

SYLLABUS B.PHARMA

SEMESTER-I

Subject code: 01260101

Subject: Pharmaceutics-I (Dispensing & Hospital Pharmacy)

THEORY:

1. Pharmaceutical literature

Historical background to the profession of Pharmacy in India in brief. Brief overview of status of Pharmaceutical industry in India. Introduction to Pharmacopoeias. Development of Indian Pharmacopoeia and other Compendia including B.P., U.S.P., N.F., Ph Eur., International pharmacopoeia and B.P.C.

2. Prescription

Prescription and its parts, handling of prescription, labeling and packing, prescription containers and closure, pricing the prescription.

3. Posology

Meaning, factors affecting dose, calculation of doses for infants and children.

4. Liquid dosage forms

For internal administration

Aromatic water, syrups, elixirs, spirits, tinctures

For external administration

Mouthwash, gargles, linctus, douches, enemas, sprays, throat paint, Inhalation, Lotion, liniment, eye drop, ear drop, nasal drop

5. Hospital pharmacy – organization and management: Organizational structure – staff, infrastructure & work load statistics. Organization, Administration and functions. Roles & responsibilities of hospital pharmacist.

6. Hospital drug policy: Pharmacy and therapeutic committee (PTC), Hospital formulary, Hospital committees: Infection committee, Research and Ethical committee

7. Hospital pharmacy services: Procurement & warehousing of drugs and pharmaceuticals
Inventory control: definition, methods of inventory control, ABC, VED, EOQ, lead time, safety stock.

8. Drug distribution in Hospitals: Outpatient and inpatient services, unit dose, drug distribution system, Floor wards stock system, satellite pharmacy services, bed side pharmacy, distribution of controlled drugs.

9. Channels of distributions: Different channels of distribution of drugs. Importance and objectives of purchasing, selection of suppliers. Credit information, tenders, contract and price determination and legal requirements thereto.

10. Community pharmacy: Concept, development of community pharmacy in India, role of community pharmacist

Patient counseling: Meaning, steps involved in patient counseling, interactions with doctors.

Subject code: 01260105

Subject: Pharmaceutics-I (Dispensing & Hospital Pharmacy)

PRACTICAL: 3 Hrs. /week

1. Preparation of following classes of products involving the use of calculations in metrology: Aromatic waters, Spirits, Glycerin, Syrups, Elixirs, Lotions, Mucilages, Liniments, Powders.
2. Incompatibility in Prescriptions Physical, Chemical and Therapeutic incompatibility
3. Prescription Reading: Minimum of 20 prescriptions from the clinical practice

NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BOOKS RECOMMENDED:

1. Remington's Pharmaceutical Sciences (Latest Edition).
2. The Extra Pharmacopoeia-Martindale (Latest Edition).
3. S.J Carter: Tutorial Pharmacy
4. Cooper and Gunn's: Dispensing Pharmacy
5. N.K. Jain and S.N. Sharma: The theory and practice of Professional Pharmacy
6. Indian Pharmacopoeia (Latest Edition)

Subject code: 01260102

Subject: Pharmaceutical Chemistry-I (Inorganic Chemistry)

THEORY:

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

- **Pharmaceutical aids and necessities**
 - Acids and bases
 - Buffers
 - Antioxidant
 - Water
- **Major Intra and Extra-cellular Electrolytes**
 - Electrolytes used in replacement therapy
 - Physiological acid base balance
 - Electrolytes used in acid base therapy
 - Electrolytes combination therapy
- **Gastrointestinal Agents**
 - Acidifying agents
 - Antacids

- Protective and Adsorbents
- Saline Cathartic
- **Topical Agents**
 - Protective
 - Antimicrobial
 - Astringents
- **Dental Products**
 - Dentifrices
 - Anti-caries agents.
- **Inorganic Radio Pharmaceuticals**
 - Measurement of radioactivity
 - Artificial radioactivity
 - Radio-opaque contrast media
 - Application of radiopharmaceuticals
- **Miscellaneous Agents**
 - Poisons and antidotes
 - Respiratory stimulants
 - Expectorants and emetics
 - Tableting aids and Suspending agents

Subject code: 01260106

Subject: Pharmaceutical Chemistry-I (Inorganic Chemistry)

PRACTICAL: 3 Hrs /week

- To perform limit test of chloride, sulphate, iron, heavy metal and arsenic in the given sample.
- Salt analysis of inorganic mixtures of upto four radicals; six mixtures to be analysed.
- Identification tests for Pharmacopoeial inorganic pharmaceuticals.

BOOKS RECOMMENDED:

1. Block J.H. Roche E., Soine T. and Wilson C; "Inorganic Medicinal and Pharmaceutical Chemistry". Lea & Febiger.
2. Indian Pharmacopoeia, Ministry of Health, Govt. of India, latest edition.
3. Atherden L.M., Bentley and Drivers,"Text Book of Pharmaceutical Chemistry", Oxford University Press, London.

Subject code: 01260103

Subject: Pharmacology -I (Human Anatomy & Physiology-I)

THEORY:

1. Scope of Anatomy, Physiology and basic terminology. Structure and functions of cell: Ion channels, signal transduction, second messengers, electrophysiology of muscles, cell stimulation and neuronal functions.
2. Tissues: Epithelial, Connective, Muscular and Nervous tissues, their types and characteristics.
3. Bones and Joints: Structure and function of skeleton, types of joints and their disorder.
4. Blood and Lymph: Composition and functions of blood including their disorders. Blood grouping and its significance, mechanism of coagulation, bleeding and clotting disorders. Formation of lymph and its composition. Reticuloendothelial system and its function.
5. Cardiovascular system: Anatomy and physiology of heart, blood circulation, cardiac cycle, heart rate, blood pressure, ECG and heart sounds.
6. Respiratory system: Anatomy of respiratory tract, Mechanism of respiration, Lung volumes, Transport of oxygen and carbon dioxide.

Subject code: 01260107

Subject: Pharmacology -I (Human Anatomy & Physiology-I)

PRACTICAL: 3 Hrs /week

1. Study of microscope.
2. Determination of bleeding time of own blood.
3. Determination of clotting time of own blood.
4. Determination of hemoglobin content of own blood.
5. Determination of RBC count of own blood.
6. Determination of WBC count of own blood.
7. Determination of differential count of own blood (DLC).
8. Determination of blood group.
9. Recording of pulse rate and blood pressure.
10. Recording of ECG.
11. Recording of breathing rate.
12. Determination of vital capacity
13. Study of gross anatomy & physiology of various organs/system by models/charts/specimens:
 - i) Circulatory system
 - ii) Lymphatic system
 - iii) Respiratory system
14. Histology: Microscopic study of different types of primary tissues and organs from permanent slides.

BOOKS RECOMMENDED:

1. Ranade VG, "Text book of Practical Physiology", Pune Vidyarthi Griha Prakashan, Pune.
2. Difore S.H. "Atlas of Normal Histology"- Lea & Febiger Philadelphia.
3. Chaurasia B.D., Human Anatomy, Regional & Applied Part-I, II & III, CBS Publisher & Distributors, New Delhi.
4. Guyton AC, Hall JE, "Text book of Medical Physiology", WB Saunders Company.
5. Chatterjee C.C., "Human Physiology", Medical Allied Agency Calcutta.
6. Ross & Wilson, "Anatomy & Physiology in Health & Illness", Churchill Livingstone.
7. Tortora GJ & Grabowski SR, "Principles of Anatomy & Physiology", Harper & Row Publisher, New Delhi.
8. Parmar N.S. "Health Education & Community Pharmacy" CBS Publishers, Delhi.
9. Shalya Subhash " Human Physiology" CBS Publishers & Distributors.
10. Keele, C.A. Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.

Subject code: 01260104

Subject: Pharmacognosy-I

THEORY:

- **Introduction to Pharmacognosy**
Origin, scope and history of Pharmacognosy. Classification of crude drugs.
- **Various factors affecting quality and purity of crude drugs**
 - (a) Exogenous factors
 - (b) Endogenous factors
 - (c) Preparation of crude drug for market
 - (d) Adulteration and types of adulteration
- Alternative and Complementary systems of medicine – Ayurveda, Unani, Siddha, Homeopathy, Chinese medicine and Aromatherapy
- Introduction to different plant metabolites
 - Primary metabolites**
 - a. Brief study of basic metabolic pathways and formation of different primary metabolites through these pathways- Photosynthesis
 - b. Correlation of primary and secondary metabolites
 - c. Introduction to following primary metabolites- Carbohydrates, Lipids and Proteins
 - Secondary metabolites**
 - a. Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
 - b. Introduction to following secondary metabolites - Glycosides, Flavonoids, Saponins, Alkaloids, Tannins, Terpenoids, Steroids.
- Study of organized crude drugs viz. - Stems, Barks, Woods, Roots, Rhizomes, Leaves, Flowers, Fruits, Seeds.

- Cell differentiation and ergastic cell contents – Cell wall, Parenchymatous tissue, Epidermis, Epidermal trichomes, Stomata, Endodermis, Cork tissue, Collenchymas, Schleroides, Fibers, Xylem, Phloem, Secretary tissues, and Ergastic cell contents.

Subject code: 01260108

Subject: Pharmacognosy-I

PRACTICAL: 3 Hrs /week

- Study on the laboratory microscope
- Study of morphology and microscopy of some crude drugs related to syllabus
- To perform preliminary phytochemical screening of crude drugs for the identification of different primary and secondary metabolites i.e. carbohydrates, lipids, proteins, alkaloids, tannins, saponins, flavonoids, steroids.

BOOKS RECOMMENDED:

1. Kokate, C.K. "Practical Pharmacognosy" Vallabh Prakashan Delhi.
2. Wallis T.E., Analytical Microscopy, J&A Churchill Limited, London.
3. Brain K.R. and Turner T.D. "The Practical Evaluation of Phyto Pharmaceutical", Wright, Sciencetechnica- Bristol.
4. Kokate, C.K. Pharmacognosy, Nirali Prakashan, Pune.
5. Trease, G.E. & Evans, W.C., "Pharmacognosy" Bailleire tindall East bourne, U.K.
6. Wallis, T.E., Textbook of Pharmacognosy, J.A. Churchill, Ltd.
7. Schewer P.J., "Marine Natural Products", Academic press, London.

Subject code: 01260109

Subject: Remedial Biology

THEORY:

- Methods of classification of plants.
- Plant cell: its structure and non-living inclusions, mitosis and meiosis, different types of plant tissues and their functions.
- Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed. Modification of root and stem.
- General survey of animal kingdom, structure and life history of parasites as illustrated by amoeba, trypansomoma, plasmodium, taenia, ascaris.
- General structure and life history of insects like mosquito, houseflies and silkworm.

Subject code: 01260111

Subject: Remedial Biology

PRACTICAL: 3 Hrs /week

1. Morphology of plant parts indicated in theory.
2. Care, use and type of microscope.

3. Gross identification of slides of structures and life cycle of lower plants/animals mentioned in theory.
4. Microscopic examination of stem, root and leaf of monocot and dicot leaf.
5. Structure of human parasite and insects mentioned in theory with the help of specimen.

BOOKS RECOMMENDED:

1. Tyagi Y. D., Text Book of Botany, Universal Publication.
2. Dutta A. C., Text Book of Botany, Oxford University Press, Calcuttal-700720.
3. Khetrapal & Kotpal, Invertibrates, Rastoghi Publication, Merrut.
4. Youngken H. S., Pharmaceutical Botany, The Balkishan Company, Toranto.

Subject code: 01260110

Subject: Remedial Mathematics

THEORY:

- **Matrices and Determinants:** definition of matrix, types of matrices, arithmetic operations on matrices, determinants and its expansion, important properties of determinants, solutions of simultaneous equations by Cramer's rule.
- **Differentiation:** Concepts of functions, limits and differentiation; differentiation of standard functions (without using first principle), including function of a function (chain rule), differentiation of implicit functions, logarithmic differentiation, parametric differentiation, elements of successive differentiation.
- **Integration:** integration as inverse of differentiation, indefinite integrals of standard functions, integration- by parts and substitution methods, formal evaluation of definite integrals.
- **Differential equations:** definition, formation and solution of ordinary differential equations of first order and first degree (variable separable technique only).
- **Laplace transforms:** definition, properties of linearity and shifting, transforms of elementary function (without proof) and inverse Laplace transforms not involving Euler's theorem.
- **Measures of central tendency and dispersion:** requisites of an ideal measure, arithmetic mean, median, mode, range, mean deviation, standard deviation, coefficients of variation.
- **Linear correlation:** bi-variate data, scatter diagrams, correlation, types of correlation, Karl Pearson's and Spearman's methods, coefficients of correlation and its important properties (without proof).
- **Linear regression:** regression, method of least squares, lines of regression, regression coefficients and their important properties (without proof).

- **Probability:** events, classical and statistical definitions of probabilities, addition and multiplication laws of probability, conditional probability, Baye's theorem (statement only) and its applications.
- **Standard probability distribution:** definitions, important properties (without proof) and applications of binomial, Poisson and normal distribution/ normal curves. Central limit theorem (statement only).

BOOKS RECOMMENDED:

References:

1. Frank Mathematics for B.Pharm. by G.D. Dhall, S.N. Chhibber, Hari Om Trivedi and Subodh Chandra.
2. Introductory Mathematics for Business and Economics by V.K.Kapoor.
3. Gupta S.P., Statistical Methods, Sultan Chand & Sons, latest edition

Suggested readings:

1. Narayan S., Differential Calculus, Sultan Chand & Sons, Latest Edition
2. Narayan S., Integral Calculus, Sultan Chand & Sons, Latest Edition
3. Salhotra K.K., A Text Book of Applied Mathematics, Katson Publishing House, Latest Edition

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SEMESTER-II

Subject Code: 01260201

Subject: Pharmaceutics-II (General Pharmacy)

THEORY:

1. Pharmaceutical calculation

Percentage calculation, allegation method, calculation involving preparation of isotonic solutions, proof spirit, weights and measures.

2. Dispersed system

Emulsion-Definition, types and identification test, merits and demerits, uses and classification of emulsifying agents, preparation and stability of emulsion

Suspension- Definition, types, merits and demerits, uses and classification of suspending agents, flocculated and deflocculated suspension, preparation and stability of suspension.

3. Ointment

Classification of ointment and ointment bases, factors governing selection of ointment base, preparation, packaging, labeling, and storage of Ointments.

4. Pastes and jellies

Definition, bases of paste, preparation of paste and storage. Introduction to different types of jellies and their preparation.

5. Suppositories and pessaries

Bases, additives, preparation, displacement value and calculations

6. Powders

Definition, advantages, disadvantages, special problems, types of powders – tablet trichurates, granular effervescent powder, cachets, simple and compound powder, dusting powder, insufflations, snuffs, dentifrices, Effervescent granule

7. Extraction

Infusion, decoction, maceration and percolation process and preparation involving them

Subject code: 01260206

Subject: Pharmaceutics-II (General pharmacy)

PRACTICAL: 3 Hrs. /week

1. Demonstration of equipments Percolation and Maceration
2. Study of one monograph from the latest edition of Indian Pharmacopoeia.

NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BOOKS RECOMMENDED:

1. Indian Pharmacopoeia, Govt. of India.
2. Remington's Pharmaceutical Sciences.
3. Nanda, Popli and Sharma: Current dispensing practices.
4. R.K. Khar and Pratibha Nand: Dispensing Pharmacy, CBS Publishers, Delhi.
5. A.K. Gupta and S.S. Bajaj: Introduction to Pharmaceutics-II, 2nd Edition, CBS Publishers, New Delhi.
6. Cooper and Gunn: Dispensing for pharmaceutical students, 12th Edition, CBS Publishers, Delhi.
6. Drugs Today
7. MIMS/CIMS
8. Asgar Ali and A.D. Mahamuni: Pharmaceutics-II (Theory and Practice of Dispensing Pharmacy), Vallabh Prakashan, New Delhi.
9. Remington's Pharmaceutical Sciences.
10. W.E Hassan: Hospital Pharmacy.
11. Heifindal et al: Clinical Pharmacy & Therapeutics.
12. Allwood and Fell: Hospital Pharmacy.
13. P.C. Dandiya, R.K. Khar and N. Gumbani: Pharmacist year Book CBS Publisher.
14. Pratibha Nand and R.K. Khar: Hospital & Clinical Pharmacy.

Subject code: 01260202

Subject: Pharmaceutical Chemistry-II (Organic Chemistry-I)

THEORY:

The subject of organic chemistry will be treated in its modern perspective keeping for the sake of convenience, the usual classification of organic compounds:

1. **Structure and Properties:** Atomic structure, Atomic orbitals, Molecular orbital theory, Wave equation, Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, structure and physical properties, Intermolecular forces, Acids and bases.
2. **Stereochemistry:** Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations. Bayer strain theory
3. **Structure, Nomenclature, Preparation and Reactions of:** Alkanes, Alkenes, Alkynes, Cycloalkanes, Dienes, Alkyl halides, Alcohols, Ethers, Epoxides, Aldehyde & Ketones, carboxylic

acids and their functional derivatives, Reactive intermediates – carbocations, carbanions, carbenes, nitrene and nitrenium ions.

Subject code: 01260207

Subject: Pharmaceutical Chemistry-II (Organic Chemistry-I)

PRACTICAL: 3 Hrs /week

- The student should be introduced to the various laboratory techniques through demonstrations involving synthesis of selected organic compounds (e.g. aspirin, pbromoacetanilide, anthraquinone from anthracene, reduction of nitrobenzene etc.)
- Identification of organic compounds and their derivatisation.
- Introduction to the use of stereomodels.

BOOKS RECOMMENDED:

1. Morrison T.R. and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt.Ltd. New Delhi.
2. Finar I.L., Organic Chemistry Vol.I & II ELBS/ Longman.
3. Bahl B.S. & Bahl Arun, Advance Organic Chemistry, S Chand & Co. Ltd., Ram Nagar, New Delhi.

Subject code: 01260203

Subject: Pharmacology -II (Human Anatomy & Physiology-II)

THEORY:

1. **Digestive system:** Anatomy and physiology of organs of digestive system. Secretion and functions of – salivary glands, stomach, small intestine, large intestine pancreas and liver. Digestion and absorption of Carbohydrate, Proteins and Fats.
2. **Nervous system:** Organization, Neurons – membrane potentials as signals, Cerebrum – functional areas, sensory & motor pathways, anatomy and physiology of other parts of brain (mid brain, pons, medulla oblongata, cerebellum, thalamus and hypothalamus), extra pyramidal system, limbic system, Spinal cord (Structure and reflexes), cranial nerves (Names and functions) Autonomous nervous system (Sympathetic and parasympathetic).
3. **Urinary system:** Anatomy and physiology of urinary system, structure of Nephron, formation of urine, maturation, Renin angiotensin system.
4. **Endocrine system:** Physiology of hormones of hypothalamus-pituitary gland, adrenal gland, thyroid gland, pancreas and gonads (testis and ovary).
5. **Integumentary system:** Structure and functions of skin, regulation of body temperature.
6. **Sense organs:** Anatomy and physiology of eye and ear, sense of smell and taste.
7. **Reproductive system** Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis & oogenesis.

Subject code: 01260208

Subject: Pharmacology -II (Human Anatomy & Physiology-II)

PRACTICAL: 3 Hrs /week

1. Recording of body temperature.
2. Study of human skeleton.
3. Study of axial skeleton.
4. Study of appendicular skeleton.
5. Study of joints.
6. Study of gross anatomy & physiology of various organs/system by models/charts/specimens:
 - a. Digestive system
 - b. Central nervous system
 - c. Urinary system
 - d. Eye
 - e. Ear
7. Histology: Microscopic study of different types of primary tissues and organs from permanent slides.
8. Study of first aid measures.
9. Urine analysis for normal and abnormal constituents.

NOTE: ANY OTHER EXPERIMENT (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BOOKS RECOMMENDED:

1. C. Guyton & J.E. Hall, Text Book of Medical Physiology published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, U. S. A.
2. A. Keele, E. Neil and N. Jools, Samson Wright's Applied physiology, Thirteenth Edition, published by Oxford University Press, 1982.
3. W. F. Ganong, Review of Medical Physiology, Thirteenth Edition, published by Appleton & Lange, U. S. A.
4. J. Vander, J. H. Sherman and D. S. Luciano, Human Physiology.
5. Gray's Anatomy, edited by P.L. Williams & R. Warwick, 38th Edition, published by Churchill Livingstone, 1995.
6. Cunningham's Textbook of Anatomy, edited by G. J. Romanes, Eleventh Edition, published by Oxford University Press.
7. E. Braunwald, K.J. Isslbucher, J.B. Martin, A.S. Fauei, J.E. Wilson Harrison, D.L. Kasper, Principles of Internal Medicine, 14th Ed., McGraw Hill International Book Company, 1998.
8. Text book of Anatomy and Physiology for Health professionals by Indu Khurana, CBS Publisher.
9. Demonstration of muscle fatigue curve using computer software

Subject code: 01260204

Subject: Pharmaceutical Microbiology

THEORY:

1. Introduction to the science of microbiology-ancient theories concerning the origin of life, contribution of great scientists to this science, with particular reference to the contributions of the following scientists: A.V. Leeuwenhoek, Louis Pasteur, Edward Jenner, Robert Koch, Alexander Fleming, Joseph Lister.
2. Classification of microbes and their taxonomy.
3. Nutrition, cultivation isolation and identification of bacteria, fungi and viruses.
4. Bacterial enzymes – classification, nomenclature, production by fermentation, extraction methods, immobilization techniques and applications of bacterial enzymes in general and detailed account of following bacterial enzymes: alpha amylase (diastase) and proteases.
5. Disinfection, factors affecting disinfection, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
6. Sterilization, different methods, applications and evaluation of sterilization methods.
7. Aseptic technique.
8. Microbial standardization of antibiotics (Ampicillin, Streptomycin), Vitamins (Vitamin B-12, Niacin) and Calcium Pentothenate.
9. Fermentation: Types of media used; factors affecting, control of various parameters during fermentation. A detailed account of the industrial fermentation process for manufacture of Penicillin, Streptomycin, Glutamic acid; Lysine, Citric acid, Vit.B12.

Subject code: 01260209

Subject: Pharmaceutical Microbiology

Practical: 3 Hrs /week

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.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Various staining methods-simple, Grams staining and acid fast staining.
5. Isolation of pure culture of micro-organisms by multiple streak plate technique

6. Evaluation of antiseptic and disinfectants e.g. RWC, FDA method and chick martin.
7. Sterility testing-different methods as per IP/BP/USP
8. Hanging drop slide preparation.
9. Biochemical reactions-starch hydrolysis, nitrate reduction, litmus milk test, gelatin liquefaction,
10. Carbohydrate metabolism.
11. Microbial viable count in a pharmaceutical product and total count of bacteria
12. Thermal death time determination.
13. Microbiological assay of antibiotics.
14. Isolation of an antibiotic producer.
15. Bacteriophage isolation and characteristics
16. Normal throat flora.
17. Studying of the environment micro flora and testing of aseptic area.
18. Antimicrobial activity of an unknown compound.
19. Microbiological standardization of raw materials.
20. Demonstration of slide preparations of various microorganisms.

BOOKS RECOMMENDED:

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
3. Gilbert S. Banker and Christopher T. Rhodes: Modern Pharmaceutics.
4. Remington's Pharmaceutical Sciences.
5. Pelczar and Reid: Microbiology.
6. Dawson and Mirne: Immunological and Blood products.
7. Rose: Industrial Microbiology.
8. Prescott and Dunn: Industrial Microbiology.
9. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
10. Cooper and Gunn's: Tutorial Pharmacy
11. Pepler: Microbial Technology.
12. I.P., B.P., U.S.P.- latest editions
13. Ananthnarayan: Text Book of Microbiology.
14. Edward: Fundamentals of Microbiology
15. N.K. Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi

Subject code: 01260205

Subject: Pharmaceutical Management

THEORY:

- **Management:**

Concept of management, principles of management, primary functions of management- planning, organizing, staffing, directing, controlling, motivating, entrepreneurship development, operative management- personnel, materials, production, financial, marketing etc. Secondary functions of management: decision making, leadership, innovation, delegation authority/ responsibility.

- **Materials Management:**

A brief exposure or basic principles of materials management-major areas, scope, purchase, stores, inventory control and evaluation of materials management.

- **Pharmacoeconomics:**

Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labor welfare, general principle of insurance and inland and foreign trade, procedure of importing and exporting of goods.

- **Pharmaceutical Marketing**

Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.

- **Salesmanship:**

Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing. Recruitment, training, evaluation, compensation to the pharmacist.

- **Accountancy:**

Principle of accountancy, ledger posting and book entries, preparation of trial balance, columns of cash book, profit and loss account, balance sheet, purchase, keeping and pricing of the stock, treatment of cheques, bills of exchange, promissory note and hundies, documentary bills.

- **Production Management:**

Human resource planning, recruitment, and interviewing, human skills evaluation through various instruments, job description, job evaluation, role clarity, career planning.

- **Human Resource Management:**

Human resource planning, recruitment, and interviewing, human skills evaluation through various instruments, job description, job evaluation, role clarity, career planning.

BOOKS RECOMMENDED:

1. Principles of Marketing, by Philips Kottler.
2. Personnel management and Industrial Relations, by R.S. Davar.
3. Personnel management, by Mamoria.
4. Materials management, by Gopalkrisnan, and R.K. Rajput.
5. Purchasing and Store Keeping, by D.R. Gupta, R.K. Rajput.
6. Managing Drug Supply: management sciences for health, by Borbon.
7. Pharmaceutical Marketing by Smith.
8. Establishment of a pharmaceutical factory, by S.P. Aganil.

9. Quantitative techniques for managerial decision making, by U.K. Srivastava and S.C. Sharma.
10. Marketing Management by Philips Kottler, Tenth Edition, Printice Hall of India Pvt. Ltd.
11. Marketing Strategy: A Global Perspective by Vernon R. Stauble The Dryden Press.
12. D.A. Whetton and K.S. Cameron , Developing Management Skills, New York: Harper Collins, 1995, 72-73.
13. Peter F. Drucker, Management: Tasks, Responsibilities, And Practices, New York: Harper and Row, 1974, 523.
14. Stanley C. Hollander, The Wheel of Retailing, J. of Marketing, July 1960, pp 37-42.
15. Amber G. Rao and Peter B. Miller, Advertising/ Sales Response functions, J. of Advertising Research, April 1975, pp7-15

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SEMESTER-III

Subject 01260301

Subject: Pharmaceutics-III (Unit Operations-I)

THEORY:

1. Introduction

Introduction to unit operation and pharmaceutical engineering. Concept and requirement, basic laws, materials and energy balances.

2. Size reduction

Theories and objectives of size reduction, Factors affecting size reduction, Mechanisms of size reduction with examples of equipment.

3. Size separation

Screens, Air separation methods – cyclone separator, bag filter

4. Mixing

Types of mixtures, Equipment's used in mixing of powders, liquids and semi-solids.

5. Mass Transfer

Molecular diffusion in gases & liquids, Mass transfer in turbulent & Laminar flow, Theories of interphase, mass transfer.

6. Flow of fluids

Fluid statics, Dynamics, Transportation of Fluids-reciprocating, Rotary and Centrifugal pumps, Fluid flow rate measuring devices-orifice meter, Reynolds number, Venturi meter and rotameter.

7. Transportation of solids

Belt, screw, bucket and pneumatic conveyer for transportation of solids

8. Filtration

Mechanisms and types of filtration, Theories of filtration, factors influencing filtration, filter aids, Study of Filter press, Meta filter, rotary drum filter and disc filter.

Subject code: 01260306

Subject: Pharmaceutics-III (Unit operations-I)

PRACTICAL: 3 Hrs /week

1. Sieve analysis to study particle size distribution.
2. Study of particle sedimentation using Stoke's law.
3. Study of filter aid on rate of filtration.
4. Study of effect of centrifugation speed and time on rate of sedimentation.
5. Study of thickeners area using batch settling method.
6. Determination of hardness of water sample.
7. Reduction of particle size using ball mill.
8. Determination of drag coefficient for particles settling method.
9. Study of sedimentation behavior using suspending agents.

NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BOOKS RECOMMENDED:

1. J.F. Richardson and J.M. Coulron: Chemical Engineering
2. Walter L. Badger and J.T. Banchero: Introduction to Chemical Engineering
3. Perry: Handbook of Chemical Engineering
4. Lauer & Heckmann: Chemical Engineering Techniques
5. Peters: Elementary Chemical Engineering
6. S.J. Carter: Tutorial Pharmacy
7. N.D. Bhatt: Elementary Engineering Drawing.

Subject code: 01260302

Subject: Pharmaceutical Chemistry-III (Organic Chemistry-II)

THEORY:

1. **Conservation of orbital symmetry and rules:** Electrocyclic, cycloaddition and sigmatropic reactions.
2. Introduction to chemical reactions, Types of organic reactions including rearrangement reactions, factors affecting organic reactions.

3. **Neighbouring Group Effects:** Catalysis by Transition Metal Complexes.
4. Aromatic Hydrocarbons, Huckel's Rule, Aromatic Character, structure of benzene, resonance, orientation of substitution, Nucleophilic & Electrophilic aromatic substitution reaction.
5. **Structure, Nomenclature, Preparation and Reactions of:** Amines, Phenols, Benzene, Polynuclear aromatic compounds, Arenes.
6. Organometallic Compounds, Grignards reagent, organolithium compounds, their preparation and synthetic applications.
7. Chemistry of Fats, Oils & Waxes, analytical constants of fats & oils & their significance in the analysis, Drying, semi drying & non-drying oils.
8. Proteins and Amino Acids: Isolation and general methods of synthesis of amino acids and physico-chemical properties. General classification of proteins and end group analysis. Structural features of DNA and RNA.

Subject code: 01260307

Subject: Pharmaceutical Chemistry-III (Organic Chemistry-II)

PRACTICAL: 3 Hrs /week

Number of experiments based on aforementioned theory.

BOOKS RECOMMENDED:

1. Morrison T.R. and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt.Ltd., New Delhi.
2. Finar I.L., Organic Chemistry Vol.I & II ELBS/ Longman.
3. Agarwal O.P., Chemistry of organic Natural Products Vol I & II, Goel Publishing House, Meerut, India.
4. Peter S., A Guide book to Mechanism in Organic Chemistry, Pearson Education Ltd., India.
5. Atherden L.M., Bentley and Drivers, "Text Book of Pharmaceutical Chemistry", Oxford University Press, London.

Subject code: 01260303

Subject: Pharmaceutical Chemistry-IV (Pharmaceutical Analysis-I)

THEORY:

- Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Significant figures, Rules for retaining significant digits, Types of errors, Mean deviation, Standard deviation, Statistical treatment of small data sets, Selection of sample, Precision and accuracy, Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.

- Precipitation Techniques, solubility product, effect of acids, temperature and solvent upon the solubility of a precipitate, the colloidal state.

An outline of theoretical consideration, general methodologies, applications (in drug analysis and quality control), advantages, limitation, standardization and assay procedures of following volumetric techniques.

- **Acid Base Titrations:** Acid base concepts, Role of solvent, Relative strengths of acids and bases, Ionization, Law of mass action, Common-ion effect, Ionic product of water, pH, Hydrolysis of salts, Henderson-Hasselbach equation, Buffer solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, Mixed indicators, Polyprotic system, Polyamine and amino acid systems, Amino acid titration, applications in assay of H_3PO_4 , NaOH, $CaCO_3$ etc.
- **Oxidation Reduction Titrations:** Concepts of oxidation and reduction, Redox reactions, Strengths and equivalent weights of oxidizing and reducing agents, Theory of redox titrations, Redox indicators, Cell representations, Measurement of electrode potential, Oxidation-reduction curves, Iodimetry and Iodometry, Titrations involving ceric ammonium sulphate, potassium iodate, potassium bromate, potassium permanganate, titanous chloride and sodium 2, 6- dichlorophenol indophenol.
- **Precipitation Titrations:** Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, Indicators, Gay-Lussac method, Mohr's method, Volhard's method and Fajan's method.
- **Gravimetric Analysis:** Supersaturation, Co-precipitation, Post-precipitation, Digestional washing of the precipitate, Filtration, Filter papers and crucibles, Ignition, Thermogravimetric curves, Specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic precipitants.
- **Non-aqueous Titrations:**
 - Theory, advantages and limitation
 - Non-aqueous solvents
 - Acidimetry and Alkalimetry in non-aqueous solvents
 - Iodimetry and Iodometry
- **Complexometric Titrations:**
 - Types of EDTA – titrations with applications in Pharmaceuticals.
 - Titration of mixtures, selectivity, masking and demasking
 - Metal ion indicators- theory of the visual use of metal ion indicator

Subject code: 01260308

Subject: Pharmaceutical Chemistry-IV (Pharmaceutical Analysis-I)

PRACTICAL: 3 Hrs /week

Number of experiments based on aforementioned theory.

BOOKS RECOMMENDED:

1. Mendhanm J, Denny R.C., Barnes J.D., Thomas M, Jeffery G.H., "Vogel's Text Book of Quantitative Chemical Analysis", Pearson Education Asia.
2. Connors K.A., "Text Book of Pharmaceutical Analysis", Wiley Inter-science.
3. Beckett A.H., and Stenlake J.B., Practical Pharmaceutical Chemistry, Vol. I & II. The Atherdon Press of the University of London.
4. British Pharmacopoeia, Her Majesty's Stationery Office, University Press, Cambridge, latest edition
5. Alexeyev V." Quantitative Analysis". CBS Publishers & Distributors.
6. Indian pharmacopoeia, Ministry of Health, Govt. of India, latest edition.

Subject code: 01260304

Subject: Pharmacognosy-II (Recent Advances in Phytochemistry)

THEORY:

1. Glycosides

- Introduction, definition, occurrence, properties, classification, uses, general biogenetic pathways. General extraction and isolation methods.
- Pharmacognostic study of following drugs

Antraquinones:	Senna, Aloe, Rhubarb
Cardioactive:	Digitalis, Squill
Saponins:	Liquorice, dioscorea, shatavari
Bitter:	Quassia, Kalmegh
Cynogenetic:	Bitter almond
Isothiocyanate:	Black mustard
Flavonoid:	Orange peels
Coumarin:	Psoralea
Others:	Artemesia, Brahmi

- **Isolation, purification and therapeutic uses of following phytochemicals:** Ginkgolides, Diosgenin, Ginsenosides, Andrographolide

3. Drugs of mineral and Herbo-mineral origin

Introduction, Classification, Chemical tests and uses of following drugs- Talc, Chalk, Kaolin, Kieselgur, Bentonite, Calamine and Shilajit

4. Traditional plant drugs used in herbal formulations

Common names, sources, active constituents and uses of:

Punarnava (*Boerhavia diffusa*), Shankpushpi (*Convolvulus microphylla*), Lehsun (*Allium sativum*), Guggul (*Commiphora mukul*), Kalmegh (*Andrographis peniculata*), Tulsi (*Ocimum sanctum*), Valerian (*Valerian officinalis*), Artemisia (*Artemisia annua*), Chirata (*Swertia chirata*), Asoka (*Saraca indica*), Saffron (*Crocus sativa*), Shilajit, Brahmi (*Bacopa monnieri* and *Centella asiatica*), Salai (*Boswellia serrata*), Giloe (*Tinospora cordifolia*).

5. Marine Drugs

Sources and Pharmacological activities of newer medicinal agents of Marine source with special reference to Anti-inflammatory, cardiovascular, anticancer agents and marine toxins.

Subject code: 01260309

Subject: Pharmacognosy-II (Recent Advances in Phytochemistry)

PRACTICAL: 3 Hrs /week

- Isolation and identification of Aloin from leaves of *Aloe* species by TLC method.
- Isolation and identification of Andrographolide from *Andrographis paniculata* by TLC method.
- Determination of total content of tannins from Black catechu by UV spectroscopic method using Folin-Ciocalteu method (Demonstration).
- Extraction of total sennosides from Senna leaves.
- 5. Study of morphological and microscopical characters of -
 - a) Senna b) Digitalis c) Liquorice d) Shatavari e) Quassia f) Kalmegh
 - g) Ashoka h) Arjuna

BOOKS RECOMMENDED:

1. Kokate C.K. "Pharmacognosy" Nirali Prakashan, Pune.
2. Trease G.E. & Evans W.C., "Pharmacognosy" Balliere Tindall East Bourne U.K.
3. Tyler V.E. "Pharmacognosy " Leas & Febiger, Philadelphia.
4. Wallis, T.E. "Text Book of Pharmacognosy" J&A Churchill Ltd. London.
5. Atal C.K. & Kapur BM, "Cultivation & Utilization of Medicinal Plant, RRI, Jammu.
6. Harborne JB, Phytochemical method, Chapman & Hall International Edition, London.

Subject code: 01260305

Subject: Environmental Science

THEORY:

- **Environmental studies:** Definition, Scope and importance. Multidisciplinary nature of environmental studies.
- **Natural resources:**
 - **Forest:** Benefits of forests. Use and over exploitation, Deforestation and timber extraction. Dams - their effects on forests and tribal people.
 - **Water resources:** Global water resources distribution. Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water, Dams- benefits and problems.

- **Mineral resources:** Usage and exploitation, Environmental effects of extracting and using mineral resources.
- **Food:** World food problems, Changes caused by agriculture and overgrazing, Effects of modern agriculture, Fertilizer-pesticide problems, Water logging and salinity. Organic farming - Definition and advantages.
- **Energy sources-**Conventional and non conventional / Renewable and non renewable.
 - **Fossil fuels:** Coal, Petroleum and natural gas -Availability, Dependency and environmental problems. Effect of global price of fossil fuel on nations.
 - **Alternatives to fossil fuels:** Hydro electric power, Bio energy, Nuclear, Wind, Solar, geothermal. Energy of future for transportation-Ethanol, Biodiesel and fuel cells.
- **Land resources:** Land as a resource, Land degradation, Man induced landslides, Soil erosion and desertification.

Role of an individual in conservation of natural resources and equitable use of resources for sustainable life style.

- **Ecosystem** – Structure and functional components of ecosystem. Producers, Consumers and decomposers. Food chain and food web. Energy flow and material cycling in ecosystem. Balanced eco system.
- **Biodiversity and its conservation:** Definition: Species and ecosystem diversity. Threats to biodiversity: Habitat loss, Poaching of wild life, Man wild life conflicts. Hot spots of biodiversity. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
- **Environmental pollution:** Definition, Causes, Effects and control measures of: Water pollution (water quality standards and parameters, Assessment of water quality, Transformation process in water bodies, Oxygen transfer by water bodies, Turbulent mixing, Water quality in lakes and preservers, Ground water quality), Air pollution, Soil pollution and noise pollution), Air pollution, Soil pollution and noise pollution.
- **Current environmental issues:** Population Growth, Human health and urbanization. Global warming (greenhouse effect), Climate change, Acid rain, Ozone layer depletion, Industrial and nuclear accidents, Nosocomial diseases.
- **Environmental protection:** Salient features of Environmental Protection Act, Air & Water Acts, Wildlife and Forest Acts. Functions of Central and State Pollution Control Boards. Role of NGO'S. Environmental education. Role of information technology in environment and human health.
- **Waste management**
- **Field work: equal to 5 lectures.**
 - Visit to a local area to document environmental assets – river/forest/grassland/hill/mountain etc.
 - Visit to a local polluted site – urban/rural/industrial/agriculture

- Study of common plants, insects and birds.
- Study of simple ecosystems- pond, river, hill slopes etc

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SEMESTER-IV

Subject Code: 01260401

Subject: Pharmaceutics-IV (Unit operations-II)

THEORY:

1. Flow of heat

Mechanisms of heat transfer: conduction, convection and radiation, Fourier's law, Stefan Boltzmann's constant, Kirchhoff's law, heat transfer- between fluid & solid boundary, boiling liquids, condensing vapor's, heat exchangers and heat interchangers.

2. Evaporation

Theory of evaporation, classification of evaporators, study of evaporating pan, short tube (single and multiple effect) and long tube evaporators (forced and natural circulation), economy, capacity and feeding methods of multiple effect evaporators.

3. Distillation

Roult's law, Henry's law and Dalton's law, Volatility and relative volatility, Simple distillation, Fractional distillation and columns used in it, Azeotropic distillation, extractive distillation and molecular distillation.

4. Drying

Theory of drying, Behavior of solids on drying, Classification of solids based on drying, Tray dryer, Fluidized bed dryer, spray dryer, freeze dryer, flash dryer and drum dryer.

5. Crystallization

Theory of crystallization, Mier's theory and its limitations, Nucleation and crystal growth, Study of Agitated batch crystallizer, Swenson Walker crystallizer, Krystal crystallizer, Vacuum crystallizer, Vacuum crystallizer with recirculation and its operating variables, growth type crystallizer.

6. Environmental control

Theory of humidification and dehumidification, Study of air conditioning, refrigerants and refrigeration cycle, cooling towers.

7. Corrosion

Mechanisms, factors influencing corrosion process, method of combating it.

Subject code: 01260406

Subject: Pharmaceutics-IV (Unit operations)

PRACTICAL: 3 Hrs /week

1. Study of effect of pressure on the rate of evaporation.
2. Study of effect of viscosity on the rate of evaporation.
3. Plotting of boiling point curve.
4. Study of rate of drying of solid sample (amorphous and crystalline).
5. Study of drying behavior of solid sample (amorphous and crystalline).
6. Crystallization of sodium chloride..

BOOKS RECOMMENDED:

1. J.F. Richardson and J.M. Coulron: Chemical Engineering
2. Walter L. Badger and J.T. Banchero: Introduction to Chemical Engineering
3. Perry: Handbook of Chemical Engineering
4. Lauer & Heckmann: Chemical Engineering Techniques
5. Peters: Elementary Chemical Engineering
6. S.J. Carter: Tutorial Pharmacy
7. N.D. Bhatt: Elementary Engineering Drawing.

Subject Code: 01260402

Subject: Computer Application in Pharmacy and Statics

THEORY:

- Introduction: Importance of computers, history of computers (generations), types of computers, classification of computers, components of a computer, applications of computers including Pharmaceutical applications, hardware description, Languages like assembly, machine, and common high-level languages, computer viruses.
- Introduction to Internet: Concepts of Internet, WWW, Gopher, email and applications of Internet.
- Programming in BASIC: Introduction to BASIC, flowcharting, BASIC statements, constants and variables, expressions in BASIC, print control, jumping and looping, subscripted variables, functioning and subroutines, histogram and graphs, programme design, file management in BASIC and computer graphics.
- Introduction to operating system with a special emphasis on Windows.
- MS-Word- Introduction to Word processing, Introduction to MS-word, Editing, formatting,, previewing and printing a document, advanced features of MS word (Find and replace, grammar and spelling, auto correct, word count, mail merge, table and charts.
- MS- excel- Worksheet basics, creating, formatting, previewing and printing a worksheet, graphs and charts, working with formulas and cell referencing, database creation,

sorting, database functions (Mathematical and trigonometrical, statistical and logical functions).

- MS-PowerPoint- Features and various versions, creating presentations, working with different views and menus of PowerPoint, editing and formatting a text, working with slides, printing a presentation, inserting objects, slide sorter and animation effects.

Subject Code: 01260407

Subject: Computer Application in Pharmacy and Statics

PRACTICALS: 3 Hrs /week

Number of experiments based on aforementioned theory.

Subject code: 01260403

Subject: Pharmaceutical Chemistry-V (Pharmaceutical Biochemistry)

THEORY:

- The concept of free energy, determination of change in free energy from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance.
- **Carbohydrate Metabolism:** Conversion of polysaccharide to glucose phosphate, Glycolysis, Gluconeogenesis Glyconeogenesis, Metabolism of galactose and galactosemia, Role of sugar nucleotides in biosynthesis and Pentosephosphate pathway.
- **Enzymes:** Nomenclature, enzyme kinetics and its mechanism of action, mechanism of inhibition of enzymes and iso-enzymes in clinical diagnosis.
- **Co-enzymes:** Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance.
- **Biological Oxidation:** The respiratory chain, its role in energy capture and its control, Energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation.
- **Lipids Metabolism:** Oxidation of fatty acids, oxidation & energetic, α -oxidation,-oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids.
- Biosynthesis of amino acids, Catabolism of amino acids, Conversion of amino acids to specialized products, biosynthesis of purines and Pyrimidine, formation of deoxyribonucleotides.
- Biosynthesis of Nucleic Acids, Biosynthesis of DNA and its replication, Mutation, Physical & chemical mutagenesis, carcinogenesis, DNA repair mechanism, Biosynthesis of RNA.
- Genetic code and Protein Synthesis, Components of protein synthesis, and Inhibition of protein synthesis.
- Regulation of gene expression.

Subject code: 01260408

Subject: Pharmaceutical Chemistry-V (Pharmaceutical Biochemistry)

PRACTICAL: 3 Hrs /week

Number of experiments based on aforementioned theory.

BOOKS RECOMMENDED:

1. Jayaraman J., Laboratory manual in Biochemistry, Wiley Eastern limited.
2. Plummer, David J., An Introduction to practical Biochemistry, Mc Graw Hill, New Delhi.
3. Singh S.P., Practical manual to Biochemistry, CBS Publisher, New Delhi.
4. Martin D.W., Mays P.A. & Redwell V.M., "Harper's review of Biochemistry" Lange Medical Publication.
5. Conn E.E. & Stumph P.K., Outline of Biochemistry, Macmillan Worth Publishers.
6. Nelson D.L. & Cox MM, Lehninger Principles of Biochemistry, Mcmillan Worth Publishers.
7. Stryer L., Biochemistry, WH, Freeman & Company, San Francisco.
8. Harrow B. & Mazur A., Text Book of Biochemistry, W.B. Saundeers Co., Philadelphia.

Subject code: 01260404

Subject: Pharmacology-III (Pathophysiology of diseases)

THEORY:

Path physiology of common diseases:

- (1) Central Nervous System: - Epilepsy, Parkinsonism, schizophrenia, depression, mania
- (2) Cardio Vascular System: - Hypertension, Angina, Myocardial Infarction, Congestive Heart Failure Atherosclerosis
- (3) Respiratory system: - Asthma, Chronic obstructive pulmonary disease, Tuberculosis
- (4) Gastro Intestinal Tract: - peptic ulcer, hepatitis, cirrhosis
- (5) Diabetes, rheumatoid arthritis, Gout, Alzheimer's disease
- (6) Urinary system: - Acute and chronic renal failure

Subject code: 01260409

Subject: Pharmacology-III (Pathophysiology of diseases)

PRACTICAL: 3 Hrs /week

1. Different methods for collection of blood.
2. Estimation of Haematocrit
3. Estimation of packed cell volume.
4. Physical examination of urine
5. Chemical examination of urine. (Protein, Albumin)
6. Chemical test of urine sugar, ketone bodies.
7. Test for bile salt and bile pigment in urine.

8. Determination of glucose in serum.
9. Estimation of serum cholesterol.
10. Estimation of serum triglycerides.
11. Estimation of serum proteins.
12. Estimation of SGOT and SGPT in serum
13. Estimation of creatinine in serum and urine
14. Estimation of urea in serum and urine.
15. Estimation of serum acid and alkaline phosphatase.
16. Estimation of bilirubin content in blood

Subject code: 01260405

Subject: Pharmaceutical Jurisprudence and Ethics

THEORY:

1. Historical background of Drug legislation in India.

Origin and nature of pharmaceutical legislation in India, Its scope and objective, new drug policy and future trends.

2. Code of Ethics for Pharmacists.

Principles and significance of professional ethics, critical study of code of pharmaceutical ethics drafted by PCI regarding to pharmacist in relation to his job, to his trade, and to medical profession.

3. Pharmacy Act 1948.

Definition, PCI and State Councils, Composition and Function, Preparation of Registers and qualifications for entry into registers, Educational Regulation and Approval of Courses and Institutions, Offences and Penalties

4. Medicinal and Toilet Preparations (Excise Duties) Act 1955, Rules 1976.

Definitions, restricted and unrestricted preparations, Manufacturing in bond and outside bond.

5. Drug Price Control Order 2013

6. Drugs and Magic Remedies (Objectionable Advertisements) Act 1954.

Definitions, Prohibited Advertisement, Savings

7. Drugs and Cosmetics Act 1940, Rules 1945.

Definitions, Advisor bodies DTAB and DCC Composition and function, Drug Control Laboratories and Government Analysts, Drug inspectors, Licensing Authorities, Controlling Authorities and Customs Collectors Provisions Governing Import, Manufacture and Sale of Drugs. Labeling and Packaging of Drugs. Provisions applicable

to manufacture and Sale of Ayurvedic Drugs, Provisions Governing Import, Various offences and corresponding Penalties, Broad content of various Schedules of the Drugs and Cosmetic Act and Rules.

8. Narcotic Drugs and Psychotropic Substances Act, and Rules there under

Definition, Prohibited and controlled operation, cultivation of poppy plants, sale of opium, import and export of narcotics as amended to date, Offences and corresponding penalties.

9. Consumer Protection Act, Prevention to Animal Cruelty Act, Wildlife Protection Act

BOOKS RECOMMENDED:

1. N. K. Jain: Pharmaceutical Jurisprudence
2. S. P. Aggarwal and R. Khanna: Pharmaceutical Jurisprudence, Tata Publishers.

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SEMESTER-V

Subject code: 01260501

Subject: Pharmaceutics-V (Physical Pharmacy-I)

THEORY:

1. Micromeritics

Particle size, 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.

2. Solubility and Distribution Phenomena

Mechanism of solute solvent interactions. Ideal solubility Quantitative approach to the factors influencing solubility of drugs. Application of distribution phenomena in pharmacy, Phase rule and phase equilibrium, phase diagram, one and two component, the solid state amorphous, crystalline and polymorphism.

3. 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. HLB scale, Factors affecting micelle formation, structure of micelle and liquid crystal, Micellar solubilization and its pharmaceutical significance.

4. Dispersion System

Theoretic considerations, particle interaction and behavior, flocculation and deflocculation, sedimentation parameters, role of wetting, controlled flocculation and structured vehicle in formulation and manufacture of suspension, evaluation of suspension.

Types, Thermodynamic consideration, Mechanism of droplet stabilization, Theories of emulsification. Formulation and manufacturing of emulsions, stability of emulsions.

Properties of colloids – Optical, Kinetic and Electrical and their application in determining molecular weight of polymer. Stability of colloidal systems, Mechanism of peptization, coacervation and protective action.

5. Rheology

Types of flow behavior, thixotropy and thixotropic coefficient. Measurement of various rheological properties, factors influencing rheology of dispersed systems.

Subject code: 01260506

Subject: Pharmaceutics-V (Physical Pharmacy)

PRACTICAL: 3 Hrs /week

1. Determination of particle size by optical method.
2. Determination of particle size by sieving method and efficiency of screening operation.
3. Determination of particle size by sedimentation method using and Andreesen pipette.
4. Determination of flow properties of powder through the tube as a function of length of tube, diameter of orifice of tube and pressure head.
5. Experiments demonstrating the measurement of angle of repose of powders and the factors affecting.
6. Determination of interfacial tension between two immiscible liquids and to calculate spreading coefficient.
7. Determination of CMC of a surfactant through interfacial tension measurement method.
8. To study the effect of electrolyte on CMC of surfactant
9. Determination of HLB of surfactant.
10. Formulation and evaluation of emulsion
11. Formulation and evaluation of suspension
12. Study of effect of particle size on angle of repose and flow properties.
13. Study of effect of fines and lubricant on angle of repose and flow properties.
14. Determination of bulk density, True density and Granular density of few pharmaceuticals and to calculate porosity of material.
15. Determination of relation between dielectric constant of solvent and solubility of drugs.
16. To plot ternary phase diagram.
17. Determination of partition coefficient and distribution of drug between two phases.
18. Study of rheograms of some mucilages.
19. Determination of molecular weight of polymer by viscosity measurement method
20. To determine the distribution coefficient of benzoic acid between water – benzene system.

21. To study the effect of temperature and pH on aspirin hydrolysis.
22. To determine upper consolute temperature of phenol water system.

BOOKS RECOMMENDED:

1. Martin: Physical Pharmacy, K.M.B. Varghese Co. Bombay.
2. A.T. Florence and D. Attwood W: Physicochemical principles of Pharmacy.
3. Shotton and Ridgeway: Physical Pharmaceutics.
4. Remington's Pharmaceutical Sciences, Mark Publishing Co.
5. H.S. Beans, A.H. Beckett and J.E. Carless: Advances in Pharmaceutical Sciences, Vol. 1 to 4.
6. S.P. Aggarwal, Rajesh Khanna: Physical Pharmacy, CBS Publishers, New Delhi.

Subject code: 01260502

Subject: Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)

THEORY:

- **Basic principles of medicinal chemistry:**
Structure of biological membrane, physicochemical parameters affecting drug action, drug absorption, distribution and elimination. Stereochemical aspects of drug action, drug receptor interaction including transduction mechanism, blood brain barrier.
- **Drug metabolism:**
Phase I and phase II reaction, biological factor affecting drug metabolism, inducers and inhibitors of drug metabolism, significance of drug metabolism studies in drug development.
- **Prodrug concept:** Principles of prodrug design and applications.

Following topics shall be treated covering nomenclature, synthetic procedure of official drugs, uses SAR including physicochemical and steric aspects and mode of action. Antiasthmatics, bronchodilators, phosphodiesterase inhibitors, expectorants, decongestant and antitussives.

- General and local anaesthetics, sedative and hypnotics, skeletal muscle relaxants, anticonvulsant, CNS stimulant agents, antipsychotics and antidepressants, hypoglycemic agents and oxytocics .
- Antihistaminics, drugs used in Parkinsonism, Alzheimer's diseases and urinary tract infection.
- Thyroid hormones and antithyroid drugs, Narcotic analgesics and NSAIDs, prostaglandins and eicosanoids.

Subject code: 01260507

Subject: Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)

PRACTICAL: 3 Hrs /week

Number of experiments based on aforementioned theory.

BOOKS RECOMMENDED:

1. Mann P. G. & Saunders B. C., Practical Organic Chemistry, ELBS/Longman, London.
2. Furnis B. A., Hannaford A. J., Smith P. W. G. and Tatehell A. R., Vogels's Text Book of Practical Organic Chemistry, The ELBS/Longman, London.
3. Indian Pharmacopoeia, Ministry of Health, Govt. of India.
4. Abraham, Burger's Medicinal Chemistry and Drug Discovery, John Wiley and sons, New York.
5. Dagado J.N. and Remers W A R, 10th eds., Wilson and Giswold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
6. Foye W. C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh H. and Kapoor, V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
8. Nogrady; T, Medicinal Chemistry- A Biochemical Approach, Oxford University Press, New York, Oxford.
9. Finar I.L. Organic Chemistry Vol.I & II ELBS/ Longman, London.

Subject code: 01260503

Subject: Pharmaceutical Chemistry-VII (Pharmaceutical Analysis-II)

Theory:

- **Solvent extraction**
Basic Principle, Extraction process, liquid-liquid extraction, Methods of extraction, factors affecting extraction, Selection of solvent as an extraction solvent, extraction techniques, Applications.
- **Chromatography**
Introduction, Important terms, Classification, Advantages and disadvantages, Application, Difference between following methods.
- **Electrophoresis**
Types of electrophoresis, requirements of electrophoretic chambers, problems in electrophoresis.
 - ii) Column Chromatography**
Adsorption column chromatography, Development Techniques (Frontal, displacement and elution analysis), Preparation of column, Factors affecting column efficiency, Partition chromatography.
 - iii) Ion exchange Chromatography**

Principle, Ion exchange resins/material, Properties of ion exchangers, Mechanism of ion exchange process, Factors affecting ion exchange.

iv) Paper chromatography

Principle, Choice of filter papers, Solvents, Chromatographic chambers, Development techniques (Descending, Ascending, Radial multiple chromatography, two dimensional chromatography), post development derivative techniques, Factors affecting retention factor.

v) Thin layer chromatography (TLC)

Principle, Different methods / techniques, Development of chromatograph, Rf value (Retention factor) and factors affecting Rf value.

vi) Gas chromatography

Theory, Instrumentation (Carrier gas, Columns, stationary phases for gas-liquid and gas-solid chromatography, Detectors- flame ionization, electron capture and thermal conductivity detector), Quantitative analysis/ Derivatisation technique.

vi) High Performance Thin layer chromatography (HPTLC)

Principle, Instrumentation, Preparation of plate, Development techniques.

viii) High Performance Liquid chromatography (HPLC)

Principle, Instrumentation, Solvent treatment systems, Pumps, column packing material, Detectors.

- **Electrochemistry:** Introduction, Dielectric cell, electrode potential, Nernst equation, Salt bridge, Standard potential, Reference & Indicator electrodes, measuring the relative voltage of cell.
- **Potentiometry:** General principles, instrumentation & applications.
- **Conductometry:** General principles, instrumentation & applications.
- **Coulometry:** General principles, instrumentation & applications.
- **Polarography:** General principles, instrumentation & applications.
- **Amperometry:** General principles, instrumentation & applications.

Subject code: 01260508

Subject: Pharmaceutical Chemistry-VII (Pharmaceutical Analysis-II)

PRACTICAL: 3 Hrs /week

Number of experiments based on aforementioned theory.

BOOKS RECOMMENDED:

1. Willard H.H., Merritt L.L. & Dean J.A., Instrumental Methods of Analysis, Van Nostrand, Reinhold, New York
2. Beckett A.H. & Stenlake J.B., Practical Pharmaceutical Chemistry, Vol. I & II, The Athlone Press of the University of London.
3. Connors K.A., A Text Book of Pharmaceutical Analysis, Wiley – Interscience, New York.
4. Jeffery G.H., Bassett J., Mendham J, Denney R.C., Vogel's Text Book of Quantitative Chemical Analysis, Addison Wesley Longman, Indian Branch Delhi

5. Ewing Gale W., Instrumental Methods of Chemical Analysis, Mc Graw Hill, USA

Subject code: 01260504

Subject: Pharmacognosy-III (Chemistry of Natural Products)

Theory:

- **Heterocyclic Compounds:** Study of fundamentals of heterocyclic compounds, nomenclature, method of synthesis and important chemical reactions of the following: Five membered Heterocycles: Furan, Thiophene, Pyrrole, Thiazole, oxazole, imidazole, Pyrazole. Six membered Heterocycles: Pyridine, pyridazine, Pyrimidine, Pyrazine, Pyrones. Benz-fused Heterocycles: Quinoline, Isoquinoline, Indole.
- **Carbohydrates:** An account of the chemistry of Arabonose, Ribose, mannose, Glucose, fructose, Sucrose, Lactose, Cellulose, starch, Glycogen and dextrans, Structure elucidation of glucose, sucrose, starch. Study of chemistry of fixed oils, fats and waxes.
- **Terpenes:** Classification, Isoprene rule, Chemistry of various constituents of volatile oils: Limonene, Pinene, Cineole, Camphor, Menthol, Menthone, Thymol, Citral and Eugenol. Structure elucidation of Pinene, Limonene, Camphor, Citral.
- **Glycosides:** Classifiaction and method of isolation of α and β -d-methyl glucoside. Chemistry of salicin, cardiac glycosides, anthraquinone glycosides, saponins. Structure elucidation of cardiac glycosides.
- **Carotenoids:** β -carotenoids, α -carotenes, vitamin A, Xanthophylls of medicinal importance.

Subject code: 01260509

Subject: Pharmacognosy-III (Chemistry of Natural Products)

PRACTICAL: 3 Hrs /week

- Laboratory experiments on isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.
- Exercises on paper and thin layer chromatographic evaluations of herbal drug constituents.
- Extraction of volatile oils and their chromatographic profiles.
- Identification of following crude drugs by their morphological characters and chemical tests

Colophony, Benzoin, Balsams, Storax, Asafoetida, Guggul, Boswellia, Myrrh

BOOKS RECOMMENDED:

1. Brain, K.R. & Turner T.D., "The Practical Evaluation of Phytopharmaceuticals", Wright, Bristol.
2. Stahl.E. "Thin Layer Chromatography" A Laboratory Hand Book" Springer Verlag,

Berlin.

3. Pharmacopoeia of India.

4. Finar, I.L. "Organic Chemistry" Vol.I & II ELBS, London.

5. Aggarwal, O.P., "Chemistry of Organic Natural Products", Vol.I & II, Goel Publ.House, Meerut.

6. Trease G.E. & Evan W.C., "Pharmacognosy" Baillaire Tindall East bourne, U.K.

7. Tyler V.E. "Pharmacognosy" Lea & Febiger, Philadelphia.

8. Pridham J.B. & Swain T. "Biosynthetic Pathway Higher Plants" Academic Press, New York.

Subject code: 01260505

Subject: Pharmacology-IV

THEORY:

General pharmacology:

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

B. Pharmacokinetics:

1. Principles and applications of pharmacokinetics.
2. Transport across cell membrane
3. Absorption of drug and factors affecting absorption
4. Drug distribution: physiological barriers and factors affecting
5. Biotransformation of drugs
6. Excretion of drugs

C. Pharmacodynamics: General, molecular & biochemical aspects of drug actions, receptors, drug receptor interactions, factors modifying drug effects.

D. Toxicology, Drug interactions, Adverse Drug Reaction, Therapeutic Drug Monitoring. Drug induced disease.

Study of Pharmacological action of following classes of drug with respect to classification of recently available drugs, Mechanism of action, Receptors, Adverse effects, Drug interaction, Contraindication and Therapeutic uses:

- **Pharmacology of drugs acting on ANS**
 - A. Introduction- Neurohumoral transmission
 - B. Adrenergic and cholinergic receptors
 - C. Adrenergic drugs
 - D. Adrenergic receptor blockers
 - E. Cholinomimetics, anticholinesterases

- F. Anti- muscarinic agents
- G. Ganglionic blockers and stimulants
- H. Neuromuscular blocking agents

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SEMESTER-VI

Subject code: 01260601

Subject: Pharmaceutical Chemistry-VIII (Physical Chemistry-I)

THEORY:

- 1. Behaviour of Gases:** Kinetic theory of gases, deviation from ideal behaviour and explanation.
- 2. The Liquid State:** Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moment) and chemical constitution.
- 3. Solutions:** Ideal and real solutions, solutions of gases in liquids, colligative properties.
- 4. Thermodynamics:** Fundamentals, first, second, third and zeroth law, Joule- Thompson's effect, Thermochemical equations.
- 5. Phase equilibria:** Phase, component, degree of freedom, phase rule (excluding derivation). Cooling curves & Phase diagrams for one & two component system (example-Sulphur, H₂O, KI-H₂O, NaCl-H₂O system)
- 6. Chemical Kinetics:** Zero, first and second order reactions, complex reactions theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid base and enzyme catalysis.
- 7. Electro chemistry:** Faraday's law of electrolysis, Electrolytic conductance and its measurements, molar and equivalent conductivity, its variation with dilution. Kohlrausch law, Arrhenius theory, Degree of ionization and Ostwald's dilution law. Theory of strong electrolytes (Debye Huckle theory)
- 8. Photochemistry:** Consequences of light absorption, Jablonski diagram, Lambert-Beer law, Quantum efficiency.
- 9. Partition Coefficient**
- 10. Adsorption:** Freundlich and Gibbs adsorption isotherms (excluding derivation), Langmuir theory of adsorption.

Subject code: 01260606

Subject: Pharmaceutical Chemistry-VIII Practical (Physical Chemistry)

PRACTICAL: 3 Hrs /week

- Determination of molar mass by Rast cryoscopic method.
- Determination of refractive index of given liquids.
- Determination of specific rotation of sucrose at various concentrations and determination of intrinsic rotation.
- Determination of rate constant of simple reaction.

- Determination of cell constant, verify Ostwald's dilution law and perform conductometric titration.
- Determination of surface tension.
- Determination of partition co-efficient.
- Determination of viscosity.
- Determination of solubility.
- Determination of heat of solution, heat of hydration and heat of neutralization.

BOOKS RECOMMENDED:

1. Bahl B.S., Tuli G.D. & Bahl Arun, Essentials of Physical Chemistry, S.Chand & Co Delhi
2. Shoemaker D.P., Garland C.W., Experiments of Physical Chemistry, Mc Graw Hill Book Co.
3. Pali S.R., and Prabartak S.K.D.E., Practical Physical Chemistry, Halton Limited, Calcutta.
4. Negi A.S. & Anand S.C."Text Book of Physical Chemistry" Wiley Eastern Ltd.
5. Glasstone S. & Lewis D, Elements of Physical Chemistry, Macmillan Education.

Subject code: 01260602

Subject: Pharmaceutical Chemistry-VIII (Medicinal Chemistry-II)

THEORY:

Following topics shall be treated covering nomenclature, synthetic procedure of official drugs, uses SAR including physicochemical and steric aspects and mode of action.

- **Chemotherapeutic agents:** Antimalarial, antiamoebic, anthelmintic and sulfonamides, antimycobacterial agents (antitubercular and antileprotic agents), antifungal agents, antiviral (including drugs used in AIDs), antineoplastic agents,
- **Antibiotics and prominent analogues:** Penicillin, cephalosporin, aminoglycosides, tetracyclines, polypeptides, chloramphenicol, macrolide, lincomycins, lactamase inhibitors
- **Drug design:** Objectives, general principles, physicochemical properties and common approaches. Computer aided drug design (CADD), Theoretical consideration of quantitative structure activity relationship (QSAR) and its methods, molecular modeling, simple correlation equation. Brief introduction to combinatorial chemistry. Concept and brief introduction of genetic engineering in medicinal chemistry.

Subject code: 01260607

Subject: Pharmaceutical Chemistry-VIII (Medicinal Chemistry-II)

Practical: 3 Hrs /week

Number of experiments based on aforementioned theory.

BOOKS RECOMMENDED:

1. Mann P. G. & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
2. Furnis B. A., Hannaford A. J., Smith P W G and Tatehell A R, Vogels's Text Book of Practical Organic Chemistry, The ELBS/Longman, London.
3. Indian Pharmacopoeia, Ministry of Health, Govt. of India.
4. Abraham, Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons, New York.
5. Dagado J.N. and Remers W A R, 10th edn., Wilson and Giswold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
6. Foye W. C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
8. Nogrady T; Medicinal Chemistry- A Biochemical Approach, Oxford University Press, New York, Oxford.
9. Finar I.L. Organic Chemistry Vol.I & II ELBS/ Longman, London.

Subject code: 01260603

Subject: Pharmacognosy -IV (Recent Advances in Phytochemistry)

THEORY:

1. Alkaloids

Introduction, definition, occurrence, properties, classification, chemistry. General Biosynthetic pathways for Indole, Tropane Quinoline and Isoquinoline alkaloids Systematic pharmacognostic study of following crude drugs containing Alkaloids.

- a. Indole-Ergot, Rauwolfia, Nux-vomica, Vinca.
- b. Tropane - Datura, Coca, Belladonna.
- c. Purines - Tea, Theobroma.
- d. Quinoline - Cinchona.
- e. Isoquinoline - Opium, Ipecac.
- f. Pyridine/ Piperidine - Lobelia.
- g. Imidazole - Pilocarpus.
- h. Quinazoline – Vasaka
- i. Amino alkaloids - Colchicum, Ephedra.
- j. Steroidal - Ahwagandha, kurchi, solanum khasian

2. Flavonoids

Introduction, properties, classification, chemistry, extraction and general biosynthetic Pathway.

1. Flavones: Roman chamomile, *Passiflora incarnate*, Grape fruit.
2. Isoflavones: Derris Roots, Soyabean,
3. Flavonol: Buch Wheat, Green Tea
4. Flavonones: Liquorice, Citrus Peels
5. Chalcones: Safflower
6. Bioflavones- Gingko
7. Anthocynidine- Blueberry, Blackcurrent,Vine

3. Herbal Formulations

A comparative study of Ayurvedic and modern dosage forms, Different stages of Herbal formulations , study of methods of preparations of various ayurvedic dosages forms. like Aristas, Asava, Ghutika, Tailia, Churna, Avaleha, Ghritaand Bhasms, Unani formulations like Majooms, Safoofs and their evaluation. Determination of heavy metals in herbal preparation and alcohol contents in Aristas and Asvas.

4. Herbal cosmetics

Source, Historical background and present status Raw material – Oils, Waxes, Gums, Hydrophillic colloids, colours, perfumes, protective agents, Bleaching agents, Preservatives, Antioxidants and other Auxiliary agents. Formulation aspects of incorporating Herbal extracts in various preparations like Talcum powders, Face pack, cold cream, cleansing creams, shampoo & lipstick.

5. Standardization of Herbal Drugs

Importance of standardization and problems involved in the stanardisation. Standardization of single Drug and compound Formulations, W.H.O. guidelines for quality standardised Herbal formulations, Validation of Herbal products. Estimation of parameters limit Used for standardization and herbal extracts.

Subject code: 01260608

Subject: Pharmacognosy -IV (Recent Advances in Phytochemistry)

PRACTICAL: 3 Hrs /week

- Identification of following crude drugs by their morphological characters and chemical tests:
 - a. Pale catechu, b. Black catechu, c. Bahera, d. Myrobalon
- Isolation of caffeine from Tea powder
- Identification of following crude drugs by their morphological characters and chemical Tests of some alkaloidal containing drugs.
- Study of morphological, microscopical characters & chemical / microchemical tests for Following crude drugs:
 - Leaf: Datura, Vinca, Vasaka
 - Roots: Rauwolfia

- Barks: Cinchona, Kurchi,
- Stem: Ephedra
- Seed: Nux-Vomica
- Wood: Quassia

BOOKS RECOMMENDED:

1. Kokate, C.K."Practical Pharmacognosy" Vallabh Prakashan Delhi.
2. Wallis T.E., Analytical Microscopy, J&A Churchill Limited, London.
3. Ganborg & Weltor, Plant Tissue Culture Methods, National Research Council of Canada, Saskatchewan.
4. Clarke ECG, Isolation & Identification of Drugs, The Pharmaceutical Press, London.
5. Trease, G.E. & Evans, W.C., "Pharmacognosy" Bailleire Tindall East Boarne, U.K.
6. Tyler V.E.: "Pharmacognosy" Lea & Febiger, Philadelphia.
7. Wallis, T.E., "Text book of Pharmacognosy", J&A Churchill Ltd. London.
8. Kokate, C.K.etal Pharmacognosy, Nirali Prakashan, Pune.,
9. Atal C.K. & Kapur BM, "Cultivation & Utilization of Medicinal Plant, RRL, Jammu.
10. Stahl .E, Thin Layer Chromatography, A Laboratory Handbook, Springer Verlog, Berlin.
11. Henry TA. The Plant Alkaloids, Mc Graw Hill, New York.
12. Dixit, V.K.,Vyas S.P.Pharmaceutical Biotechnology, CBS Publication, New Delhi.
13. Street H.E. Tissue Culture & Plant Science, Academic Press, London.
14. Kokate C.K.,Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Publication.

Subject code: 01260604

Subject: Pharmacology-V

THEORY:

Study of Pharmacological action of following classes of drug with respect to classification of recently available drugs, Mechanism of action, Receptors, Adverse effects, Drug interaction, Contraindication and Therapeutic uses:

1. Pharmacology of drugs acting on CVS

- A. Antihypertensive drugs
- B. Antianginal drugs
- C. Antiarrhythmic drug
- D. Drugs used for CHF
- E. Drugs used in Hyperlipidemia
- F. Drug therapy of shock

2. Pharmacology of drugs acting on renal system

- A. Diuretics
- B. Anti- diuretics

3. Autocoids and their blockers

- A. Histamine and antihistaminic
- B. 5- Hydroxytryptamine and its antagonist
- C. Prostaglandins and non steroidal anti-inflammatory drugs, antipyretic, analgesic
- D. Leukotrienes and platelet activating factor.

4. Pharmacology of drugs acting on Haemopoitic system

- A. Haematinic
- B. Coagulants and anticoagulants
- C. Fibrinolytic and antiplatelet agents.

Subject code: 01260609

Subject: Pharmacology-VI

Practical

1. Introduction to Experimental Pharmacology.
2. Preparation of different solutions for experiments.
3. Common Laboratory animals and their maintenance.
4. Study of commonly used instruments in experimental pharmacology.
5. Procedures for rendering animals unconscious –stunning of rodents, pithing of frogs, chemical anaesthesia.
6. Experiments on intact preparations:i.Study of different routes of administration of drugs in mice / rats.
7. Experiments on Central Nervous System:
 - i. Recording of spontaneous motor activity, stereotypy, analgesia, Anticonvulsant activity and muscle relaxant activity of drugs using Simple experiments.
 - ii. Effects of autonomic drugs on rabbit's eye.

NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BOOKS RECOMMENDED:

1. Essential of Medical Pharmacology, K.D.Tripathy, JAYPEE.
2. Pharmacology & Parmacotherapeutics, Satoshkar & Bhandarkar, Popular Publication.
3. Pharmacology, Prasun Kumar Das, S.K.Bhattacharya, Elsevier.
4. The Pharmacological Basis of Therapeutics, Goodman & Gilman, Mc Graw Hill.
5. Text book of Pharmacology, S.D. Sethi, BI Churchill Livinstone.
6. Pharmacology, Rang, Dale and Ritter, Churchill Living Stone.
7. Basic & Clinical Pharmacology, B.G.Katzung, Lange.
8. Pharmacology, Mary J, Mycer, Richard A, Lippincott William & Willans

Subject code: 01260605

Subject: Pharmaceutics–VII (Regulatory Affairs and Intellectual Property Right)

THEORY:

- **Regulatory Affairs**

Introduction, Importance of regulatory affairs, Functions of regulatory affairs, Regulation marketing and Violation and Enforcement.

- **Drug regulatory strategy**

Regulatory strategies for different phases of product development:- Regulatory strategy during the preclinical development phase, Regulatory strategy during the clinical development Phase (Phase I, Phase II, Phase III) and Regulatory strategy for the post approval phase.

- **Drug regulatory authorities and agencies: -**

United States food and drug administration (USFDA), Therapeutic goods administration (TGA), Medicines and healthcare regulatory agency (MHRA), International conference on harmonisation (ICH), World health organization (WHO), Ministry of health, labor and welfare (MHWL) in Japan, Central drugs standard control organization (CDSCO), Indian pharmacopoeia commission (IPC)

- **Investigational new drug application (INDA)**

Introduction, The content and format of an IND application, maintaining an IND

- **New drug application (NDA)**

Introduction, FDA Guidelines, Assembling applications for submission, NDA contents.

- **Abbreviated new drug application (ANDA)**

Introduction, Requirements for filing ANDA,

- **Drug master file (DMF)**

Introduction, Types of DMF, DMF submission.

INTELLECTUAL PROPERTY RIGHTS

- **Introduction**

Understanding Intellectual property rights (IPR) and review of IPR regime: - Copyrights, Trademarks, Geographical indications, Appellations of origin, Industrial designs, and Intellectual property laws in India.

- **Patent legislation**

Patent Act 1970, Patentability criteria, Patentable subject matter, Patent amendment (1999, 2002, 2005).

- **Patent procedure, filing, search and licensing.**

- **Patent infringement issues and freedom to operate.**

International treaties and conventions on IPR; Trade related Intellectual property rights (TRIPS), Paris convention, World trade organization (WTO), General agreement on trade and tariff (GATT), Patent cooperation treaty (PCT).

Other Features: Hatch-Waxman Act, Compulsory licensing, Laws related to Biosimilars.

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SEMESTER-VII

Subject Code: 01260701

Subject: Pharmaceutics – VIII (DFT-I Conventional)

THEORY:

1. Preformulation Considerations

Concept, study of physical properties: description, microscopic examination, particle size, partition coefficient, dissolution, solubility, membrane permeability, drug stability, crystal structure and polymorphism.

Study of chemical properties of drug like hydrolysis, oxidation, reduction, racemization, polymerization etc. and their influence on stability.

2. Tablets

Rationale, market perspectives, types of tablets, tablet excipients, methods of tablet manufacture (wet, dry & direct compression), granulation, tablet compression: physics, mechanism, compression cycle, tablet processing problems and defects, tablet evaluation.

Types of coating (sugar, press & film coating), coating formulation, film forming materials, coating process & equipments, coating defects, evaluation of coated tablet.

3. Capsule

Hard gelatin capsule: Advantages & disadvantages, material for production and manufacturing of capsule shell, Capsule size, method of capsule filling, evaluation of capsule.

Softgels: Shell and content, manufacturing process and quality control.

4. Cosmetics

Fundamentals, structure and function of skin and hair, classification, formulation and preparation and packaging of various skin products, cold cream, vanishing cream, moisturizing cream, face powders & dentifrices, toothpastes & tooth powders.

5. Sterile Dosage Form

Type of injections, parenteral routes of administrations, water for injection, pyrogenicity, non aqueous vehicle, isotonicity and method of its adjustment. large & small volume parenteral, ophthalmic, ear and nasal solutions and suspensions.

6. Validation of Pharmaceutical Processes:

Process validation options, the validation committee, validation master plan, validation protocol & report. Preapproval inspection, pilot plant scales up & technical transfer, stages of validation, Introduction, validation of raw materials, analytical methods validation, Equipment/ facility validation, definition and control of process variables, In-process tests, finished product tests, guidelines for process validation of solid dosage form .

Subject code: 01260706

Subject: Pharmaceutics – VIII (DFT-I Conventional)

PRACTICAL: 3 Hrs /week

1. Preparation of tablets by the following techniques:
 - a. Wet granulation (Aqueous).
 - b. Wet granulation (non-aqueous).
 - c. Dry granulation (Slugging).
2. Coating of tablets - sugar coating and film coating.
3. Strip packing of tablets.
4. Quality control of tablets.
5. Filling and sealing of hard capsules.
6. Quality control of capsules.
7. Preparation of sustained release dosage forms employing various techniques.
8. Preparation of an aerosol dosage form and its evaluation.
9. Preparation and evaluation of microcapsules by employing various techniques.
10. Any other experiments illustrative of the theory of syllabus.

BOOKS RECOMMENDED:

1. L. Lachman, H. A. Liberman, and J. L. Kanig: Theory and practices of Industrial Pharmacy, 3rd Edition, 1986.
2. M. E. Aulton: Pharmaceutics: The science of dosage form design, ELBS publisher, 1988.
3. G.S. Banker and C.T. Rhodes: Modern Pharmaceutics, 2nd Edition, Marcel Dekker, 1990
4. Remington's Pharmaceutical Sciences, 18th Edition, Mack Publishing Company, 1990.
5. Cooper and Gunn's Tutorial Pharmacy, 6th Edition, CBS Publishers and Distributors, 1999.
6. H. A. Liberman,, L. Lachman, and J. B. Schwartz: Pharmaceutical dosage forms: Tablets, Vol. 1,2 and 3, 2nd Edition Marcel Dekke r, 1989.
7. A. L. Brody and K. S. Marsh: Encyclopedia of packaging technology, 2nd Edition, John Wiley and Sons Inc., 1997.
8. P. P. Sharma: How to practice GMPs, 2nd Edition, Vandana Publications, 1995.
9. World Health Organization's guidelines on good manufacturing practices and inspection
10. L. Lachman: Theory and practices of Industrial Pharmacy, 2nd Edition. 18. S. D. Bruck: Controlled drug delivery, Vol. I and II.

Subject code: 01260702

Subject: Pharmaceutical Chemistry – IX (Medicinal chemistry-III)

THEORY:

Following topics shall be treated covering nomenclature, synthetic procedure of official drugs, uses SAR including physicochemical and steric aspects and mode of action.

- **Sympathetic and parasympathetic agents**
Including biosynthesis and metabolism of adrenergic neurotransmitters, adrenoreceptor blockers.
Cholinergic agents, cholinergic inhibitors, anticholinergic agents including antispasmodics, ganglionic stimulants and blockers, neuromuscular blockers.
- **Cardiovascular drugs**
Antihypertensive, cardiotonics, antiarrhythmic, anticoagulant, Antithrombotics, thrombolytics, antianginal, coronary vasodilators, hypolipidemic drugs, diuretics.
- **Steroids**
Androgens and anabolic agents, estrogens, progestational agents, adrenocorticoids and oral contraceptives

Subject code: 01260707

Subject: Pharmaceutical Chemistry – IX (Medicinal chemistry-III)

Practical: 3 Hrs /week

Number of experiments based on aforementioned theory.

BOOKS RECOMMENDED:

1. Mann P. G. & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
2. Furnis B. A., Hannaford A J, Smith P W G and Tatehell A R, Vogels's Text Book of Practical Organic Chemistry, The ELBS/Longman, London.
3. Indian Pharmacopoeia, Ministry of Health, Govt. of India, India, Latest edition.
4. Abraham, Burger's Medicinal Chemistry and Drug Discovery, John Wiley & sons, New York.
5. Delagado J.N. and Remers W A R, 10th eds., Wilson and Giswold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
6. Foye W. C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh H. and Kapoor V.K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
8. Nogrady T., Medicinal Chemistry- A Biochemical Approach, Oxford University Press, New York, Oxford.
9. Finar I.L. Organic Chemistry Vol.I & II ELBS/ Longman, London

Subject code: 01260703

Subject: Pharmacognosy-IV

THEORY:

- **Carbohydrates and related compounds**

Introduction, Collection, Preparation, Chemistry, Chemical tests and uses of-

Sugars- Honey, Sorbitol, Mannitol, Carmel, Liquid glucose

Starches and Modified starches

Cellulose and their derivatives

Polysaccharides from marine sources- Agar, Sodium alginate, and Carrageenan

Other Polysaccharides- Bael, Dextrin, Dextran, Inulin, Pectin

Gums- Acacia, Tragacanth, Gum Karaya, Guar gum

Mucilages- Isapghula

- **Lipids**

Definition, method of extraction, chemistry

Study of method of production, chemical constituents, tests, uses of the following drugs-

Fixed Oils: Castor oil, olive oil, Linseed oil, Sesame oil, Soya oil, Cod liver oil, Shark liver oil.

Fats: Cocoa butter, Kokum butter

Waxes: Bees wax, Wool fat, Carnauba wax

- **Natural fibers**

Introduction, Classification, Chemical tests and uses of following fibers- Cotton, Jute, Silk, Wool.

- **Enzymes of Pharmaceutical interest**

Papain, Pancreatin, Pepsin, Hyaluronidase, Streptokinase.

5. Tannins

- Introduction, definition, classification, properties, uses, chemical tests and general methods of extraction.

- Pharmacognostic study of following drugs

Pale catechu, Black catechu, Ashoka, Arjuna, Bahera, Amala, Myrobalon

Subject code: 01260708

Subject: Pharmacognosy -IV

PRACTICAL: 3 Hrs /week

- Identification of some carbohydrate containing crude drugs by morphological study and chemical tests.
- Evaluate following drugs by their morphological characters and chemical tests - Castor oil, Wool fat, Bees wax and Sesame oil.
- Detection of adulteration of fixed oil by chemical tests
- Identification of mineral drugs- Talc, Chalk, Kaolin, Kieselguhur and Bentonite
- Determination of swelling factor of Isapghula seeds

- Identification of fibers by morphological characters and chemical tests - Cotton, Jute, Silk, Wool.
- Isolation of starch from potato.

BOOKS RECOMMENDED:

1. Kokate, C.K. "Practical Pharmacognosy" Vallabh Prakashan Delhi.
2. Wallis T.E., Analytical Microscopy, J&A Churchill Limited, London.
3. Ganborg & Weltor, Plant Tissue Culture Methods, National Research Council of Canada, Saskatchewan.
4. Clarke ECG, Isolation & Identification of Drugs, The Pharmaceutical Press, London.
5. Trease, G.E. & Evans, W.C., "Pharmacognosy" Bailleire Tindall East Boarne, U.K.
6. Tyler V.E.: "Pharmacognosy" Lea & Febiger, Philadelphia.
7. Wallis, T.E., "Text book of Pharmacognosy", J&A Churchill Ltd. London.
8. Kokate, C.K.etal Pharmacognosy, Nirali Prakashan, Pune.,
9. Atal C.K. & Kapur BM, "Cultivation & Utilization of Medicinal Plant, RRL, Jammu.
10. Stahl .E, Thin Layer Chromatography, A Laboratory Handbook, Springer Verlog, Berlin.
11. Henry TA. The Plant Alkaloids, Mc Graw Hill, New York.
12. Dixit, V.K.,Vyas S.P.Pharmaceutical Biotechnology, CBS Publication, New Delhi.
13. Street H.E. Tissue Culture & Plant Science, Academic Press, London.
14. Kokate C.K.,Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Publication.

Subject code: 01260704

Subject: Pharmaceutics–IX (Biopharmaceutics and Pharmacokinetics)

THEORY:

1. Absorption of Drug

Physiology of Cell membrane, Mechanisms of drug absorption, Factors affecting drug absorption- i) Physicochemical ii) Physiological iii) Pharmaceutical. Non-oral routes of drug absorption (buccal, sublingual, transdermal, nasal and parenteral).

2. Drug distribution

Introduction, factors affecting drug distribution. Concept of apparent volume of distribution. Protein-drug binding. Significance of drug-protein binding and drug displacement interactions. Kinetics of protein binding.

3. Drug metabolism and elimination

Study of factors affecting metabolism. Pathways of metabolism. Types of drug excretion, renal excretion, concept of clearance, factors affecting renal clearance, Non renal routes of elimination. Extraction ratio and first-pass effect, hepatic clearance, biliary excretion.

4. Dissolution studies

Introduction to Biopharmaceutical classification system, Theories of dissolution, In-vitro studies dissolution testing, and all latest models: Zero order, Matrix, First order, Higuchi. Hixon Crowel model. In-vitro in-vivo correlation.

5. Bioavailability and Bioequivalence

Definition and concept of absolute & relative bioavailability. Purpose of bioavailability testing. Methods of assessing bioavailability. Bioequivalence study and introduction to various study designs. Biowaivers.

Introduction to pharmacokinetics, Introduction to compartmental and physiological models.

6. Compartment models

Assumptions of one and two compartment open model. Assessment of pharmacokinetic parameters after i.v. bolus and oral administration of drug following one and two compartment model.

7. Non-Linear Pharmacokinetics

Reasons for non-linearity (saturation mechanism). Michaelis Menten equation. Definition of V_{max} and K_m . Determination of V_{max} and K_m .

Subject code: 01260709

Subject: Pharmaceutics–IX (Biopharmaceutics and Pharmacokinetics)

PRACTICAL: 3 Hrs /week

1. Improvement of dissolution characteristics of slightly soluble drugs by Solid Dispersion.
2. Improvement of dissolution characteristics of slightly soluble drugs by Solvent deposition.
3. Improvement of dissolution characteristics of slightly soluble drugs by complexation.
4. Improvement of dissolution characteristics of slightly soluble drugs by solvent evaporation.
5. Comparison of dissolution studies of two different conventional marketed products of same drug. - 2 experiments.
6. Influence of polymorphism on solubility.
7. Influence of polymorphism on dissolution.
8. Protein binding studies of a highly protein bound drug.

9. Protein binding studies of a poorly protein bound drug.
10. Permeation study of drug through biological membrane.
11. Calculation of K_a , K_e , $t_{1/2}$, C_{max} , and T_{max} for two sets of data. -2 experiments.
12. Calculation of bioavailability from urinary excretion data for two drugs. -2 experiments.
13. Calculation of AUC and bioequivalence from the given data for two drugs. -2 experiments.

BOOKS RECOMMENDED:

1. J.G. Wagner: Text Book of Biopharmaceutics and Pharmacokinetics.
2. Shargel and Yu: Text Book of Biopharmaceutics and Pharmacokinetics (Prentice Hall).
3. Controlled drug bioavailability published by Wiley interscience.
4. Blanchard and Brodie: Principles and Perspective in drug bioavailability.
5. R.E. Notari: Biopharmaceutics and Pharmacokinetics.
6. Remington's Pharmaceutical Sciences.
7. Rowland and Tozer: Textbook of clinical Pharmacokinetics
8. J. Swarbrick: Current concepts in Pharmaceutical sciences and Biopharmaceutics
9. Javed Ali, Roop K. Khar and Alka Ahuja, TextBook of Biopharmaceutics and Pharmacokinetics, Birla Publication, 2001.
10. H.F. Lodish, and J.E. Rothman: The assembly of cell membranes Sci. Am. 240:48-63, 1979.
11. R.I. Oberle, G.L. Amidon: J. Pharmacok. and Biopharm., 15: 529-544, (1987).
12. A.Rubinstein, V.H.K. Li and J. R. Robinson: In Oral sustained release formulations, Design and Evaluation, NewYork, Pergman, 1988 chap 6
13. .P. Skelly, W.H. Barr: In Robinson, J.R. Lee, V.H.L. (eds) Controlled Drug Delivery, Fundamentals and applications 2nd eds. NewYork Macel Dekker, 1987.

Subject code: 01260705

Subject: Pharmacology-VI

THEORY:

Study of Pharmacology of following classes of drug with respect to classification of recently available drugs, mechanism of action, receptors, adverse effects, Drug interaction, contraindication and therapeutic uses

- **Pharmacology of drug acting on CNS**
 - A. Introduction: cell signaling, neurotransmission, central neurotransmitters
 - B. Alcohol and alcoholism

- C. General anesthetics
- D. Sedatives and hypnotics
- E. Anticonvulsants
- F. Antipsychotics, antidepressants and anxiolytics
- G. CNS stimulants
- H. Opioid Analgesic.
- **Pharmacology of local anesthetics**
- **Pharmacology of drugs acting on Respiratory System**
 - A. Drug therapy of asthma
 - B. Anti tussives, expectorant and mucolytic agent.
- **Pharmacology of drugs acting on GIT**
 - A. Drugs used in ulcers
 - B. Drugs for treatment of diarrhea and constipation.
 - C. Emetic and anti-emetics.
- **Basic concepts of Pharmacotherapy**
 - i. Drug use during infancy and in the elderly (Pediatrics & geriatrics).
 - ii. Drug use during pregnancy
- **Clinical Research:**
 - Clinical Trials: History, Terminologies, Various phases of clinical research, Role of clinical trial in new drug development.

BOOKS RECOMMENDED:

1. Essential of Medical Pharmacology, K.D.Tripathy, JAYPEE.
2. Pharmacology & Parmacotherapeutics, Satoshkar & Bhandarkar, Popular Publication.
3. Pharmacology, Prasun Kumar Das, S.K.Bhattacharya, Elsevier.
4. The Pharmacological Basis of Therapeutics, Goodman & Gilman, Mc Graw Hill.
5. Text book of Pharmacology, S.D. Sethi, BI Churchill Livinstone.
6. Pharmacology, Rang, Dale and Ritter, Churchill Living Stone.
7. Basic & Clinical Pharmacology, B.G.Katzung, Lange.
8. Pharmacology, Mary J, Mycer, Richard A, Lippincott William & Willans

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SEMESTER-VIII

Subject code: 01260801

Subject: Pharmaceutics-X (DFT-II) (NDDS)

THEORY:

1. Fundamental Concepts in Controlled Release

Introduction. Rationale of sustained/controlled drug delivery. Routes of drug delivery. Polymer properties influencing drug permeation. Factors influencing the design and performance of sustained/controlled drug delivery system. Physicochemical properties

of a drug influencing drug product design and performance. Biological factors influencing design and performance of sustained/controlled release system.

2. Oral Controlled Drug Delivery Systems

Introduction, Design and fabrication of novel drug delivery system for oral controlled release- osmotic pressure controlled gastrointestinal delivery systems, hydrodynamic pressure-controlled gastrointestinal delivery systems, membrane permeation-controlled gastrointestinal delivery systems, gel diffusion-controlled gastrointestinal delivery systems, pH-controlled gastrointestinal delivery systems, ion-exchange-controlled gastrointestinal delivery systems.

3. Ocular Controlled Drug Delivery Systems

Eye anatomical and physiological overview. Absorption of drug in eye. Controlled ocular delivery systems: - Ocular drug delivery devices:- Matrix-type drug delivery systems, capsular-type drug delivery systems, implantable drug delivery pumps. Particulate systems for ocular drug delivery, Vesicular system for ocular drug delivery.

4. Parenteral Controlled Drug Delivery Systems

Introduction, Major routes of parenteral administration, Biopharmaceutics of sustained/controlled release parenteral drug products. liposomes, implants, infusion devices, prodrugs. Drug targeting: Active and passive drug targeting, carriers for targeted drug delivery system (Monoclonal antibodies, immunoliposomes, lipoproteins, polymeric micelles and nanoparticles).

5. Transdermal Drug Delivery Systems

Introduction. Fundamentals of skin permeation. Rationale for transdermal drug delivery. Approaches to development of transdermal therapeutic systems: - membrane-moderated systems, adhesive diffusion-controlled systems, matrix dispersion-type systems, microreservoir system.

Subject code: 01260805

Subject: Pharmaceutics-X (DFT-II) (NDDS)

PRACTICAL: 3 Hrs /week

1. To prepare microspheres by desolvation technique and characterize them.
2. To study the effect of temperature on rheological properties of thermosensitive polymers.
3. To study the effect of pH on rheological properties of Carbopol gels.
4. To prepare granules by melt granulation technique and evaluate them.
5. To prepare transdermal film and characterize it.
6. To prepare matrix tablet containing swellable polymer and perform water uptake study.
7. To study the effect of pH on swelling properties of polymer.

BOOKS RECOMMENDED:

1. Robinson and Lee: Controlled drug delivery: Fundamentals and applications, 2nd Edition, Marcel Dekker, Inc., 1987.
2. J.S Warbrick: Novel drug delivery systems, Vol. 14
3. N. K. Jain: Advances in controlled and novel drug delivery system, 1st Edition, CBS Publishers and Distributors, 2001.
4. A. Kydonieus: Treatise on controlled drug delivery, Marcel Dekker, Inc., 1991.
5. L. Krowczynski: Extended release dosage forms, CRC press, Inc., Boca Raton, 1987. J. Swarbrick, and J. C. Boylan: Encyclopedia of pharmaceutical Technology, Vol 1-18, Marcel Dekker, 1988.

Subject code: 01260802**Subject: Pharmaceutical Chemistry-X (Pharmaceutical Analysis-III)****THEORY:**

- Quality Assurance: Philosophy of GLP, ISO-9000, TQM, quality Review and Quality documentation. Regulatory aspects: Legislation & 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 spectra and applications of the following analytical techniques should be thoroughly studied
 - a) Ultraviolet and Visible Spectrophotometry.
 - b) Fluorimetry.
 - c) Infrared spectrophotometry.
 - d) Nuclear magnetic resonance spectroscopy including ¹³C NMR.
 - e) Mass spectroscopy.
- The theoretical aspects, basic instrumentation, elements of interpretation of spectra and applications of the following analytical techniques should be thoroughly studied
 - a) Flame photometry.
 - b) Emission spectroscopy.
 - c) Atomic absorption spectroscopy
 - d) X-Ray
 - e) Radioimmunoassay

Subject Code: 01260806**Subject: Pharmaceutical Chemistry-X (Pharmaceutical Analysis-III)****PRACTICAL: 3 Hrs /week**

Number of experiments based on aforementioned theory.

BOOKS RECOMMENDED:

1. Indian Pharmacopoeia, Ministry of Health, Govt. of India, 1996 edition.
2. Becket A.H. and Stenlake J.B. Practical Pharmaceutical Chemistry Vol.I and II, the Athlon press of the University of London.
3. Chatten L.G. A Text Book of Pharmaceutical Chemistry Vol.I & II, Marcel Dekker, New York.
4. Willard H.H. and Merrit L.Jr. and Dean J.A., Instrumental Methods of Analysis Van Nostrand Renhold, New York.
5. Obonson J.W.R. Undergraduate Instrumental Analysis, Marcel Dekker Inc, New York, 1970.
6. Parikh V.H. Absorption Spectroscopy of Organic Molecules, Addison- Wesley Publishing Co., London 1974.
7. Silverstein R. M. & Webster FX, Spectrometric Identification of Organic Compounds, John Wiley & Sons.
8. Skoog V; Principles of Instrumental Analysis, Holler- Neiman.
9. John & Dyer "Application of Absorption Spectroscopy of Organic compounds.
10. Mohan J., Organic Spectroscopy Principles & Applications, Narosa Publishing House, India.
11. Ewing Galen W. Instrumental methods of Chemical Analysis, Mc Graw-Hil, USA.

Subject code: 01260803

Subject: Pharmacology-VII

THEORY:

Study of Pharmacological action of following classes of drug with respect to classification of recently available drugs, mechanism of action, receptors, adverse effects, Drug interaction, contraindication and therapeutic uses

- **Pharmacology of drug acting on endocrine systems**
 - A. Pitutory hormone and regulation of secretion
 - B. Thyroid hormone, antithyroid agents
 - C. Parathyroid harmone, calcitonin, vitamin D.
 - D. Insulin, oral hypoglycemic agents.
 - E. Adrenocorticoids, anabolic steroids and fertility agents
- **Chemotherapy of microbial infection 24 Hrs**
 - A. Introduction
 - B. Penicillin and cephalosporins
 - C. Macrolides and amino glycosides and polypeptides
 - D. Quinolones and fluoroquinolines
 - E. Chemotherapy of fungal infections

- F. Chemotherapy of viral infections
- G. Chemotherapy of malaria
- H. Chemotherapy of tuberculosis and leprosy
- I. Pharmacology of anthelmintics
- J. Anti-neoplastic agents
- **Drugs acting on Immune system**
 - A. Immunostimulants
 - B. Immunosuppressant
- **Pharmacovigilance (Drug safety):** Introduction, Methods, MedDRA, Causality Assessment, Single detection, CIOMS, Special cases, Thalidomide tragedy

Subject code: 01260807

Subject: Pharmacology-VII

PRACTICAL: 3 Hrs /week

Number of experiments based on aforementioned theory portion.

1. Experiments on isolated preparations:
2. To calculate the PA₂ value of atropine using acetylcholine as an agonist on rat ileum preparation.
3. To calculate the PA₃ value of mepyramine or chlorpheniramine using histamine as agonist on guinea pig ileum.
4. To find out the strength of the given sample on agonist (e.g. Acetylcholine, Histamine, 5-HT, Oxytocin etc.) using a suitable isolated muscle preparation by--Matching Assay- Two Point Assay-Three Point Assay

NOTE: ANY OTHER EXPERIMENTS (S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.

BOOKS RECOMMENDED:

1. Essentials of Medical Pharmacology, K.D.Tripathy, JAYPEE.
2. Pharmacology & Pharmacotherapeutics, Satoshkar & Bhandarkar, Popular Publication.
3. Pharmacology, Prasun Kumar Das, S.K.Bhattacharya, Elsevier.
4. The Pharmacological Basis of Therapeutics, Goodman & Gilman, Mc Graw Hill.
5. Text book of Pharmacology, S.D. Sethi, Elsevier.
6. Pharmacology, Rang, Dale and Ritter, Churchill Living Stone.
7. Basic & Clinical Pharmacology, B.G.Katzung, Lange.
8. Pharmacology, Mary J, Mycer, Richard A, Lippincott William & Willans

Subject code: 01260804

Subject: Pharmaceutics-XI (Pharmaceutical Biotechnology and Molecular Biology)

THEORY:

- **Basic Principles of Molecular Biology and Recombinant DNA Technology**
General structure of cell, recombination in cell. Tools and Techniques of rDNA technology - Enzymes, cloning vectors, gene cloning, gene library, Southern blotting, Western blotting, Colony hybridization, Polymerase chain reaction, Preparation of Recombinant DNA. Pharmaceutical Application of rDNA technology- Production of recombinant proteins, insulin, growth hormones, interferon, monoclonal antibodies.
- **Plant Tissue Culture**
Development of plant tissue cultures, Cellular totipotency, Organ cultures, callus and suspension cultures, Organogenesis, somatic embryo genesis, Protoplast fusion. Germplasm storage including cryopreservation.
- **Animal Tissue Culture**
Animal cell & tissue culture, advantages and disadvantages, laboratory technique, primary culture, cell-lines and cloning. Disaggregation of tissue and primary culture, cultured cells and evolution of cell lines, cloning of cell lines, Large Scale Cell cultures in Biotechnology, Somatic cell fusion. Genetic recombination in animal cells, Mammalian cell cultures.
- **Introduction to fermentation process**
Fermenter- Construction, type and working. Fermentation monitoring. Fermentation medium and its sterilization. Downstream processing – *In situ* recovery of fermentation products. Isolation of fermentation products with special reference to penicillins, streptomycin, tetracyclines and vitamin B12.
- **Immobilization technology**
Need, Principle, Methods- Adsorption, Entrapment, Covalent bonding, Cross-linking. Application of immobilized cell and enzymes.

Subject code: 01260808

PROJECT

Topics from: Pharmaceutics
Pharmaceutical Chemistry
Pharmacology
Pharmacognosy & Phytochemistry
Pharmaceutical Biotechnology

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