –III

3 –T4)

(60 hours per Year)

1. General Pharmacology:

Introduction to Pharmacology. Dosage forms and routes of administration. Factors influencing dosage and drug action. Dynamics of adsorption, distribution, metabolism and excretion of drug. Pharmacogenetics, Mechanism of drug action, adverse drug reaction and treatment of poisoning. Drug interactions. Pharmacological involvement in new drugs development.

2. Drugs acting on central nervous system:

General consideration alcohol and alcoholism, General anesthetics, sedatives and analgesics, hypnotics, and antipyretics, Anti-inflammatory agents, Psychopharmacological agents, Antiepileptics. CNS stimulants, problems of drug dependence, Antiparkinsoni drugs.

3. Drugs acting on peripheral nervous system:

General considerations, Cholinergic and anticholinergic agents, Adrenergic stimulants and blocking agents, Skeletal muscle relaxants, Local anaesthetic agents.

4. Fluid and electrolyte Balance, Diuretics

5. Drugs acting on cardiovascular System:

General consideration, Cardiac Glycosides, Anti arrhythmic agents, Drug therapy of hypertension.

6. Autocoids:

Histamine, antihistaminics, Serotonin and its antagonists, prostaglandins. Prostacyclines.

PHARMACEUTICAL MICROBIOLOGY AND BIOTECHNOLOGY

3 –T5)

(60 hours per Year)

Introduction: History of Microbiology its branches and its importance; general microbiological techniques, identification, staining, enumeration etc. General classification of micro - organisms & study of bacteria, moulds, yeasts, viruses & actinomycetes -Nutrition, cultivation, Isolation and identification; Effect of moisture, temperature, ion, light and pH on the growth of micro - organisms; bacteriological media; Bacterial metabolism - EMP and TCA pathways; Salient features of common communicable disease producing microbes; study of different types of microscopy; bacterial resistance.

Immunology: Introduction, Types of Immunity, Immunological products like sera, vaccines, toxoids: Phagocytosis, antigens, antibodies, components; Immune systems- humoral immunity, cellular immunity, privileged graft, sites, graft host reaction; tolerance, immunogenetics; Types of reactions and their application.

Preparation and standardization of Immunological products e.g. BCG vaccines, diphtheria toxoids, small pox vaccine, poliomyelitis vaccine; tetanus anti-toxin, diagnostic biologicals; General method of the preparation of bacterial vaccines, toxoids; viral vaccine; rickettsial vaccines; anti-toxins; serum-immune blood derivatives and other products relative to immunity; Interferon.

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

Sterilization methods and Principles: Methods of sterilization; Physical, Chemical, Heat, radiation, gaseous, filtration. Evaluation of the efficiency of sterilization methods; Equipments employed in large scale sterilization. Examples of the materials sterilized by different methods. Sterility indicators.

Sterility testing of pharmaceutical products: Sterility testing of products according to IP, BP and USP. Sterility testing of parenteral products - solids, liquids; Ophthalmic and other sterile products according to the I.P., B.P. and U.S.P. Sterility testing of sterile

surgical devices; dressings, implants, absorbable, haemostats, surgical ligatures and sutures, surgical catgut etc.

Aseptic Technique: Designing of aseptic area, laminar flow equipments; study of different sources of contamination aseptic area and methods of prevention.

Fermentation Technology: Fermentation methods and general requirements; study of media, equipments, sterilization methods, aeration process, stirring, etc. Large scale production fermenter design and its various controls. Study of the production of - penicillins, citric acid, fungal diastase and Dextran.

Microbiological Standardization: Microbiological methods for standardization of antibiotics, vitamins and amino acids; Immunoassay; Assessment of a new antibiotic and testing of antimicrobial activity of a new substance.

Microbial spoilage and preservation of Pharmaceutical products: Types of spoilage; factors affecting the microbial spoilage of pharmaceutical products., sources and types of microbial contaminants; assessment of microbial contamination and spoilage; preservation of pharmaceutical products using antimicrobial agents; Evaluation of microbial stability of formulations.

Control of microbial contamination during manufacture: General aspects- environmental cleanliness and hygiene, quality of starting materials, process design, quality control and documentation.

Pharmaceutical biotechnology: Introductions, biotechnology drugs, applications of biotechnology in Pharmacognosy, pharmacology, pharmaceutical manufacturing and organic synthesis.

Prebiotic and Probiotic approach: Definition, principle, importance and commonly used products.

BIOPHARMACEUTICS

3 –T6)

(60 hours per Year)

Drug absorption: Gastrointestinal absorption, membrane physiology, mechanisms of solute transport across the cell membrane, Factors affecting drug bioavailability / absorption.

Drug Distribution: Disposition processes, distribution in blood, factors affecting drug distribution, Blood pH, drug pka and partition coefficient, physiological barriers like plasma membrane, blood brain barrier, CSF barrier, placental barrier and blood-testis barrier to drug distribution, perfusion rate to the tissue, drug-tissue binding, P-D binding and miscellaneous factors like age, diet, obesity, pregnancy, diseased state and drug interaction.

Plasma protein-drug binding: Proteins binding kinetics, factors affecting P-D binding and therapeutic significance of P-D binding.

Biotransformation: Definition, chemical pathways of drug biotransformation, metabolizing enzymes, factors affecting drug biotransformation and drug response. Inhibition and stimulation of drug biotransformation

Excretion: Renal and non renal excretion, concept of clearance, renal clearance, renal impairment and dose adjustment. Biliary and salivary excretion of drugs.

Compartments models: Concepts and their importance in the study of pharmacokinetics. One compartment open model. Determination of drug /metabolite levels on administration of single and multiple dose in plasma and urine after i.v. injection. Oral administration and first order absorption. Percent absorbed time plot and absorption rates based on one compartment model.

Two compartments open model, pharmacokinetics of single and multiple dose administration as applied to intravenous (rapid) and oral administration, intravenous transformation.

Bioavailability and Bioequivalence: Objectives, absolute and relative bioavailability, measurement of bioavailability, pharmacokinetics and pharmacodynamics methods, methods of enhancement of bioavailability, bioequivalence studies in-vitro and in-vivo correlations. Review of regulatory requirements for conduction of bio-equivalent studies.

PRACTICALS

PHARMACEUTICS –III **(Physical Pharmacy)**

3 –P1)

(3 hours per week)

1. To determine the heat of solution of benzoic acid, boric acid etc.
2. To determine the relation between dielectric constant of solvent and solubility of drugs.
3. To plot ternary phase diagram.
4. To find out the partition coefficient and distribution of the drug between two phase.
5. To determine CMC of a surfactant through interfacial tension measurement
6. To plot adsorption isotherm.
7. To calculate the sedimentation parameters of suspensions.
8. To verify the Holfmeister series for the flocculation of colloid.
9. To measure the mean globule diameter of the emulsion.
10. To study the effect of phase volume ratio on viscosity of emulsion.
11. To study the effect of particle size or angle of repose and flow properties.
12. To study the effect of fines and lubricant on angle of repose and flow properties.
13. To determine the bulk density, True density and granule density of few Pharmaceuticals and to calculate the porosity of the material.
14. To study the effect of temperature and centrifugation on the stability of emulsion.

PHARMACEUTICAL CHEMISTRY –V

3 –P2)

(3 hours per week)

1. Synthesis of some Pharmaceutical compound.
2. Estimation of Nitrogen and Functional groups likes Amino, Hydroxyl, Aldehyde, Ketone, Carboxyl and ester group.

PHARMACEUTICAL CHEMISTRY –VI

(Analysis)

3 –P3)

(3 hours per week)

1. Quantitative determination of drugs / salts by ion exchange techniques.
2. Separation and identification of drugs by TLC.
3. Separation and quantitative determination of drugs by paper chromatography.
4. Quantitative determination of APC by column chromatography.
5. Experiments in conductometric titration's.
6. Experiments involving use of colorimeter and spectrophotometer in quantitative analysis of drugs.
7. Flame photometric determinations of Na⁺ and K⁺ ions.
8. Experiments involving use of fluorimeter in analysis of drugs.
9. Experiments based on the use of the oxygen flask combustion technique.
10. Biochemical analysis involving use of above instruments.

PHARMACOLOGY –III

3 –P4)

(3 hours per week)

1. Introduction to Experimental Animals.
2. Introduction to commonly used instruments in experimental pharmacology.
3. Physiological salt solutions.
4. Demonstration of routes of administration (oral, IM, IV, SC) in experimental animal, stunning and pithing of animals and euthanasia.
5. Antagonism between Acetylcholine and d-tubocurarine on frog rectus.
6. Cardiac stimulants and depressant on isolated frog's heart.
7. Effects of miotics and mydriatics on rabbit's eye.
8. Effect of Antidepressant activity of various drugs on tail suspension test
9. Evaluation of Antiparkinsonian activity
10. Screening of Analgesics by Writhing method
11. Effect of various tranquillizers and sedatives on motor co-ordination by rota-rod test in mice
12. ExPharm demonstration.

PHARMACEUTICAL MICROBIOLOGY & BIOTECHNOLOGY

3 –P5)

(3 hours per week)

Exercise illustrating the course contents of theory including :

1. Preparation of various types of culture media
2. Studying of different laboratory equipments and processing e.g. B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes etc.
3. Subculturing of aerobic and anaerobic bacteria, fungus and yeast, Nutrient stabs and slants preparations.
4. Various staining methods-simple, Grams staining and acid fast staining, structural staining etc.
5. Isolation of pure culture of micro-organisms and identification of micro-organisms. Evaluation of sterilizing techniques.
6. Evaluation of antiseptic and disinfectants e.g. RWC, FDA method and chick martin.
7. Sterility testing-different methods as per IP/BPIUSP
8. Hanging drop slide preparation
9. Biochemical reactions-starch hydrolysis, nitrate reduction, litmus milk test, gelatin liquification and haemolysis of blood.
10. Microbial viable count in a pharmaceutical product, total count of bacteria
11. Thermal death time
12. Microbiological assay of antibiotics & vitamin B12
13. Test for limit of alkalinity of glass
14. Pyrogen testing
15. Standardization of surgical dressings and sutures and ligatures
16. Studying the effect of Temperature, pH on the medium etc. on growth.
17. Isolation of an antibiotic producer.
18. Bacteriophage isolation and characteristics
19. Standard analysis of water & Biochemical oxygen demand
20. Normal throat flora
21. Studying of the environment microflora and testing of aseptic area e.g. dextrose injection, calcium gluconate injection, oily injections, injections of vitamins etc.

Reference Books

THIRD YEAR

PHARMACEUTICS –III (Physical Pharmacy)

1. Martin physical Pharmacy; Lea and Febiger.
2. Burlage and Lee; Physical and technical Pharmacy.
3. Rawlins; Bentley's T.B. of Pharmaceutics, E.L.B.C. London.
4. Shotton and Ridgway; Physical Pharmaceutics.
5. Bean, Beckett, Carless; Advance in Pharmaceutical sciences Vol. I, II and IV.
6. Gennaro, Remington's Pharmaceutical sciences, Mack Publishing Co.
7. Hoover; Dispensing of medication, Mack Publishing Co.
8. Aulton; Pharmaceutics- The science of dosage form design, Lea E.L.B.C.
9. Lachman; Theory of practice of industrial Pharmacy, Lea and Febiger.

PHARMACEUTICAL CHEMISTRY –V

1. Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry, Lippincott-Raven Publishers - New York, Philadelphia.
2. William.O.Foye, Principles of Medicinal Chemistry, B.I.Waverly Pvt. Ltd., NewDelhi.
3. Burgers, Medicinal Chemistry, M.E.WeHy, Med.Chemistry M.E.
4. Walffed Johnwiley and Sons, Wiley-interscience Publication, New York, Toranto.
5. A Text book of Medicinal Chemistry Vol. I and II by Surendra N.
6. Pandey a, S.G. Publisher, 6, Dildayal Nagar, Varanasi -10
7. Indian Pharmacopoeia, 1996, 2007, 2010, The Controller of Publications, Civil Lines, Delhi - 54.
8. Current Index of Medical Specialities (CIMS) and MIMS India,
9. MIMS, A.E. Morgan Publications (I) Pvt. Ltd., New Delhi - 19.
10. Organic Drug Synthesis - Ledniser Mitzsher Vol. I and II.
11. Synthesis of drugs Rothe and Knellmann.
12. The Science and Practice of Pharmacy Vol. 1 and 2, Remington, MACK Publishing Company, Easton, Pennsylvania, 18042.
13. Medicinal and Pharmaceutical Chemistry by Harikishan Singh and V. K. Kapoor.
14. Medicinal Chemistry by Ashuthosh Kar.

PHARMACEUTICAL CHEMISTRY –VI

(Analysis)

1. A.H. Beckett and J.B. Stenlake; Practical Pharmaceutical chemistry Part I and II, The Athlone Press, University of London, London.
2. L.G. Chatten; A.T.B. of Pharmaceutical chemistry Vol. I and II, Marcel Dekker, N. Y.
3. Pharmacopoeia of India, Govt. Of India; Ministry of Health.
4. K.A. Connors, A.T.B. of pharmaceutical analysis, Wiley Intersciences, N. Y.
5. J. Bassett R.C. Denny, G.H. Jeffery, L. Mentum, Vogel's; T.B. of quantitative inorganic analysis including elementary instrumentation analysis, The E.L.B.S. and Logmen, London.
6. Garrett; T.B. Pharmaceutical analysis.
7. Highuchi; Pharmaceutical analysis.
8. Ewing; Instrumental methods of chemical analysis.
9. L.M. Atherdan, Bentley and Drivers; T.B. of Pharmaceutical chemistry, Oxford University Press, Delhi.
10. H.H. Willard; Instrumental methods of analysis, Van Nostrand Reinhold, N. Y.
11. G.L. Jendins, J.E. Christian, G.P. Hager; Quantitative Pharmaceutical chemistry, McGraw Hill Company Inc. N. Y.

PHARMACOLOGY –II

1. Craky; Introduction to general Pharmacology.
2. Krantz and Carr; Pharmacological principles of medical practice.
3. Crossland and James; Lewis's Pharmacology.
4. Goodman and Gillman; Pharmacological basis of therapeutics.
5. Satoskar and Kale; Pharmacology and Pharmacotherapeutics Part I, II.
6. Grollman; Pharmacology and therapeutics.
7. Drill; Pharmacology in medicine.
8. Barar F.S.K. Essentials of Pharmacotherapeutics.
9. Craiz and Stitzer; Modern Pharmacology, Little Brown and Co.
10. Katzung; Basic and clinical Pharmacology, Appleton and Lange.

PHARMACEUTICAL MICROBIOLOGY AND BIOTECNOLOGY

1. Pelczer and Reid; Microbiology.
2. Macom Harris; Pharmaceutical Microbiology.
3. Prescott and Dunn; Industrial Microbiology.
4. Rawlin's Bentley's; T.B. of Pharmaceutics, E.L.B.S., London.
5. Gennaro, Remingtons Pharmaceuticals Sciences, Mack Publishing Co.
6. Hogo & Russel; Pharmaceutical Microbiology, Blackwell scientific and Publication.
7. Metcalf and Eddy; Waste Water Engineering: Treatment Disposal reuse, Tata Mc Graw Hill.
8. Indian Pharmacopeia

BIOPHARMACEUTICS

1. Milo Gibaldi; Biopharmaceutics and clinical Pharmacokinetics, Lea and Fegiber.
2. Notari Biopharmaceutics and clinical Pharmacokinetics an introduction, Morcel Dekker Inc.
3. Sharjel, Applied Biopharmaceutics and Pharmacokinetics, Appleton Century Crofts.
4. Niazi, T.B. of Biopharmaceutics and clinical Pharmacokinetics, Appleton Century Crofts.
5. Rowland and Tozer, Clinical Pharmacokinetics, Lea and Febiger.
6. Ritschel, Handbook of Basic Pharmacokinetics.
7. Gerraro Remington's Pharmaceutical sciences, Mack Publishing Co.
8. Stockley Drug Interaction, Blackwell Scientific Publications.
9. Hansten Drug Interactions, Lea and Febiger.
10. C. Hansch, Comprehensive medicinal chemistry Vol. V Biopharmaceutics ed, J.B. Taylor, Pergamon Press.

**Final Examination for the Degree of Bachelor of Pharmacy
(Four year integrated course)**

| Sr. No. | Subject | Max. Marks | | Total | Mini. Marks for passing |
|-----------------------------|--|------------|--------------------|-------|-------------------------|
| | | Sessional | Paper or Practical | | |
| <u>THEORY PAPERS</u> | | | | | |
| 4-T1 | Pharmaceutics –IV (Dosage form technology) | 30 | 70 | 100 | 45 |
| 4 –T2 | Pharmaceutical Chemistry–VII (Medicinal) | 30 | 70 | 100 | 45 |
| 4 –T3 | Pharmaceutical Chemistry –VIII (Medicinal) | 30 | 70 | 100 | 45 |
| 4 –T4 | Pharmacology –IV | 30 | 70 | 100 | 45 |
| 4 –T5 | Pharmacognosy and Phytochemistry – III | 30 | 70 | 100 | 45 |
| 4 –T6 | Pharmaceutical Management and Hospital Pharmacy | 30 | 70 | 100 | 45 |
| <u>PRACTICALS</u> | | | | | |
| 4 –P1 | Pharmaceutics –IV (Dosage form Technology) | 40 | 60 | 100 | 50 |
| 4 –P2 | Pharmaceutical Chemistry -VII | 40 | 60 | 100 | 50 |
| 4 –P3 | Pharmaceutical Chemistry -VIII | 40 | 60 | 100 | 50 |
| 4 –P4 | Pharmacology -IV | 40 | 60 | 100 | 50 |
| 4 –P5 | Pharmacognosy and Phytochemistry - III | 40 | 60 | 100 | 50 |

NOTES: -

3. In order to pass, the examinee must obtain minimum pass marks as above.
4. The Sessional marks will be based on three tests conducted during the academic year by the teachers and in practicals on evaluation of the experiments done during the academic year and a test conducted by the teacher.

PHARMACEUTICS –IV **(Dosage from Technology)**

4 –T1)

(60 hours per Year)

Preformulation studies: Physical Properties - Polymorphism, solubility, Rheology, Salt formation and partitioning Effects. Chemical Properties - Hydrolytic degradation, oxidation, Drug substance - Excipient interaction, other changes. Biologic and Pharmacologic Properties of dosage forms

Sterile dosage forms: Pyrogens nature, source and elimination, Formulation development of sterile dosage forms. Production facility, environmental control and personnel in the production of sterile dosage form, compounding, processing and sealing, quality control test like sterility, pyrogen, clarity, safety and leakage testing.

Tablets: Types of tablets, tablet ingredients, diluents, binders, disintegrants, lubricants, colours, flavours, sweetners etc. Manufacture of tablets by wet granulation, dry granulation and direct compression. Tablet processing problems and defects, tablet standardization: - hardness, friability, weight variation, disintegration, dissolution and content uniformity tests.

Tablet coating: Type of coatings: Sugar, press-coating, and film coating, (enteric and nonenteric). Coating formulation, process and equipments used coating defects.

Capsules: Hard gelatin capsules: Capsule size, formulation and preparation of filled hard gelatin capsules. Soft gelatin capsules (Softgels): Manufacturing procedures. Quality control of capsules.

Microencapsulation: Core and coat properties, important techniques of microencapsulation.

Pharmaceutical aerosols: Components, formulation, types of systems, manufacturing, operation of an aerosol package, quality control and testing, oral, Inhalation, Nasal and topical Aerosols, Future developments.

Novel drug delivery system : Introduction to novel drug delivery systems like micro-capsule and micro-pellet parenteral and implantable therapeutic systems, transdermal

therapeutic systems, micro-particulate drug carrier system, micro-encapsulation – types, method of preparation and evaluation.

Packaging of Pharmaceutical Products : Packaging components, types, specifications and methods of evaluation, stability aspect of packaging, packaging equipment, factors influencing choice of containers, legal and other official requirements for containers, packaging testing.

Cosmeceuticals & Nutraceuticals: Definition and basic concepts

PHARMACEUTICAL CHEMISTRY –VII

(Medicinal)

4 –T2)

(60 hours per Year)

Introduction, Structure, Stereochemistry, Nomenclature, Synthesis of specified drugs (given in parenthesis), mode of action, Structure Activity Relationships (if any) uses and Physicochemical properties of the following classes of drugs:

Steroids: Biosynthesis of Cholesterol; Estrogens (Oestradiol), Nonsteroidal estrogens (Stilboesterol), Antiestrogens, Progestogens, (progesterone from stigmasterol), Synthetic Progesterone (norethisterone), antiprogestogens, oral contraceptives, androgens (biosynthesis of testosterone and its synthesis from diosgenin), anabolic agents and adrenocorticoids (pathway for steroidogenesis), SAR of glucocorticoids.

General Anaesthetics: Inhalational anaesthetics, Intravenous anaesthetics.

Local Anaesthetics: Esters (Benzocaine), Amides (Lignocaine).

Hypnotics and Sedatives: Barbiturates (Phenobarbitone); benzodiazepines (Nitrazepam)

Anticonvulsants: Barbiturates; Hydantoin (Phenytoin); Oxazolidinediones (Troxidone); Benzodiazepines and Carbamazepine.

Opioid Analgesics: Morphine and related drugs; Synthetic modifications of Morphine, totally synthetic analgesics; 6, 7-Benzomorphan (Pentazocine), 4-phenylpiperidines (pethidine), Methadone and related derivatives; endogenous opioid peptides and opioid antagonists (Nalorphine).

Antitussives: Centrally acting Antitussives, Opium alkaloids and related agents and Synthetic Antitussives, Peripherally acting antitussives and Expectorants.

Central Nervous System Stimulants: Natural and Synthetic (Nikethamide); methylxanthines (Theophyllines) and Modified methylxanthines.

Psychopharmacological Agents: Antipsychotic agents: Phenothiazines (chlorpromazine); butyrophenones and miscellaneous; Antidepressants: Tricyclic

antidepressants (Amitriptyline), Atypical antidepressants; Monoamine oxidase inhibitors; Anxiolytics: Meprobamate and related drugs (Meprobamate); benzodiazepines (Diazepam).

Diuretics: Carbonic anhydrase inhibitors (Acetazolamide); Thiazides and related drugs (Bendrofluzide); High ceiling diuretics (Furosemide), Aldosterone antagonists (spironolactone); other potassium sparing diuretics and osmotic diuretics.

Cardiovascular agents: Cardiac glycosides; Antihypertensive agents; Antianginals and vasodilators; Antiarrhythmic drugs; Antihyperlipidemic drugs; Anticoagulant and platelet aggregation inhibitors (methyldopa, propranolol, procainamide, nitroglycerin).

PHARMACEUTICAL CHEMISTRY –VIII (Medicinal)

4 –T3)

(60 hours per Year)

Modern concept of rational drug design: A brief introduction to Quantitative Structure Activity Relationship (QSAR), prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules.

Introduction, Structure, Stereochemistry, Nomenclature, Synthesis of specified drugs (given in parenthesis), mode of action, Structure Activity Relationships (if any) uses and Physicochemical properties of the following classes of drugs:

Antibacterials: Penicillins, Cephalosporins, Tetracyclines, Aminoglycosides, Polypeptides antibiotics, Chloramphenicol, Quinolones, Sulphonamides.
Antimycobacterials: (p-Aminosalicylic acid, Thiacetazone, Isoniazid, Dapsone)

Antimalarials: Quinoline and analogues, 4-Aminoquinolines, 8-Aminoquinolines, 9-Aminoacridines, Biguanides (Chloroquine, Primaquine), Artemisinin & its derivatives

Antiviral agents: Introduction to DNA, RNA and retroviruses.

Antiamoebic and antiprotozoal drugs: Emetine hydrochloride, quinoline derivatives, organometallic compounds, Metronidazole (Metronidazole, Diloxanide furoate).

Anthelmintics: Drugs used in cestode infection, antifilarial agents (Thiabendazole, Niclosamide, Hexylresorcinol)

Antifungal drugs: (Clotrimazole ,Ketoconazole)

Antineoplastic agents: Alkylating agents, Antimetabolites, Antitumor alkaloids, Hormones agonist and antagonists (Tamoxifen, Thiotepa, flurambucil),Antibiotics,Vinca Alkaloids and Paclitaxel.

Hormones: Thyroid and Antithyroid Drugs; Insulin & Oral hypoglycemic agents

PHARMACOLOGY –IV

4 –T4)

(60 hours per Year)

Drugs acting on blood- Forming Organs: Hematinics, Anticoagulants, Fibrinolytic (thrombolytic) agents, antiplatelet agents, hypolipidemic agents.

Drugs acting on Gastrointestinal system: Laxatives, antidiarrheal agents, emetics, antiemetics, agents for control of Gastric acidity and treatment of peptic ulcers.

Drugs acting on respiratory system: Antitussives and expectorants, Drug therapy of asthma, Respiratory stimulants.

Drugs affecting Endocrine system: Hormones and their analogues including hypoglycaemic. Adrenocorticoids, anabolics as well as antifertility and antithyroid agents.

Basic concepts of Chemotherapy: sulphonamides, urinary tract. Antiseptics; Antibiotics drugs used in the Chemotherapy of Tuberculosis, and leprosy, Antifungal agents; Antineoplastic agents, Immunomodulating drugs; drugs used in the chemotherapy of Helminthiasis; drugs used in the chemotherapy of protozoal infections (Malaria, Amebiasis, Giardiasis and Trichomoniasis, Leshmaniasis, Trypanosomiasis).

Toxicology: Principles of Toxicology, Manifestations of toxicity, Immunotoxicity. General treatment of poisoning, systemic antidotes, Treatment of poisoning due to insecticides, heavy metals, narcotics, barbiturates, organophosphorous compounds

Clinical pharmacology: Concepts and scope of clinical pharmacology covering the aspects of community pharmacy. Drug therapy in Geriatric patient: Treatment of Diabetes, Arthritis, Hypertension, Prostate hyperplasia

Drug interactions: Definition and Introduction. Mechanism of drug interactions. Drug - Drug Interactions with reference to Analgesics, Diuretics, Cardiovascular drugs, Gastrointestinal agents, Vitamins and Hypoglycemic drugs

PHARMACOGNOSY AND PHYTOCHEMISTRY –III

4 –T5)

(60 hours per Year)

1. Glycosides: Nature, Occurrence, Chemistry and Biogenesis.

Anthraquinone glycosides: Cascara, aloe, Rhubarb, Senna Cardiac glycosides: Digitalis, Strophanthus, Squill, Theyetia. Bitter glycosides: Quassia. Saponin glycosides: Dioscorea, Quillia Flavonoid glycosides: Ruta graveolens

2. Alkaloids: Nature, Occurrence, Chemistry and Biosynthesis.

Pyridine-piperidine alkaloids: Nicotine, areca nut. Tropane alkaloids: Belladonna, Hyoscymus, Stramonium, Duboisia. Quinoline alkaloids: Cinchona. Isoquinoline alkaloids: Opium, Ipecac . Indole alkaloids: Nux-vomica, Ergot, Rauwvffla, Catharanthus. Steroidal alkaloids: Kurchi, Solanum. Alkaloidal Amines: Ephedra, Colchicum.

3. Botanical source, history, clinical uses, chemical, constituents, authentication and standardization of traditional drugs such as Tylophora indica, Tribulus terrestris, Allium sativum, Achyranthus aspera, Centelia asiatica, Boerha diffusa, Phyllanthus embellica, Azadirachta indica, Ocimum sanctam, Commiphora mukul, Swertia chirata, Withania somnifera.

4. Study of general aspects of plant tissue culture techniques and their contribution to phytopharmaceuticals. Plant growth regulators.

5. Plant allergens and allergenic substances.

6. Natural Pesticides and insecticides.

7. Biological source, preparation and uses of the following enzymes: Diastase, papain, Maltase, Bromalein, ficin.

8. World wide trade, commercial potential and demand of crude drugs with reference to phytochemical industry in India.

9. Phytochemical analysis: Quantitative microscopic techniques, modern techniques, standardisation of new materials and herbal products. Quality control of herbal drugs.

PHARMACEUTICAL MANAGEMENT AND HOSPITAL PHARMACY

4 –T6)

(60 hours per Year)

Part-I: Pharmaceutical Management

Personnel Management and Industrial Relations: Objectives and functions of personnel department, Employment and development of personnel. Industrial Relations: Problems of labour management relations, courses of Industrial disputes, Remedies, Industrial Dispute Act, Trade Union, Grievance and Grievance Handling procedure, Causes of grievances, Need for grievance procedure, Grievance redressal machinery

Motivation: Objectives, Rules of Motivation, Motivation steps, Types of motivation, Non-financial motivators, Theories of motivation: McGregor's Theory X and Y, Herzberg's Time factor theory, McClelland's Need for Achievement theory Vroom's Expectancy theory, Behavioural theory, Employee- Centred approach

Communication: Importance, Nature of communication, oral vs. written Media of Communication, Barriers to communication, Communication failure, Achieving effective communication.

Purchasing and Store Keeping: Objectives, Organisation and responsibilities of purchasing department, methods of purchasing, Centralised and Decentralised purchasing, Types of stores Depot, Location and Layout of a store, problems and development

Materials management: Materials handling, Equipment, Inventory management, Economic ordering quantity, ABC analysis, Value analysis, classification and codification of stores, obsolete, surplus and scrap management, lead time, inventory carrying costs, safety stock, solutions to problems relating to EOQ.

Drug Supply: Planning and management, supply process and its pitfalls, planning for drug supply, planning models, steps to develop a formulary, predicting drug requirements, procurement cycle and its methods, designing training programs to improve pharmaceutical logistics

Pharmaceutical Marketing: Goals, theories of selling process, company market, systems, market and sale forecasting, market test method, statistical Demand analysis, Types of sales organizations, Salesmanship, Qualification of a salesman, Channels of Distribution Advertising, Presentation and analysis of statistical data. (Charts, frequency distribution)

Establishment of a pharmaceutical factory: Choice of site, trends in location of a plant, plant facilities, layout of stores in an industry, layout of Injectable unit or sterile area, tableting department and area requirement for each department

Part-II: Hospital Pharmacy

Introduction: Status of health delivery systems in India. Definition and role of hospitals in the health delivery systems. Types of hospitals.

Hospital Pharmacy: Definition, functions and objectives of hospital pharmacy, Location, Layout & flow chart of material and men, personnel and facilities required, including equipments.

Drug distribution system in Hospitals: Out patients; In patients: Unit dose dispensing, Floor ward stock system & satellite pharmacy services, Central sterile services; bed side pharmacy, Prepackaging

Establishment of an OTC counter & dispensing: Personnel, space, equipment, apparatus and other facilities required for; Methods to achieve safe and efficient and speedy dispensing of drugs.

Maintenance of records: Issue and use of Narcotics and Dangerous drugs, Ward stock medicines and emergency drugs.

Medical Stores: Objectives, Layout facilities; Procedures for procurement of drugs and supplies from medical stores depot, manufacturer, distributor, local market; procedure and limits of emergency purchase.

Pharmacy Therapeutics Committee: Constitution and functions of Pharmacy therapeutics committee, Hospital formulary system and their organization, Functions and composition.

Drug Information service and drug information bulletin.

PRACTICALS

PHARMACEUTICS –IV (Dosage from Technology)

4 –P1)

(3 hours per week)

1. Illustrative formulation development, preparation and evaluation of following dosage forms at laboratory scale. Syrups, Suspension, Emulsions, tablets, Capsules and Injections.
2. Selected techniques in formulation development.

PHARMACEUTICAL CHEMISTRY –VII 4 –P2)

(3 hours per week)

1. Evaluation of edible oil and fats.
2. Analysis of turmeric / chillie.
3. Analysis of tea / coffee.
4. Analysis of wheat flour / cereals.
5. Detection and determination of food colors and preservatives.
6. Analysis of milk and milk product.
7. Some biochemical analysis.

PHARMACEUTICAL CHEMISTRY –VIII 4 –P3)

(3 hours per week)

1. Organic synthesis involving advanced reactions and techniques.
2. Experiments based on pharmacopoeial methods of control of various quality pharmaceutical dosage form and drugs.

PHARMACOLOGY –IV
4 –P4)

(3 hours per week)

1. Study of instruments for isolated tissue experiments
2. Introduction to Bioassay of Drugs
3. Effect of various drugs on goat trachea
4. Dose response curve on rat ileum
5. Effect of 5-hydroxytryptamine on rat fundus
6. Effect of Ang-II on rat ascending colon
7. Effect of various drugs on vasdeferens
8. Lengendroffs heart preparation
9. Effect of various Chetacholamines on rat B.P
10. Study of analeptics and depressant using Actophotometer
11. Study of catalepsy in rat
12. Screening for analgesics in rats by hot plate and tail flick method
13. Demonstration: Screening of Antiinflammatory activity by Plethysmometer
14. Demonstration: measurement of rat B.P by PowerLab instrument

PHARMACOGNOSY AND PHYTOCHEMISTRY –III

4 –P5)

(3 hours per week)

1. Chemical tests for constituents such as carbohydrates, lipids, proteins, alkaloids.
2. Isolation of alkaloids, caffeine.
3. Study of cinchona, Ipecac, Datura, Ergot, Ratuwolfia, Ephedra.
4. Determination of ash values, extractive values.
5. Study of chromatographic technique.
6. Estimation of quinine.

Reference Books

FINAL YEAR

PHARMACEUTICS –IV (Dosage from Technology)

1. Lachman, Prof. N.K. Jain CDDS; Theory and Practice of Industrial Pharmacy, Lea and Febiger.
2. Rawlines, Bentley's; T.B. of Pharmaceutics, E.L.B.S. London.
3. Ansel Pharmaceutical dosage form and drug Delivery systems, Lea and Febiger.
4. Autton Pharmaceutics- The science of dosage form design, E.L.B.S., London.
5. Banker, Modern Pharmaceutics, Morcel Dekker Inc.
6. Gennaro, Remington's Pharmaceutical Sciences, Mack Publishing Co.

PHARMACEUTICAL CHEMISTRY –VII (Medicinal)

1. Wilson and Gisvold's T.B. of Organic, Medicinal and Pharmaceutical chemistry, Lippincott. Co.
2. M.E. Wolff Burger's Medicinal chemistry Vol. I, II and III, John Wiley and Sons, N. Y.
3. W.C. Foye, Principles of Medicinal chemistry, Lea and Febiger.
4. Finar Organic chemistry Vol. II, E.L.B.S., London.
5. Martindate, The extra Pharmacopoeia.
6. Lzaky, cuttings Handbook of Pharmacology, Appleton Century.
7. Lednicer, Mitscher, George, The Organic chemistry of drug synthesis Vol. I, II, III and IV, Wiley Interscience.

PHARMACEUTICAL CHEMISTRY –VIII (Medicinal)

1. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, Eleventh Edition, edited by J. H. Block and J. M. Beale Jr., Lippincott Williams & Wilkins, Philadelphia, 2004.
2. Pharmaceutical Chemicals in Perspective, B.G. Reuben and H.A. Wittcoff, John Wiley & Sons, New York, 1989.
3. Foye's, Principles of Medicinal Chemistry, Sixth Edition, Wolters Kluwer (India), Lea & Febiger, Philadelphia, USA, 2008.
4. Hansch, C. Comprehensive medicinal Chemistry Vol.IV, Quantitative Drug Design. Pergamom Press, Oxford.
5. Singh, H. and Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, Second Edition Vallabh Prakashan, Delhi, 2005.
6. Povl Krogsgaard, Tommy, Textbook of Drug Design & Discovery, 3rd edition, 2004,

PHARMACOLOGY –III

1. B.G. Katzung, Basic and clinical Pharmacology, Longe medical Publications.
2. A.G. Gilman, L.S. Goodman, T.W. Rall & F. Murad, The Pharmacological Basic of therapeutics, Macmillan Publishing Co. Inc.
3. C.R. Craig and R.E. Stitzel, Modern Pharmacology, Little Brown and Co.
4. D.G. Grahame, Smith and J.K. Aronson, Oxford Text Book of clinical Pharmacology and drug therapy, Oxford University Press.
5. F.S.K. Barar; Essentials of Pharmacotherapeutics, S. Chand and Co. New Deldi.
6. Crossland James; Lewis's Pharmacology.
7. Grollman; Pharmacology and therapeutics.
8. Drill; Pharmacology in medicine.
9. P.K. Gupta, Modern Toxicity Vol. 1-3 metropoliton, New Delhi.
10. J. Doull, C.D. Klassgen & M.A Amdur, Casarett & Doulls Toxicology, Macmillan Publishing Co. Inc.

PHARMACOGNOSY AND PHYTOCHEMISTRY –III

1. G.E. Trese and Evans; Textbook of Pharmacognosy.
2. S.C. Dutta; Textbook of botany for degree students.
3. Clause and tyler; Pharmacognosy.
4. Finar; Organic chemistry Vol. II.

PHARMACEUTICAL MANAGEMENT AND HOSPITAL PHARMACY

1. Hassan, William E. Hospital Pharmacy. Lea & Febiger, Philadelphia.
2. Remington's The Science & Practice of Pharmacy Mack Publishing Co. Easton, PA
3. Mohan S, Jai D." Drug Store and Business Management ", 1st edition, 1995,S.V Kar & Co, Jalandhar .
4. Singh S, Singh P." Drug Store and Business Management", 1st edition, 1995, S.Dinesh & Co.Circular Road
5. Jalandhar.
6. Koontz & O'Donnel Principles of Management Tata Mc Graw Hill, Delhi.
7. Allwodd MC and Feil JT. Text book of Hospital Pharmacy, Blackwell Scientific Publication, Oxford.
8. Merchant HS, Quadry JS. Text book of Hospital Pharmacy. B.S. Shah Prakashan, Ahemdabad
9. Kotler P. Marketing management, Prentice Hall of India Limited.