

SEMESTER – I

PHAR – 111 M REMEDIAL MATHEMATICS

Unit – I

1. **Algebra:** Equations reducible to quadratics, simultaneous equation (linear & quadratic)
Determinants: Properties of determinants, solution of simultaneous equations by Cramer's rule.
Matrices: Properties of matrices, solution of simultaneous equations by matrices, pharmaceutical applications of determinants and matrices, evaluation of En1, En2 and En3, mensuration of its pharmaceuticals applications. [08]

Unit – II

2. **Measures of Central value:** Objectives and pre-requisites of an ideal measure, mean, mode and median. [05]

Unit – III

3. **Trigonometry:** Measurement of angle, T-ratio, addition, subtraction and transformation formulae, T – ratio of multiple, submultiple, allied and certain angles, application of logarithms in pharmaceutical computations. [08]

Unit – IV

4. **Analytical Plain Geometry:** Certain co-ordinates, distance between two points, area of triangle, locus of a point, straight line, slope and intercept form, double intercept form normal (perpendicular form), slope point and two point form, general equation of first degree. [07]

Unit – V

5. **Calculus:**

- a. **Differential:** Limits and functions, definition of differential coefficient, differentiation of standard functions, including function of a function (chain rule), differential, parametric differentiation, successive differentiation.
- b. **Integral:** Integration as inverse of differentiation, indefinite integrals of standard form, integration by parts. Substitution and partial fractions form, evaluation of definite integral. [12]

BOOKS RECOMMENDED

1. A Textbook of Mathematics for XI-XII Students NCERT Publication, Vol. I-IV.
2. Loney, S.L “Plane Trigonometry” AITBS Publishers.
3. Loney, S.L “The Elements of Coordinate Geometry” AITBS Publishers.
4. Gupta S.P. Statistical Methods, Sultan Chand and Co, New Delhi.
5. Narayan Shanti, Integral Calculus, Sultan Chand & Co.
6. Prasad Gorakh, Text Book on Differential Calculus, Pothishala Pvt. Ltd, Allahabad.
7. Narayan Shanti, Diffrential Calculus, Shyamlal Charitable Trust, New Delhi.
8. Prasad Gorakh, Text Book on Integral Calculus, Pothishala Pvt. Ltd, Allahabad.

PHAR – 111 B REMEDIAL BIOLOGY

THEORY

Unit – I

General survey of Animals Kingdom, structure and life history of parasites as illustrated by amoeba, entamoeba, trypanosoma, plasmodium, taenia, ascaris, schistosoma, oxyuris and ancylostoma. [08]

Unit – II

General structure and life history of insects like mosquito, house fly, mites and silk worm. [08]

Unit – III

Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed, modification of stems and roots. [12]

Unit – IV

Plant cell: Its structure and non- living inclusion, mitosis and meiosis, different types of plant tissues and their functions. Basic concept of molecular biology (DNA, RNA). [08]

Unit – V

Methods of classification of plants. [04]

PHAR – 111 B REMEDIAL BIOLOGY

PRACTICAL

1. Morphology of plant parts indicated in theory.
2. Care, use and type of microscopes.
3. Gross identification of slides of structures and life cycle of lower plants/animals mentioned in theory.
4. Morphology of plant parts indicated in theory.
 - a. Preparation, microscopic examination of stem, root and leaf of monocot and dicot plants.
5. Structure of human parasites and insects mentioned in theory with the help of specimens.

Note: There shall be no University Examination for Remedial Biology Practical.

BOOKS RECOMMENDED

1. Dutta A C “Botany for Degree Students” Oxford.
2. Marshall & Williams, “Text Book of Zoology”, CBS Publishers & Distributors, Delhi.
3. Fahn, “Plant Anatomy”, Aditya Books Private Limited, New Delhi.
4. Weiz, Paul B, “Laboratory Manual in Science of Biology”, McGraw Hill Book Company.

PHAR – 112 PHARMACEUTICAL ANALYSIS

THEORY

Unit – I

Significance of quantitative analysis in quality control. Different techniques of analysis. Preliminaries, definitions, precision and accuracy. Fundamentals of volumetric analysis, method of expressing concentration, primary and secondary standards. [06]

Unit – II

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 solution, neutralization curves, acid base indicators, theory of indicators, choice indicators, mixed indicators, polyprotic system, polyamine and amino acid system, amino acid titration, application in assay of H_3PO_4 , NaOH, Na_2CO_3 . [10]

Unit – III

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 representation, measurement of electrode potential, oxidation reduction curves, iodimetry and iodometry, titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate, titanous chloride and sodium-2,6-dichlorophenol indophenol. [10]

Unit – IV

Precipitation Titrations:

Precipitation reaction, solubility products, effect of acids, temperature and solvent upon the solubility of precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate indicators, Gaylussac method, Mohr's method, Volhard's method and Fajan's method. [06]

Unit – V

Gravimetric Analysis:

Precipitation techniques, solubility products, the colloidal state, supersaturation, co-precipitation, post-precipitation, digestion, washing of the precipitate, filtration, filter papers and crucibles. Ignition, thermogravimetric curves, specific examples like barium as barium sulphate, aluminum as aluminum oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants. [08]

PHAR – 112 P

PHARMACEUTICAL ANALYSIS – I

PRACTICAL

The students should be introduced to the main analytical tools through demonstration. They should have a clear understanding of a typical analytical balance, the requirements of a good balance, weights, care & use of balance, methods of weighing and errors in weighing. The students should be acquainted with the general apparatus requiring various analytical procedures. Students should be acquainted with the general apparatus requiring various analytical procedures.

1. Standardization of analytical weights and calibration of volumetric apparatus.
2. **Acid Base Titrations:** Preparation and Standardization of acids and bases, some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures, e.g. boric acid, should be covered.
3. **Oxidation Reduction Titrations:** Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc. Some exercises related to determinations of oxidizing & reducing agents. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2,6 dichlorophenolindophenol and ceric ammonium sulphate.
4. **Precipitation Titrations:** Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, titrations according to Mohr's, Volhard's and Fajan's methods.
5. **Gravimetric Analysis:** Preparation of Gooch crucible for filtration and use of sintered glass crucible. Determination of water of hydration, some exercise related to gravimetric analysis should be covered.

BOOKS RECOMMENDED

1. Mendham J, Denny R.C. Barnes J.D Thomas M, Jeffery G.H., "Vogel's Textbook of Quantitative Chemical Analysis", Pearson Education Asia.
2. Connors K.A. "A Text book of Pharmaceutical Analysis", Wiley Inter Science.
3. Beckett. A.H and Stenlake, J.B. Practical Pharmaceutical Chemistry Vol. I &II. The Atherden Press of the University of London.
4. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.
5. Alexeyev, V. 'Quantitative Analysis'. CBS Publishers & Distributors.
6. The Pharmacopoeia of India.

PHAR – 113
PHARMACEUTICAL CHEMISTRY-I
(INORGANIC PHARMACEUTICAL CHEMISTRY)

THEORY

Unit – I:

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

Gases and Vapours: Oxygen, Anesthetics.

Dental Products: Denitrifies, anti caries agents. [08]

Unit – II:

Gastrointestinal Agents: Acidifying agents, antacids, protectives and adsorbents, cathartics.

Pharmaceutical Acid & Necessities: Acids and bases, buffers, anti-oxidants, water and pharmaceutically acceptable glass. [08]

Unit – III:

Major Intra & Extra – Cellular Electrolytes: Physiological ions, Electrolytes used for replacement therapy, acid – base balance & combination therapy.

Cationic & anionic components of inorganic drugs useful for systemic effects. [08]

Unit – IV:

Essential and Trace Elements: Transition elements and their compounds of pharmaceutical importance, Iron and hematinics, mineral supplements (Cu, Zn, Cr, Mn, Sb, S, I)

Co-ordination compounds and complexation, study of such compounds used in therapy.

Inorganic Radio-Pharmaceuticals: Nuclear radio pharmaceuticals, nomenclature, methods of obtaining their standards and units of activity, measurement of activity, clinical application and dosage hazards and precautions. [08]

Unit – V:

Topical Agents: Protectives, astringents and anti infectives.

Miscellaneous Agents: Inhalants, respiratory stimulants, sclerosing agents, expectorants, emetics, poison antidotes, sedatives. [08]

PHAR – 113 P
PHARMACEUTICAL CHEMISTRY-I
(INORGANIC PHARMACEUTICAL CHEMISTRY LAB)

List of Experiments

No. of Labs.

- | | |
|---|-----|
| 1. To Perform limit of chloride sulphate, iron, heavy metal and arsenic in the given sample | [5] |
| 2. Salt analysis | [7] |
| 3. Preparation of following compounds: | [6] |
| a) Boric acid | |
| b) Magnesium sulphate | |
| c) Heavy magnesium carbonate | |
| d) Calcium carbonate | |
| e) Alum | |
| f) Zinc sulphate | |

BOOKS RECOMMENDED

1. Block, JH, Roche, E, Soine, T, Wilson, C. 'Inorganic Medicinal & Pharmaceutical Chemistry' Lea & Febiger.
2. Discher, LA. 'Modern Inorganic Pharmaceutical Chemistry'.
3. Pharmacopoeia of India. 1996 Edition
4. Atherden LM. Bentley and Drivers, "Text Book of Pharmaceutical Chemistry" Oxford University Press, London.

PHAR – 114 PHARMACEUTICS – I (GENERAL PHARMACY)

THEORY

Unit – I

History of Pharmacy: Origin & development of pharmacy, scope of pharmacy, introduction to pharmacopoeias with special reference of IP, BP, USP & International Pharmacopoeia. [04]

Pharmaceutical Additives: Colouring, flavouring & sweetening agents, co-solvents, preservatives, surfactants, antioxidants & their applications. [03]

Unit – II

Size Reduction: Definition, factors affecting size reduction, principles, laws & factors affecting energy requirements, different methods of size reduction, study of hammer mill, ball mill, fluid energy mill & disintegrator. Various methods & equipments employed for size separation e.g. sieving, sedimentation, cyclone separator, elutriation methods. [06]

Unit – III

Pharmaceutical Calculations: Posology, calculation of doses for infants, adults and elderly patients. Enlarging and reducing recipes, percentage solutions, alligation, alcohol dilution, proof spirit, isotonic solutions, displacement value etc. [10]

Unit – IV

Extraction & Galenicals: Extraction processes, study of infusion, decoction, digestion, percolation, maceration & their modification, application in the preparation of tinctures & extracts. Factors affecting selection of extraction processes. [07]

Unit – V

Mixing: Theory of mixing solid – solid, solid – liquid & liquid mixing equipments. [03]

Introduction to Pharmaceutical Dosage Forms: A brief theory of solutions, mixtures, spirits, aromatic waters, glycerins, paints, syrups, elixirs, mouth washes, mucilages, lotions, liniments, pastes, inhalations and powders. [07]

PHAR – 114 P
PHARMACEUTICS – I
(GENERAL PHARMACY)

PRACTICAL

1. Preparation of following classes of Pharmaceutical dosage forms (involving the use of calculations in metrology) as officials in IP, BP, USP/NF
 - a. Aromatic Waters
 - i. Chloroform water BP
 - ii. Camphor Water BP
 - iii. Rose water NF
 - b. Solutions
 - i. Lysol solution IP
 - ii. Strong Ammonium Acetate solution BP
 - c. Syrups
 - i. Simple Syrup BP
 - ii. Simple syrup USP/NF
 - d. Elixirs
 - i. Aromatic Elixirs USP/NF
 - e. Spirits
 - i. Aromatic Ammonia spirit BP
 - f. Powders
 - i. ORS Powder IP
 - ii. Absorbable dusting powder USP/NF
 - g. Lotions
 - i. Calamine lotion IP
 - ii. Amino benzoic acid lotion BP
 - h. Liniments
 - i. Methyl Salicylate liniment BP
 - ii. Turpentine liniment BP
 - i. Mucilage
 - i. Starch Mucilage IP
 - j. Glycerin
 - i. Kaolin Poultice BP
 - k. Inhalation
 - i. Benzoin Inhalation BP
 - l. Tinctures & Extracts
 - i. Infusion of tea
 - ii. Decoction of Ispaghula
 - iii. Compound benzoin tincture BP
 - iv. Strong Ginger Tincture BP
 - v. Liquorice Liquid extract BP
2. Experiments to illustrate principles of size reduction using Ball Mill.
 - a. Effect of Size of balls, number of balls and time on the efficiency of Ball Mill.
3. Experiments to illustrate mixing efficiency:
 - a. Solid – Solid Mixing.

BOOKS RECOMMENDED

1. Pharmacopoeia of India, The Controller of Publications, Delhi.
2. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.
3. Carter SJ. "Cooper and Gunn's Tutorial Pharmacy" CBS Publishers, Delhi.
4. Rawlins, EA. Bentley's Text Book of Pharmaceutics, ELBS/Bailliere Tyndall.
5. Lachman, L, Liberman, HA, Kanig, JL. "Theory and Practice of Industrial Pharmacy", Lea and Febiger.
6. Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.
7. Aulton, ME, Text Book of Pharmaceutics, Vol. I & II, Churchill Livingstone.
8. United States Pharmacopoeia (National Formulary)
9. Remington: "The Science and Practice of Pharmacy", Vol. I & II. Mack Publishing Co. Pennsylvania.

PHAR – 115 ANATOMY & PHYSIOLOGY – I

THEORY

Unit – I

- a) Introduction & organization of human body.
- b) Structure of cell, functions of its components. Structure of cell membrane & physiology of transport process.
- c) Tissue – structure. & functions of different types of tissues. [10]

Unit – II

- d) Haemopoietic system – Composition & functions of blood & its elements. Erythropoiesis, blood coagulation & blood group.
- e) Lymphatic system – Composition, formation & functions of lymph. Lymph node & spleen..... [08]

Unit – III

- f) Cardiac system- Functional anatomy of heart. Conducting system of heart. Cardiac cycles and ECG. [08]

Unit – IV

- g) Respiratory system- Anatomy & functions of respiratory system. Mechanism & regulation of respiration. [08]

Unit –V

- h) Urinary system- Anatomy & physiology of urinary system. Physiology of urine formation. Acid base balance. [08]

PHAR – 115 P ANATOMY & PHYSIOLOGY – I

PRACTICAL

1. Microscopic study of different tissues.
2. Estimation of haemoglobin in blood. Determination of bleeding time, clotting time, R.B.C. Count, Total leukocyte count, DLC, ESR.
3. Recording of body temperature, pulse rate and blood pressure, basic understanding of electrocardiogram – PQRST waves and their significance.

BOOKS RECOMMENDED

1. Ranade VG, "Text Book of Practical Physiology" Pune, Vidyarthi Griha Prakashan, Pune.
2. Difore SH, "Atlas of Normal Histology", Lea & Febiger Philadelphia.
3. Chaurasia BD, "Human Anatomy, Regional & Applied" Part – I, II & III, CBS Publishers & Distributors, New Delhi.
4. Guyton AC, Hall JE, "Text Book of Medical Physiology", WB Saunders Company.
5. Chattarjee CC, "Human Physiology", Medical Allied Agency, Calcutta.
6. Ross & Wilson "Anatomy & Physiology in Health & Illness", Churchill Livingstone.
7. Tortora GJ, & Anagnodokos NP, "Principles of Anatomy & Physiology", Harper & Row Publishers, New Delhi.
8. Parmar NS, "Health Education & Community Pharmacy", CBS Publishers, New Delhi.
9. Shalya Subhash, "Human Physiology", CBS Publisher & Distributors.
10. Keele CA, Niel E, Joels N, "Samson Wright's Applied Physiology", Oxford University Press.

PHAR – 116

PROFESSIONAL COMMUNICATION – I

Unit – I

English Grammar:

Parts of speech, Articles, Preposition, Tenses, Active – Passive voice, Direct – Indirect, Speech. [12]

Unit – II

Letter writing, Precis and Essay writing.

Comprehension:

Speed reading, scanning & swimming. [08]

Unit – III

Working on accent neutralization, pauses stresses, non words, voice modulation, eye contact for small & large groups. [08]

Unit – IV

Presentation techniques: Tips.

Importance of non – verbal communication, debates, Role plays. [06]

Unit – V

Personality types:

Decision making, Motivation, Attitude, Thinking. [06]

BOOKS RECOMMENDED

1. Wren PC and Martin H, "High School Grammar and Composition" S. Chand & Co.
2. Robbins S, Organizational Behaviour.

SEMESTER – II

PHAR – 121 PHYSICAL CHEMISTRY

THEORY

Unit – I

1. **Behaviour of Gases:** Kinetic theory of gases, deviation from ideal behaviour and explanation.
2. **The Liquid State:** Physical properties (surface tension, parachor, viscosity, rheochor, refractive index, optical rotation, dipole moment and chemical constituents).
3. **Solution:** Ideal and real solutions, solutions of gases in liquids, colligative properties. [08]

Unit – II

4. **Thermodynamics:** Fundamentals, first, second and zeroth law, Joule-Thompson's effect, absolute temperature scale.
5. **Adsorptions:** Freundlich and Gibbs absorption Isotherms, Langmuir theory of adsorption. [08]

Unit – III

6. pH, its determination, buffer, theory of buffers, partition theory.
7. **Chemical Kinetics:** Zero, first and second order reaction, complex reactions, elementary idea of reaction kinetics, characteristics of homogenous and heterogeneous catalysis, acid base and enzyme catalysis.
8. **Electro Chemistry:** Faraday's Laws of Electrolysis, electrolytic conductance & its measurement, molar & equivalent conductivity, its variation with dilution. Kohlrausch law, Arrhenius theory, degree of ionization & Ostwald dilution law. Transport number & migration of ion, Hittorfs theoretical device, theory of strong electrolytes (Debye Huckle theory). [08]

Unit – IV

9. **Thermo Chemistry:** Definition & conventions, heat of reaction, heat of formation, heat of solution, heat of neutralization, heat of combustion. Hess law of constant summation, Bomb calorimeter, bond energies, Kirchoffs equation. [08]

Unit – V

10. **Phase Equilibria:** Phase, component, degree of freedom, phase rule (excluding derivation). Cooling curves & Phase diagrams for one & two component system involving eutectics, congruent & incongruent melting point (examples – water, sulphur, KI – H₂O, NaCl – H₂O system). Distribution Law & application to solvent extraction.
11. Amorphous and crystalline solids, geometry & symmetry of crystals, Millers indices, types of crystals, physical properties of crystals, crystal diffraction. [08]

PHAR – 121 P PHYSICAL CHEMISTRY

PRACTICAL

1. Determination refractive index of given liquids.
2. Determination of specific rotation of sucrose at various concentrations and determine the intrinsic rotation.
3. Determination of rate constant of simple reaction.
4. Determination of cell constant, verify Ostwald dilution law and perform conductometric titrations.
5. Determination of surface tension.
6. Determination of partition co – efficient.

7. Determination of viscosity.
8. pH Determination by different methods.
9. Determination of solubility.

BOOKS RECOMMENDED

1. Pali SR and Prabartak SKDE, Practical Physical Chemistry, Haltone Ltd., Calcutta.
2. Shoemaker DP, Garland CW, Experiments of Physical Chemistry, McGraw Hill Book Co.
3. Bahl BS, Tuli GD, Bahl A, Essentials of Physical Chemistry, S. Chand & Co.
4. Negi AS, Anand SC, "Textbook of Physical Chemistry", Wiley Eastern Ltd.
5. Glasstone S, Lewis D, Elements of Physical Chemistry, Macmillan Education.

PHAR – 122 PHARMACEUTICAL CHEMISTRY – II (ORGANIC CHEMISTRY – I)

THEORY

Unit – I

Structure and Properties: Atomic Structure, atomic orbital, molecular orbital, hybridization, sigma & pi bonds, covalent, electrovalent & coordinate bond, inductive effect, resonance. Classification & nomenclature of organic compounds. [08]

Unit – II

Isomerism, geometrical isomerism, stereochemistry including optical activity, stereoisomerism, specification of configuration and conformational analysis. [08]

Unit – III

Important methods of preparation, reactions with special reference to mechanism of the following classes of compounds: Alkanes, Alkenes, alkynes, & dienes, free radical substitution reaction, alkyl halides. [08]

Unit – IV

Aromatic Compounds, aromatic character, structure of benzene, resonance, orientation of aromatic substitution, arenas, amines (aliphatic & aromatic), phenols, aryl halides. [08]

Unit – V

Aldehydes and ketones (aliphatic & aromatic), carboxylic acids & their derivatives, di & tricarboxylic acids, hydroxy acids.

Organometallic Compounds: Grignard reagent, organolithium compounds, their preparation & synthetic application. [08]

PHAR – 122 P PHARMACEUTICAL CHEMISTRY – II (ORGANIC CHEMISTRY – II)

PRACTICAL

1. Identification of elements and functional groups in given sample. [6]
2. Purification of solvents like Benzene, chloroform, acetone, preparation of absolute alcohol. [4]
3. Synthesis of compounds involving benzylation, acetylation, bromination, reduction & oxidation. [5]
4. Synthesis of following compounds:
 - a. Picric Acid
 - b. Aniline
 - c. Acetanilide
 - d. Aspirin
 - e. Hippuric Acid

- f. P – Bromo acetanilide
- g. Iodoform

BOOKS RECOMMENDED

1. Mann FG, Saunders BC, "Practical Organic Chemistry", ELBS/Longman.
2. Vogel AI, "Textbook of Practical Organic Chemistry", ELBS/Longman.
3. Morrison RT, Boyd RN, "Organic Chemistry", Prentice Hall of India Pvt. Ltd., New Delhi.
4. Finar IL, "Organic Chemistry", Vol. I & II, ELBS/Longman.
5. Jain MK, "Organic Chemistry", Sohanlal Nigam Chand & Co., 60 B, Bunglow Road, Delhi.
6. Hendrikson, "Organic Chemistry".

PHAR – 123

ANATOMY & PHYSIOLOGY – II

THEORY

Unit – I

- a) **Central Nervous System:** Anatomy & functions of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, cranial nerves & their functions.
- b) **Automatic Nervous System:** Anatomy & Physiology of the automatic nervous system.
- c) **Sense Organs:** Eye, ear, taste buds, nose and skin. [14]

Unit – II

- d) **Endocrine system:** Anatomy & physiology of pituitary, Thyroid, Adrenal & Pancreas. Control of hormone secretion. [06]

Unit – III

- e) **Digestive system:** Parts of digestive system, their structure and functions. Various G.I.T. secretions and their role. Physiology of digestion. [07]

Unit – IV

- f) **Reproductive system:** Male & female reproductive system. Spermatogenesis, menstruation cycle and oogenesis. [08]

Unit – V

- g) Structure and function of skeleton. Classification of joints.
- h) Anatomy of skeletal & smooth muscle. Neuromuscular Junction (NMJ), Physiology of muscle Contraction. [08]

PHAR – 123 P

ANATOMY & PHYSIOLOGY – II

PRACTICAL

1. Study of different systems with the help of charts and models.

BOOKS RECOMMENDED

1. Ranade VG, "Text Book of Practical Physiology", Pune Vidyarthi Griha Prakashan, Pune.
2. Difore SH, "Atlas of Normal Histology", Lea & Febiger, Philadelphia.
3. Chaurasia BD, "Human Anatomy, Regional & Applied", Part I, II & III, CBS Publishers & Distributors, New Delhi.
4. Guyton AC, Hall JE, "Textbook of Medical Physiology", WB Saunders Company.
5. Chatterjee CC, "Human Physiology", Medical Allied Agency, Calcutta.
6. Ross & Wilson, "Anatomy & Physiology in Health & Illness", Churchill Livingstone.
7. Tortora GJ, Anagnostikos NP, "Principles of Anatomy & Physiology", Harper & Rave Publishers, New Delhi.
8. Parmar NS, "Health Education & Community Pharmacy", CBS Publishers, New Delhi.
9. Shalya Subhash, "Human Physiology" CBS Publishers & Distributors.

PHAR-124

Computer Fundamentals & Programming

THEORY

Unit - I

Computer Fundamentals: Definition, characteristics, history, computer terminology, computer organization, input & output devices, storage devices, classifications of computers, binary conversions and ASCII code, types of languages, application of computers in pharmacy. [06]

Unit - II

Operating Systems: Definition, functions of an operating system, types of operating systems and their characteristics.

DOS: Introduction, basic DOS commands such as creating directory, copying creating files, backup, restore, autoexec.bat file, config.sys file, etc. internal and external commands for file and directory management.

Windows: Introduction to M.S.-WINDOWS. What is GUI and WINDOWS? Desktop, start-menu, control panel, accessories, my computer, my documents, recycle bin, maximizing, minimizing, restoring and closing of windows, windows explorer, concepts of toolbars, menus, title bars, controls, dialogue box, status bar. [07]

Unit - III

MS Word: Word Essentials, the word workplace, Parts of MS Word screen, Typing and Editing, Finding and Replacing, Autocorrect and Auto text, Reusing Text and Graphics, use of spell-check & grammar, thesaurus and scientific symbols, viewing of document by various ways, Editing Tools, Formatting Text, Formatting Text Character, Formatting Paragraphs, Formatting and Sorting Lists, Page Design and Layout, Page Setup : Margins, Page Numbers, and Other Items, Newspaper -style Columns, Working with Tables, Creating and formatting of tables and sorting, merging etc. of data in tables, Inserting, deleting and sizing of rows and columns in tables, Opening, Saving and Protecting Documents, Printing, Assembling Documents with Mail Merge.

MS Excel: Introduction to EXCEL worksheet, Open/create spreadsheet, Save/exit spreadsheet, Edit spreadsheet using formula and functions, Format spreadsheet, print spreadsheet, calculations in EXCEL, important functions such as logarithm, square root, standard deviation, sum, average etc. Drawing graphs in EXCEL line graph, histogram, pie-chart, Editing chart features such as labeling of axis, changing legends etc.

MS PowerPoint: Creating and viewing a presentation, adding animations and managing slide shows etc. [12]

Unit - IV

Networking & Internet: Computer networks, networking technology, components of network. Internet – Basic terms, software and hardware requirement for internet, internet tools, Email-components and working, study of pharmaceutical web sites and search engines.

Programming: Planning the computer program, algorithm, flowchart, decision table. [05]

Unit - V

'C' Language: Introduction to 'C' Language, Writing simple programs in 'C', Numeric constants and variables, Arithmetic Expression, Input & Output in 'C' programs, conditional statements, logical expressions and control statements such as switch, break and continue functions, implementing loops in programs. [10]

PHAR-124 P
Computer Fundamentals & Programming

Exercises based on the following are to be dealt:

1. Computer operating system like DOS and Windows.
2. Simple Program in 'C' Language.
3. Introduction to MS – Office (MS – Word, MS – Excel, Power Point).
4. Internet Features.

BOOKS RECOMMENDED

1. Sinha RK, "Computer Fundamentals" BPB Publications.
2. Raja Raman V, "Computer Programming in 'C' " PHI Publication.
3. Hunt N, Shelly J, "Computers and Common Senses" Prentice Hall of India.

PHAR-125
ADVANCED MATHEMATICS

Unit - I

Differential Equations:

Definition of differential equations, equations of first order and first degree. Variable, Separable, homogeneous and linear differential equation, equation reducible in such types. [08]

Unit – II

Linear differential equation of order greater than one with constant coefficients, complimentary function and particular integral, pharmaceutical applications. [08]

Unit - III

Biometrics: Data Collection, data organizations and diagrammatic representation of data. 1D & 2D diagrams: bar diagrams and pie diagram. Measures of central tendency, mean mode. Measures of dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation. [08]

Unit – IV

Correlation Analysis: Positive & negative correlation, Karl Pearson's coefficient of correlation, spearman's rank correlation. Regression Analysis: regression lines Y and X on Y. [08]

Unit – V

Sampling Distribution: Student's t test, χ^2 test, F test, elements of Anova-one way classification. Application of statistical concepts in pharmaceutical sciences. [08]

BOOKS RECOMMENDED

1. Vasishtha & Agarwal, "Advanced Mathematics for Pharmacists" Krishna Prakashan.
2. Dhall, Chhibber, Trivedi and Chandra "Frank Mathematics for B. Pharm", Frank Publication.
3. Gupta & Kapoor, "Remedial Mathematics" Pragati Prakashan.
4. Singhal Naveen & Singhal Shailey, "Fundamental of Pharmaceutical Statistical Techniques".

SEMESTER – III

PHAR – 231 PHARMACEUTICS – II (UNIT OPERATIONS – I)

THEORY

Unit – I:

1. **Unit Operations:** Introduction basic laws.
2. **Fluid Flow:** Types of flow, Reynold's number, Viscosity, Concept of Boundary layer, basic situation of fluid flow, valves, flow manometers and measurement of flow and pressure. [08]

Unit – II:

3. **Water System:** Raw water, soft water, purified water, water for injection, quality requirement and treatment of water, washing, cleaning and standardization of cleaning.
4. **Filtration and Centrifugation:** Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter. Factors affecting filtration, principles of centrifugation, industrial centrifugal filters & centrifugal sedimenters. [10]

Unit – III

5. **Crystallization:** Characteristics of crystals like purity, size, shape, geometry, habit, forms size and factors affecting them, solubility curves and calculation of yields. Material and heat balances around Swenson Walker Crystallizer. Supersaturation theory and its limitations. Nucleation mechanisms, crystal growth, study of various types of crystallizers, tanks agitated batch, Swenson Walker, single vacuum, circulating magma and Krystal crystallizer, caking of crystals and its prevention. [08]

Unit – IV

6. **Heating, Ventilation & AC System:** Basic concepts and definition, wet bulb and adiabatic saturation temperatures. Psychometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipment for dehumidification operations. Principles and applications of refrigeration and air conditioning. [08]

Unit – V

7. **Material of Construction:** General study of composition, corrosion, resistance, properties and applications of the materials of construction with special reference to stainless steel and glass.
8. **Industrial Hazards and Safety Precautions:** Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, t-record. [06]

PHAR – 231 P PHARMECEUTICS – II (UNIT OPERATIONS – I)

PRACTICAL

1. Measurement of rate of flow of fluids and pressure by:
 - a. Simple and differential manometers
 - b. Venturimeter
 - c. Orificemeter
2. Determination of Reynold's Number
3. Study of factors affecting rate of filtration.
 - a. Effect of different filter media
 - b. Effect of viscosity of filtrate
 - c. Effect of pressure

- d. Effect of thickness of cake
- e. Effect of filter aids
4. Study principle of Centrifugation for
 - a. Liquid – Liquid separation and stability of emulsions.
 - b. Solid – Liquid separation and stability of suspensions.
5. Determination of dry bulb and wet bulb temperatures and use of Psychometric charts.
6. Study of Characteristics of crystals.
7. Study of solubility curve of crystals.

BOOKS RECOMMENDED

1. Badger WL, Banchero JT, “Introduction to Chemical Engineering”, McGraw Hill International Book Co., London.
2. Perry RH, Chilton CH, “Chemical Engineers Handbook”, McGraw Kogakusha Ltd.
3. McCabe WL, Smith JC, “Unit Operation of Chemical Engineering”, McGraw Hill International Book Co., London.
4. Sambhamurthy, “Pharmaceutical Engineering”, New Age Publishers.
5. Gavhane KA, “Unit Operation – I”, Nirali Prakashan.

PHAR – 232

PHARMACEUTICS JURISPRUDENCE & ETHICS

Unit – I

Introduction

1. **Pharmaceutical Legislations** – A brief review
2. **Drugs & Pharmaceutical Industry** – A brief review
3. **Pharmaceutical Education** – A brief review
4. **Pharmaceutical Ethics** [06]

Unit – II

5. **An Elaborate study of the following:**
 - a. Pharmacy Act 1948
 - b. Drugs and Cosmetics Act 1940 and Rules 1945 [14]

Unit – III

- c. Medicinal & Toilet preparations (Excise duties Act 1955)
- d. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
- e. Drugs Price Control Order 1995 [08]

Unit – IV

6. A brief study of the following with special reference to the main provisions.
 - a. Poisons Act 1999
 - b. Drugs and magic remedies (Objectionable Advertisements) Act 1954.
 - c. Medical termination of Pregnancy Act 1970 & Rules 1975.
 - d. Prevention of cruelty to animals Act 1961.
 - e. States Shops & Establishments Act & Rules. [05]

Unit – V

- f. A.I.C.T.E. Act 1987
- g. Patents Act 1970
- h. Weight and Measures Act
- i. Package and Commodity Act.

j. U. S. Food & federal D & C Act.

[07]

Note: The teaching of all the above Acts should cover the latest amendments.

BOOKS RECOMMENDED:

1. Mittal BM, "Textbook of Forensic Pharmacy", National Book Centre, Dr. Sundari Mohan Avenue, Calcutta.
2. Relevant Acts & Rules, Published by the Govt. of India.
3. Jain NK, "A Textbook of Forensic Pharmacy", Vallabh Prakashan, New Delhi.
4. Singh, Harikishan "History of Pharmacy in India", Vol – I, II, III, Vallabh Prakashan.

PHAR – 233

PHARMACOGNOSY – I

THEORY

Unit – I

Definition, history, scope and development of pharmacognosy. [02]

1. Source of Drug:

- a. Biological (plant & animal origin), mineral & plant tissue cultures as source of drugs.
- b. Marine Pharmacognosy: novel medicinal agents from marine source. [04]

2. Classification of Drugs: Alphabetical, Morphological, taxonomical, chemical & pharmacological. [02]

Unit – II

3. Plant Taxonomy: Definition, taxonomy of plant kingdom followed by study of families with special reference to medicinally important plants of Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Labiatae, Acanthaceae, Compositae, Papavarecae. [04]

Unit – III

4. Systematic Pharmacognostic Study of following:

- a. Carbohydrates & derived products: Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia & Tragacanth. [07]
- b. Lipids: Beeswax, Castor oil, Cocobutter, kokum butter, Hydnocarpus oil, Cod liver oil, Shark liver oil, Linseed oil, Wool fat, rice – bran oil, Lard & Suet. [08]

Unit – IV

5. Fibres: Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass wool, polyester & asbestos. [03]

6. Pharmaceutical aids: Study of pharmaceutical aids like Talc, Diatomite, Kaolin, Bentonite, Fullers earth, Gelatine and Natural Colours. [02]

Unit – V

7. Cultivation, Collection, Processing & Storage of Crude Drugs:

- A. Factors influencing cultivation of medicinal plant, type of soils & fertilizers of common use. [02]
- B. Pest management & natural pest control agents. [02]
- C. Poly Houses / Green Houses for cultivation. [02]

8. Herbal formulations & cosmetics [01]

PHAR – 233 P
PHARMACOGNOSY – I

PRACTICAL

1. Morphological characteristics of plant families mentioned in theory.
2. Microscopical identification of cells & cell contents: starch grains, Calcium oxalate Crystals & Phloem Fibres.
3. Identification of crude drugs belonging to carbohydrates & lipids.
4. Study of fibres and pharmaceutical aids.
5. Preparation of herbarium sheets.

SUGGESTED PRACTICAL

1. Study of Plants belonging to family Solanaceae
2. Study of Plants belonging to family Rutaceae.
3. Study of Plants belonging to family Liliaceae.
4. Study of Plants belonging to family Umbelliferae.
5. Microscopical identification of starch grains (Wheat, Maize, Rice, Potato).
6. Microscopical identification of calcium oxalate crystals (Rhubarb, Senna, Liquorice etc).
7. Study of various types of phloem fibres.
8. Chemical Tests of Agar, Acacia, Sterculia and Tragacanth.
9. Chemical tests of Pectin, starch and Honey.
10. Swelling factor & average weight of Isapaghula husk.
11. Study of Cotton, Silk and Wool with their Chemical Tests.
12. To study the morphology and chemical tests Talc, Diatomite, and Kaolin.
13. Morphology and microscopy of Bentonite, Gelatine and natural colours (Saffron).
14. Physical characteristics of Caster oil, Cod liver oil, Shark liver oil and Linseed oil.

PROJECT WORK:

Preparation of herbarium sheets (with reference to medicinally important plants, two from each family in Unit II).

BOOKS RECOMMENDED

1. Kokate CK, "Practical Pharmacognosy" Vallabh Prakashan, Delhi.
2. Wallis TE, "Analytical Microscopy", J & A Churchill Limited, London.
3. Brain KR, Turner TD, "The Practical Evaluation of Phyto Pharmaceutical", Wright, Scientiechnica, Bristol.
4. Kokate CK, "Pharmacognosy", Nirali Prakashan, Pune.
5. Trease GE, Evans WC, "Pharmacognosy", Bailleire Tindall, East Bourne, U.K.
6. Wallis TE, Text book of Pharmacognosy, J.A. Churchill Ltd
7. Schewer PJ, "Marine Natural Products", Academic Press, London.

PHAR – 234
PHARMACEUTICAL ANALYSIS – II

THEORY

Unit – I

Theoretical considerations and application in drug analysis and quality control by the following analytical techniques:

- A) Non – aqueous Titration
- B) Complexometric Titration

[08]

Unit – II

- C) Miscellaneous Methods of Analysis:

Diazotization titrations, Kjeldalh method of Nitrogen estimation, Karl – Fischer titration, Radioassays, alcohol estimation in galenicals.

[08]

Unit – III

Electro Chemistry: Introduction, Dielectric cell, electrode potential, Nernst equation, salt bridge, standard potential, reference and indicator electrodes, measuring the relative voltage of cell.

- A. Potentiometry: General principles, instrumentation and applications.
- B. Conductometry: General Principles, instrumentation and applications. [08]

Unit – IV

Principle, Instrumentation and Pharmaceutical applications of Paper Chromatography, Column Chromatography and TLC. [08]

Unit – V

Principle, Instrumentation and Pharmaceutical applications of Ion Exchange Chromatography and Size Exclusion Chromatography. [08]

PHAR – 234 P

PHARMACEUTICAL ANALYSIS - II

PRACTICAL

1. **Non – aqueous Titrations:** Preparation and standardization of perchloric acid and sodium / potassium methoxide solutions, estimation of some pharmacopoeial products.
2. **Complexometric Titrations:** Preparation and standardization of EDTA solution, some exercise related to pharmacopoeial assays by complexometric titrations.
3. **Miscellaneous Determinations:** Exercise involving Diazotization, Kjeldahl's, Karl Fisher.
4. Exercise based on acid base titrations in aqueous and non aqueous media. Oxidation reduction titrations using potentiometric technique, determination of acid base dissociation constants and plotting of titration curves using pH meter.
5. Exercise involving conductometric titrations.
6. Exercises based on paper, column and thin layer chromatography.

BOOKS RECOMMENDED

1. Beckett AH, Stenlake JB, "Practical Pharmaceutical Chemistry", Vol. I & II, The Athlone Press of the University of London.
2. "Pharmacopoeia of India", Published by the Controller of Publications, Delhi.
3. "British Pharmacopoeia", Her Majesty's Stationary Office, University Press, Cambridge.
4. Mendham J, Denny RC, Barnes JD, Thomas MJK, "Vogel's Text Book of Quantitative Chemicals", Pearson Education, Asia.
5. Connors KA, "Textbook of Pharmaceutical Analysis", Wiley Interscience, New York.

PHAR – 235

PHARMACEUTICS – III (COMMUNITY PHARMACY)

THEORY

Unit – I

1. Definition, scope of community pharmacy, roles and responsibilities of Community pharmacist, code of Ethics.
2. Community Pharmacy Management
 - a. Selection of site, Space layout, and design
 - b. Staff, Materials – coding, stocking
 - c. Legal requirements
 - d. Maintenance of various registers
 - e. Use of computers: Business and health care soft wares. [06]

Unit – II

3. Prescription: Parts of prescription, legality & identification of medication related problems like drug interactions incompatibility
4. Inventory control in community pharmacy. Definition, various methods of inventory control. ABC, VED, EOQ, lead time, safety stock. [08]

Unit – III

5. Pharmaceutical care: Definition and Principles of Pharmaceutical care.
6. Communication skills and patient counselling. Need for good communication, Key communication skills. Strategies to overcome barriers. Patient information leaflets – content, design & layouts, advisory labels.
7. Patient compliance: Definition, Factors affecting compliance, role of pharmacist in improving the compliance. [10]

Unit – IV

8. Health screening services: Definition, importance, methods for screening. Blood pressure/blood sugar/lung function and cholesterol testing.
9. OTC Medication: Definition, OTC medication list & Counselling. [06]

Unit – V

10. Health Education: WHO definition of health and health promotion, care for children, pregnant & breast feeding women and geriatric patients. Commonly occurring Communicable Diseases, Causative Agents.
11. Clinical presentations and prevention of communicable disease: Tuberculosis, Hepatitis, Typhoid, Amoebiasis, Malaria, Leprosy, Syphilis, Gonorrhoea and AIDS. Balance diet and deficiency disorders, treatment & prevention. Family planning: role of pharmacist.
12. Definition and scope of pharmacoepidemiology & Pharmacoceconomics
13. Rational drug therapy. [10]

PHAR – 235 P **PHARMACEUTICS – III** **(COMMUNITY PHARMACY)**

PRACTICAL

1. Categorization and storage of Pharmaceutical products bases on legal requirements of labeling and storage.
2. Project report on visit to the nearby community for counselling on the rational use of drugs and aspects of health care.
3. Prescription handling and identifications of drug interactions, incompatibilities.
4. Health screening services and study of equipments for :
 - a. Blood glucose determination (Glucometer)
 - b. Blood Pressure (BP apparatus)
 - c. Lung function test (Peak flow meter)
5. Design of community pharmacy to incorporate all pharmaceutical care services (as per schedule N)
6. Study of OTC medications
 - a. List & available brands
7. Interpretation of various pathological reports of blood & urine.

BOOKS RECOMMENDED

1. Carter SJ, Cooper and Gunn's "Dispensing for Pharmaceutical Students", CBS Publishers Delhi.
2. Ansel HC, "Introduction to Pharmaceutical Dosage Forms", KM Varghese & Co., Bombay.
3. Aulton ME, "Pharmaceutics – The Science of Dosage Form Design", ELBS/ Churchill Livingstone.

4. Remington Pharmaceutical Sciences, Mack Publishing Co., Pennsylvania.
5. I.P., Govt. of India Publication.
6. B.P., Her Majesty's Stationary Office, Cambridge.
7. Carter SJ, Cooper and Gunn's Tutorial Pharmacy, CBS Publishers Delhi.
8. Drugs & Cosmetics Act & Rules.
9. Parmar NS, "Community Pharmacy Health Education", CBS Publishers, Delhi.
10. Parthasarathi G, Nyfort, Hansen K, Nahata MC, "A Textbook of Clinical Pharmacy Practice: Essential Concepts & Skills, Orient Longman.

PHAR – 236
PATHOPHYSIOLOGY

THEORY

Unit – I

- a) **Cell injury:** Courses, pathogenesis & morphology of cell injury.
- b) **Cellular adaptation:** Atrophy, hypertrophy, Aplasia, metoplasia dysplasia & hyperplasia. Pathophysiology of neoplasm.
- c) Basic mechanism involved in the process of inflammation and repair. [10]

Unit – II

- d) **Disorders of CVS and blood:** Hypertension, Angina, CHF, Cardiac arrhythmias, Arteriosclerosis, Anaemia and Leukemia. [08]

Unit – III

- e) **Disorders of respiratory system & urinary system:** Asthma, Bronchitis, Glomerulonephritis and UTI. [04]

Unit – IV

- f) **Disorders of nervous system:** Parkinsonism, Alzheimer's disease, epilepsy and schizophrenia.
- g) **Disorders of endocrine system:** Gigantism, Acromegaly, Cretinism, Myxedema, Goiter, Dwarfism & Diabetes. [04]

Unit – V

- h) **Disorders of digestive system and miscellaneous:** Peptic ulcer, Cirrhosis, Arthritis, Gout, Myasthenia gravis & Hypersensitivity, cataract and glaucoma. [08]

BOOKS RECOMMENDED

1. Difore SH, "Atlas of Normal Histology", Lea & Febiger Philadelphia.
2. Chaurasia BD, "Human Anatomy: Regional & Applied", Part I, II & III, CBS Publishers & Distributors, New Delhi.
3. Guyton AC, Hall JE, Textbook of Medical Physiology, WB Saunders Company.
4. Chatterjee CC, "Human Physiology", Medical Allied Agency, Calcutta.
5. Ross & Wison, "Anatomy & Physiology in Health & Illness", Churchill Livingstone.
6. Tortora GJ, Anagnodokos NP, "Principles of Anatomy & Physiology", Harper & Rave Publishers, New Delhi.
7. Parmar NS, "Health Education & Community Pharmacy", CBS Publisher, Delhi.
8. Harshmohan, Textbook of Pathology, JayPee brothers Medical Publishers, New Delhi.
9. Kumar, Abbas, Pathologic Basis of disease, Elsevier, USA.
10. Shalya Subhash, "Human Physiology", CBS Publishers & Distributors.
11. Keele CA, Neil E, Joel N, Samson Wright's Applied Physiology, Oxford University Press.
12. Dipiro JL, "Pharmacotherapy – A Pathophysiological Approach", Elsevier.
13. Robbins SL, Kumar V, Basic Pathology, WB Saunders.

SEMESTER – IV

PHAR – 241 PHARMACEUTICS – IV (UNIT OPERATIONS – II)

THEORY

Unit – I

Stoichiometry: Unit processes, material and energy balances, molecular units, mole fraction, tie substance, gas laws, mole volume. Primary and Secondary quantities, equilibrium state, rate process, steady and unsteady states, dimensionless equations, dimensionless formulae, dimensionless groups, different types of graphic representation. [08]

Unit – II

Evaporation: Basic concepts of phase equilibria, factor affecting evaporation, evaporator, film evaporators, single effect and multiple evaporator. [08]

Unit – III

Distillation: Raoult's law, Phase Diagrams, volatility, simple steam and flash distillations, principles of rectifications, McCabe thiele method for the calculations of number of theoretical plates, Azeotropic and extractive distillation. [08]

Unit – IV

Drying: Moisture Content and Mechanism of drying, rate of drying and time of drying, calculations, classification and type of dryers, dryers used in pharmaceutical industries – Tray dryer, Fluidized bed dryer, spray dryer and special drying methods. [08]

Unit – V

Automated Process Control Systems: Process Variables, temperature, pressure, flow level and vacuum & their measurements. Elements automatic process control & introduction to automatic process control systems. Elements of Computer Aided Manufacturing (CAM). Reactors and fundamentals of reactors design for chemical reactions. [08]

PHAR – 241 P PHARMACEUTICS – IV (UNIT OPERATIONS – II)

PRACTICAL

1. Determination of overall heat transfer coefficient.
2. Study of factors effecting rate evaporation
 - a. Effect of surface area
 - b. Effect of Temperature
3. Study of factors effecting rate drying
 - a. Surface area
 - b. Temperature
4. Determination of rate of drying, free moisture content and bound moisture content.
5. Elementary knowledge of engineering drawing.
 - a. Alphabets / letters writing
 - b. Scales
 - c. Orthographic projections – First and third angle projection methods
 - d. Simple Isometric Views.

BOOKS RECOMMENDED

1. Badger WL, Banchero JT, "Introduction to Chemical Engineering", McGraw Hill International Book Co., London.
2. Perry RH, Chilton CH, Chemical Engineers Handbook, McGraw, Kogakusha Ltd.

3. McCabe WL, Smith JC, Unit Operations of Chemical Engineering, McGraw Hill International Book Co., London.
4. Gavhane KA, "Unit Operations – II", Nirali Prakashan.
5. "Sambhamuthi Pharmaceutical Engineering", New Age Publishers.

PHAR – 242

PHARMACEUTICAL MICROBIOLOGY

THEORY

Unit – I

1. Introduction to the scope of microbiology.
2. Structure of bacterial cell.
3. Classification of microbes and their taxonomy: Bacteria and viruses. [08]

Unit – II

4. Identification of Microbes: Stains and types of staining techniques, electron microscopy.
5. Nutrition, cultivation, & isolation of bacteria & viruses. [08]

Unit – III

6. Sterility testing of Pharmaceutical products as per I.P. [06]

Unit – IV

7. Control of microbes by physical and chemical methods.
 - A. Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
 - B. Sterilization, different methods, validation of sterilization methods & equipments.
 - C. Preservative efficacy
 - D. Personal microbiology [10]

Unit – V

8. Microbial assays of antibiotics, vitamin B12 and Aseptic techniques and clean area classification.
9. Environmental microbiology. [08]

PHAR – 242 P

PHARMACEUTICAL MICROBIOLOGY

PRACTICAL

Experiments devised to prepare various types of culture media, sub – culturing of common aerobic and anaerobic bacteria, fungus and yeast, various staining methods, various methods of isolation and identification of microbes, sterilization techniques and their validation, validation of sterilization techniques, evaluation of antiseptics and disinfectants, testing the sterility of pharmaceutical products as per I.P. requirements, microbial assay of antibiotics and vitamins.

SUGGESTED PRACTICALS

1. Preparation of various types of culture media.
2. Sub – culturing of common bacteria, fungi, yeast.
3. Isolation of bacteria
4. Identification and staining of bacteria.
 - a. Simple staining
 - b. Gram staining
 - c. Acid fast staining
 - d. Negative staining
 - e. Hanging drop preparation

5. Evaluation of disinfectant and antiseptics.
 - a. Phenol coefficient test.
 - b. Minimum inhibitory concentration.
6. Study of sterilization methods & equipments.
 - a. Dry heat.
 - b. Moist heat.
7. Test for sterility of pharmaceutical products as per IP.
8. Microbial assay of antibiotics as per IP

BOOKS RECOMMENDED

1. Aneja KR, "Experiments in Microbiology, Plant Pathology, Tissue Culture & Mushroom Cultivation", Vishwa Prakashan.
2. Gunasekeran P, Lab Manual of Microbiology, New Age Publishers.
3. Davis, Dulbetco, "Eisen Microbiology".
4. Stanier RY, Ingraham JL, Wheelis ML, Painter PR, "General Microbiology", McMillan Press Limited.
5. Hugo and Russell, "Pharmaceutical Microbiology", Blackwell Scientific Publication Oxford.
6. Prescott LM, Harley JP, Klien DA, "Microbiology", McGraw Hill.
7. Sykes, "Disinfection and Sterilization".
8. "Pelczar & Reid Microbiology", Tata McGraw Hill, Delhi.
9. Virella G, "Microbiology and Infectious Disease", William & Wilkins.
10. Anathanarayan R, Panikar CKJ, "Textbook of Microbiology", Orient Longman.

PHAR – 243

PHARMACOGNOSY – II

THEORY

Unit – I

Phytochemical Screening: An introduction to active constituents of drugs: their extraction, isolation, classification purification, separation, estimation and characterization with qualitative chemical tests of the followings – Alkaloids, Saponins, Cardenolides and bufadienolides, flavonoids and Leucoanthocyanidine, Cynogenetic glycosides. [14]

Unit – II

Tannins: Study of tannins & tannin containing drugs like Gambir (Pale Catechu), Black catechu, Gall and Myrobalans (Harde, Baheda, Arjuna & Ashoka). [03]

Unit – III

Resins: Study of drugs containing resins and resin combinations like Podophyllum, Cannabis, Capsicum, Shellac, Asafoetida, Balsam of tolu, Balsam of Peru, Benzoin, Turmeric, Ginger. [05]

Unit – IV

Volatile Oils: General methods of obtaining volatile oils from plants, study of volatile oils from mentha, corianders, cinnamon, jatamansi, cumin, black pepper, cassia, lemon peel, orange peel, lemon grass, citronella, caraway, dill, spearmint, clove, fennel, nutmeg, eucalyptus, chenopodium, cardamom, valerian, musk, palmarosa, gaultheria, sandalwood. [10]

Utilization of aromatic plants and desired products with special reference to Sandalwood oil, Mentha oil, Lemon grass oil, Vetiver oil, Geranium oil & Eucalyplus oil. [03]

Unit – V

Quality Control of Crude Drugs:

Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation including quantitative microscopy, commerce and quality control of the crude drugs. WHO guidelines for standardization of medicinal plants. [08]

PHAR – 243 P
PHARMACOGNOSY – II

PRACTICAL

1. Identification of crude drugs mentioned in theory.
2. Microscopic study of seven selected drugs and their powders mentioned under the category of volatile oils in theory with their chemical tests.
3. General chemical test for Alkaloids, Glycosides, Steroids, Flavonoids & Tannins.
4. Determination of leaf Constants such as Stomatal Index, Stomatal Numbers, Vein Islet Numbers, Vein Termination Number and palisade ratio.

SUGGESTED PRACTICALS

1. Morphology of Mentha, Lemongrass, Nutmeg and Chenopodium.
2. Morphology of Turmeric, Ginger, Cannabis, Eucalyptus.
3. Morphology and microscopy of Coriander and Cinnamon.
4. Morphology and microscopy of Dill and Caraway & fennel.
5. Morphology and microscopy of Clove and to study its transverse section.
6. Quantitative determinations of leaf constants with the help of camera lucida:
 - a. Determination stomatal index & stomatal index
 - b. Determination of vein islet and vein termination number
 - c. Determination of palisade ratio.
7. To perform the chemical tests of Balsam (Tolu and Peru) and Asafoetida.
8. Preparation of reagents for the chemical tests of Alkaloids and to perform the chemical tests on any Alkaloid containing drug.
9. Tests for identification of Glycosides (Saponin & Anthraquinone) and steroids.
10. Tests for identification of polyphenolic compounds (Tannins, flavonoids).
11. Preparation of medicated oil.

PHAR – 244
PHARMACEUTICAL CHEMISTRY – III
(PHARMACEUTICAL ORGANIC CHEMISTRY – II)

THEORY

Unit – I

Unsaturated carbonyl compounds, cyclo addition.

Compounds containing active methylene group and their synthetic importance – Acetoacetic ester and malonic ester. [08]

Unit – II

Heterocyclic Compounds – Nomenclature, Chemistry, preparation, properties & pharmaceutical importance of pyrrole, furan, thiophene, pyridine, pyrimidine, imidazole, pyrazole, thiazole, benzimidazole, indole, phenothiazines.

Polynuclear hydrocarbons – Naphthalene, anthracene and phenanthrene. [08]

Unit – III

Classification, structure, chemistry and identification of:

Carbohydrates:

- i. Monosaccharides – Glucose and fructose.
- ii. Disaccharides – Sucrose, lactose and maltose.
- iii. Polysaccharides – Starch [08]

Unit – IV

Classification, identification, general methods of preparation and reactions of amino acids and proteins.

Name reactions – Definition, reaction mechanism and synthetic applications of Merwin– Ponderff Verley reduction, Oppeneaur oxidation, Bechmen rearrangement, Mannich reaction, Deil’s alder reaction, Michel reaction , Reformatsky reaction and Knoevanegal reaction. [08]

Unit – V

Structure of Nucleic Acids. Chemistry & identification of oils, fats and waxes. Polymers and polymerization. [08]

PHAR – 244 P

**PHARMACEUTICAL CHEMISTRY – III
(PHARMACEUTICAL ORGANIC CHEMISTRY – III)**

PRACTICAL

1. Identification of organic compounds with derivatization.
2. Synthesis of Organic compounds involving two steps.
3. Workshop on molecular modelling of primary, secondary, tertiary structures of proteins, molecular modelling, double helical structure of nucleic acid showing hydrogen bonding.

BOOKS RECOMMENDED

1. Mann PG, Saunders BC, Practical Organic Chemistry, ELBS/ Longman, London.
2. Furniss BS, Hannaford AJ, Smith PWG, Tatehell AR, Vogel’s Textbook of Practical Organic Chemistry, The ELBS/Longman, London.
3. Morrison TR, Boyd RN, Organic Chemistry, Prentice Hall of India Pvt. Ltd. New Delhi.
4. Finar IL, Organic Chemistry, Vol. I & II, ELBS/Longman.
5. Jain MK, Sharma SC, Organic Chemistry, Shoban Lal Nagin Chand & Co., Delhi.

PHAR – 245

PHARMACOLOGY – I

Unit – I

General Pharmacological Principles – I:

Definitions, Source of drugs, Routes of drug administration, Absorption of drugs, Distribution and excretion of drugs, Biotransformation of drugs, Drug-receptor interactions. [09]

Unit – II

General Pharmacological Principles – II:

Drug Antagonism, Factors modifying drug response–1 (age, weight, sex, route of administration, tolerance, and idiosyncratic reactions), Factors modifying drug response-2 (Allergic reactions, enhanced effects, reduced effect, therapeutic index, biological half life, genetic effects, nutritional status), adverse drug reactions, neurohumoral transmission and action potential. [09]

Unit – III

Drugs affecting Autonomic Nervous System – I:

Cholinergic drugs, Cholinesterase inhibitors, Anticholinergics, Neuromuscular blocking agents..... [08]

Unit – IV

Drugs affecting Autonomic Nervous System – II:

Sympathomimetic drugs (Catecholamines and Non-Catecholamines), Alpha and Beta Agonists, Alpha and Beta-Adrenergic Blockers. [08]

Unit – V

Autocoids:

Histamine and H₁-Antagonists, 5-HT and its antagonist, Prostaglandins, Renin-angiotensin system, Kalikrien – Kinin system. [06]

PHAR – 245 P
PHARMACOLOGY – I

PRACTICAL

Use of software alternative to animals for practical where possible.

1. Commonly used instruments in experimental pharmacology.
2. Common laboratory animals and anesthetics used in animal studies
3. Preparation of different physiological salt solution used in experimental pharmacology.
4. Drug dilutions and dose calculation in experimental pharmacology.
5. Study of different routes of administration of drugs in mice/rats.
6. Preparation of calibration curve for given drug.
 - a) To study the plasma protein binding of a drug.
 - b) To study the displacement of protein binding by another drug.
7. To study the effect of mydriatic activity of drug using rabbit eye.
8. To study the miotic activity of Pilocarpine (1% w/v) by using rabbit cornea.
9. To study and set-up an organ bath for isolated frog rectus abdominus muscle preparation.
10. Esophageal motility on ciliary muscle of frog.
11. Clinical cases-I
12. Clinical cases-II

BOOKS RECOMMENDED:

1. Goodman & Gilman, The Pharmacological basis of Therapeutics, Limbird, P.B., Molinos, R.W. Ruddon and A.G. Gil, Pergamon press.
2. Katzung, B.G. Basic & Clinic Pharmacology, Prentice Hall, International.
3. Siddiqui, H.H., Essentials of Medical Pharmacology; Globalmedik Publishers, Delhi
4. Rang MP, Dale MM, Riter JM, Pharmacology Churchill Livingstone.
5. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi
6. Satoskar & Bhandarkar; Pharmacology & Pharmacotheropeutics., Popular Prakashan Pvt. Ltd. Bombay.
7. Pillai, KK, Experimental Pharmacology, CBS Publishers, Delhi.
8. Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
9. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.

SEMESTER – V

PHAR – 351 PHARMACEUTICAL CHEMISTRY – IV (BIOCHEMISTRY)

THEORY

Unit – I

1. **Enzymes:** Nomenclature, enzymes kinetics and its mechanism of action, mechanism of inhibition of enzymes, isoenzymes and its role in chemical diagnosis.
2. **Co – Enzymes:** Vitamins as co-enzymes and their significance. Metals as co-enzymes & their significance. [08]

Unit – II

3. **Carbohydrate metabolism:** Glycolysis, Gluconeogenesis and Glycogenolysis. Metabolism of galactose and galactoseamia. Role of sugar nucleotides in biosynthesis & Pentose phosphate pathway.
4. The citric acid cycle, significance, reactions and energetics of the cycle. [08]

Unit – III

5. **Lipid metabolism:** Oxidation of fatty acids, oxidation & energetics (α -oxidation, β -oxidation), biosynthesis of ketone bodies and their utilization. Biosynthesis of saturated and unsaturated fatty acids. Control of lipid metabolism. Essential fatty acids.
6. **Biological oxidation:** The respiratory chain, its role in energy capture, its control. Mechanism of oxidative phosphorylation. [08]

Unit – IV

7. Biosynthesis of amino acids: Catabolism of amino acids and conversion of amino acids to specialized products, biosynthesis of purine and pyrimidine, formation of deoxyribonucleotides.
8. Biosynthesis of Nucleic acids: Biosynthesis of DNA and its replication, mutation, physical and chemical mutagens, carcinogenesis, DNA repair mechanism. Biosynthesis of RNA. [08]

Unit – V

9. Genetic Code and Protein synthesis: components of protein synthesis, inhibition of protein synthesis.
10. Regulation of gene expression. [08]

PHAR – 351 P PHARMACEUTICAL CHEMISTRY – IV (BIOCHEMISTRY)

PRACTICAL

1. Estimation of creatinine in Blood.
2. Titration curve for Amino acids.
3. Separation of Amino acids by Chromatography.
4. Estimation of Serum/Salivary amylase.
5. Quantitative estimation of Amino acids.
6. The determination of Glucose by means of the enzymes glucose oxidase.
7. Effect of temperature on the activity of alpha amylase.
8. Estimation of Cholesterol in Blood.
9. Estimation of Glucose in Blood & urine.
10. Estimation of calcium in Blood.
11. Estimation of Ketone bodies in Blood.
12. Quantitative analysis of inorganic as well as organic constituents of urine.

BOOKS RECOMMENDED:

1. Jayaraman J, "Laboratory Manual in Biochemistry", Wiley Eastern Limited.
2. Plummer, David J, "An Introduction to practical Biochemistry", McGraw Hill, New Delhi.
3. Singh SP, "Practical Manual to Biochemistry", CBS Publishers, New Delhi.
4. "Harpers Review of Biochemistry", Lange Medical Publication.
5. Conn EE, Stumph PK, Outline of Biochemistry, John Wiley & Sons, New York.
6. Nelson DL, Cox MM, Lehninger Principles of Biochemistry, Macmillan Worth Publishers.
7. Stryer L, Biochemistry, WH Freeman & Company, San Francisco.
8. Harrow B, Mazur A, "Text Book of Biochemistry", W.B. Saunders Co., Philadelphia.

PHAR – 352

PHARMACEUTICS – V (PHARMACEUTICAL TECHNOLOGY – I)

THEORY

Unit – I

Preformulation studies:

- a) Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability.
- b) Study of chemical properties of drugs like hydrolysis, oxidation-reduction, racemization, polymerization and their influence on formulation and stability of products.
- c) Study of products in solving problems related to stability, bioavailability, elegance of formulation. [07]

Unit – II

Liquid Dosage Forms: Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colours, flavours and others. Manufacturing, packaging & evaluation of clear liquids, suspensions and emulsions. [08]

Unit – III

Semisolid Dosage forms: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging. [08]

Unit – IV

Suppositories: Ideal requirements, bases, manufacturing procedure, packaging and evaluation.

Pharmaceutical Aerosols: Definition, Propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications. [09]

Unit – V

Cosmetology and Cosmetic Preparations: Structure of skin, formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, protective cream, antiperspirants, deodorant face powder. Hair structure, shampoos, conditioner, shaving and after shave products, denitrifies & mouthwash. Lipstick & nail lacquer. [08]

PHAR – 352 P
PHARMACEUTICS – V
(PHARMACEUTICAL TECHNOLOGY – I)

PRACTICAL

1. Preparation of cold cream, vanishing cream, cleansing lotion and creams. Moisturizing creams, skin tonics, hair cream, hair conditioner shampoos, shaving creams and sticks. Tooth powder, tooth pastes. After shave lotion and other cosmetic preparations.
2. Preparation, evaluation and packing of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, eye drops, eye ointments etc.

SUGGESTED PRACTICALS:

1. Preparation, Evaluation and packing of (10 preparations = 5 labs)

A. Liquids Orals:

- | | | |
|------------------|---|--|
| (i) Solutions | : | Strong Sodium Salicylate oral solution BP
Chloral Hydrate BP |
| (ii) Suspensions | : | Magnesium sulphate oral suspension BP
Milk of magnesia IP
Aluminium Hydroxide gel IP |
| (iii) Emulsions | : | Liquid paraffin oral emulsion BP |

B. Semi – Solids:

- | | | |
|--------------------|---|---|
| (i) Ointments | : | Salicylic acid ointment BP
Whitfield ointment BP
Compound benzoic acid ointment |
| (ii) Suppositories | : | Glycerine suppositories BP
Lactic acid suppositories BP |

2. Preparation of cosmetic preparation (30 preparation = 10 labs)

- | | |
|-----------------------|------------------------------|
| i. Cold cream | xvi. Cream shampoo |
| ii. Vanishing cream | xvii. Clear liquid shampoo |
| iii. Cleansing cream | xviii. Shaving cream |
| iv. All purpose cream | xix. Brushless shaving cream |
| v. Protective cream | xx. After shave cream |
| vi. Foundation lotion | xxi. Hair fixer gel |
| vii. Sunscreen Lotion | xxii. Tooth powder |
| viii. Face Powder | xxiii. Tooth paste |
| ix. Body Powder | xxiv. Mouth wash |
| x. Hand cream | xxv. Hair conditioner |
| xi. Face pack | xxvi. Anti dandruff shampoo |
| xii. Deodorant | xxvii. Depilatory cream |
| xiii. Antiperspirant | xxviii. Bleach cream |
| xiv. Shampoo – powder | xxix. Hair setting lotion |
| xv. Oily shampoo | xxx. Tooth gel |

BOOKS RECOMMENDED:

1. Remington's Pharmaceutical Sciences, Vol. I & II, Mack Publishing Co., U.S.A.
2. Cooper JW, Gunn G, Tutorial Pharmacy, Petman Books Ltd., London.
3. Lachman L, Lieberman HA, Kanig JL, Theory and Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia.
4. Ansel, HC, Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia U.S.A.
5. Juliano RL, "Drug Delivery Systems", Oxford University Press, Oxford.
6. Harrys Cosmetology.

7. Balsam and Sagarin, Cosmetics: Science and Technology.
8. Thomssen EG, Modern Cosmetics, Universal Publishing Corporation.
9. Mittal BM, Saha RN, A Handbook of Cosmetics, Vallabh Prakashan.

PHAR – 353
PHARMACOLOGY – II

THEORY

Unit – I

Cytokines, Drugs used in rheumatoid arthritis, NSAID, Antigouts. [06]

Unit – II

Drugs affecting respiratory system

Drugs used in the treatment of bronchial asthma, Mucolytics, Cough suppressants, Expectorants, pharyngeal demulcents, Use of Oxygen in respiratory disorders, Respiratory stimulants. [09]

Unit – III

Drugs affecting cardiovascular System

Diuretics & antidiuretics, Drugs used in congestive heart failure, Antihypertensives, Antianginals, Antiarrhythmics, Hypolipidemics. [10]

Unit – IV

Drugs affecting blood and blood formation

Hematinics & Erythropoietin, Antiplatelet drugs, Anticoagulants, Fibrinolytics, Plasma expanders. [07]

Unit – V

Drugs affecting gastrointestinal tract

Drugs used in peptic ulcer, Ulcerative colitis, Laxatives, Antidiarrhoeals, Emetics & antiemetics. [08]

PHAR – 353 P
PHARMACOLOGY – II

PRACTICAL

Use of software alternative to animals for practical where possible.

1. To perform the student-t- test significance of variance.
2. DRC of Ach on isolated frog rectus abdominus muscle.
3. DRC of Ach on isolated guinea pig ileum.
4. To study the effect of different drugs on isolated frog heart.
5. To study the effect of different ions on isolated frog heart.
6. Clinical cases-I
7. Clinical cases-II
8. Clinical cases-III
9. Clinical cases-IV

BOOKS RECOMMENDED:

1. Goodman & Gilman, The Pharmacological basis of Therapeutics, Limbird, P.B., Molinos, R.W. Ruddon and A.G. Gil, Pergamon press.
2. Katzung, B.G. Basic & Clinic Pharmacology, Prentice Hall, International.
3. Siddiqui, H.H., Essentials of Medical Pharmacology; Globalmedik Publishers, Delhi
4. Rang MP, Dale MM, Riter JM, Pharmacology Churchill Livingstone.
5. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi
6. Satoskar & Bhandarkar; Pharmacology & Pharmacotherapeutics., Popular Prakashan Pvt. Ltd. Bombay.

- Pillai, KK, Experimental Pharmacology, CBS Publishers, Delhi.
- Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
- Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.

PHAR – 354
PHARMACOGNOSY – III

THEORY

Unit – I

A. Study of the biological source, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic, macroscopic and microscopic features and specific chemical tests of following:

Glycosides:

(Definition & classification according to linkage and genin moiety)

- Saponins:** Liquorice, Ginseng, Dioscorea, Coleus species. [04]
- Cardioactive sterols:** Digitalis, Squill, Strophanthus & Thevetia. [03]
- Anthraquinone Cathartics:** Aloe, Senna, Rhubarb & Cascara. [03]

Unit – II

Others: Psoralia, Ammi majus, Ammi visnaga, Gentian, Saffron, Chirata, Quassia and Andrographis paniculata. [03]

B. Utilization and production of phytoconstituents such as calcium sennosides, Diosgenin, Solasodine & Podophyllotoxin. [03]

Unit – III

Studies of Traditional Drugs: Common Vernacular name, Biological sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and toxicological activity of marketed formulation of following indigenous drugs namely Amla, Kantkari, Satavari, Tylophora, Bhilwa, Kalijiri, Bach, Rasna. [07]

Unit – IV

Punarnava, Chitrak, Apamarg, Gokharu, Shankhpushpi, Brahmi, Methi, Lehsun, Guggul, Gymnema, Shilajit, Tulsi, Malkanguni and Neem. [08]

Unit – V

Introduction of Herbal Pharmacopoeia. The Holistic concepts of drug administration in traditional system of medicine. Introduction to ayurvedic preparations like Arishtas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas & analysis of official formulations derived from crude drugs. [07]

PHAR – 354 P
PHARMACOGNOSY – III

PRACTICAL

- Identification of crude drugs listed in theory.
- Microscopic study of some important glycoside containing drugs as outlined above study of powdered drugs.
- Standardization of some traditional drug formulations.

SUGGESTED PRACTICALS

- Morphology and microscopy (powder) of liquorice along with its chemical tests.
- Morphology of Aloe and chemical tests on Aloe extracts.
- Morphology and Microscopy (powder and T.S.) of Thevetia
- Morphology and Microscopy (powder) of Rhubarb.
- Morphology of Psoralia, Saffron and Chirata
- Morphology of Amla, Kantkari, Shatavari and Bach
- Morphology of Purnarnava, Apamarg, Gokhru, shankhpushpi.

8. Morphology of Brahmi, Methi, Lehsun and Neem.
9. Identification Tests for Guggul liquids.
10. To study the following standards
 - a. Loss on drying
 - b. Extractive values
 - c. Ash values.
 - d. pH of 1% solution in water and alcohol of any Ayurvedic formulation (solid) available in the market.
11. To perform above studies (exp 11) in any liquid Ayurvedic formulation

PROJECT WORK

A report of marketed preparations based on traditional drugs mentioned in theory

BOOKS RECOMMENDED:

1. Kokate CK, "Practical Pharmacognosy", Vallabh Prakashan, New Delhi.
2. Wallis TE, "Analytical Microscopy", JA Churchill Ltd., London.
3. Trease GE, Evans WC, "Pharmacognosy", Bailliere Tindall, East Borne, U.K.
4. Tyler VE, "Textbook of Pharmacognosy", Lea & Febiger, Philadelphia.
5. Wallis TE, "Pharmacognosy", JA Churchill Ltd., London.
6. Kokate CK et al, "Pharmacognosy", Nirali Prakashan, Pune.
7. "Medicinal Plants of India", I & II, Indian Council of Medical Research, New Delhi.
8. Nadkarni AK, "Indian Material Medica, 1-2, Popular Prakashan (P) Ltd., Bombay.
9. Atal CK, Kapur BM, "Cultivation & Utilization of Medicinal Plants", RRL, Jammu.
10. "Indian Herbal Pharmacopoeia", Vol. I & II, ICMR & RRL Jammu.
11. "Pharmacopoeial Standards for Ayurvedic Formulations" CCRAS, Delhi.
12. The Wealth of India, Raw Materials (All volumes), Council of Scientific & Industrial Research, New Delhi.
13. Rastogi & Mehrotra, Compendium of Indian Medicinal Plants, Vol. I-IV.
14. "Indian Ayurvedic Pharmacopoeia", Govt. of India.
15. Kokate CK, Gokhale AS, Gokhale SB, "Cultivation of Medicinal Plants", Nirali Prakashan.
16. "British Herbal Pharmacopoeia".
17. "Indian Herbal Pharmacopoeia".
18. Chaudhary R.R., "Herbal Drug Industry".

PHAR – 355

PHARMACEUTICS – VI (PHYSICAL PHARMACY)

THEORY

Unit – I

Kinetics and Drug Stability: Accelerated stability study, expiration dating, Climatic zones & ICH guidelines, requirements of GMP, CGMPI, GLP, USFD, WHO guidelines and ISO 9000 series. [08]

Unit – II

Micromeritics and Power Rheology: Particle size and distribution, average particle size, number & weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties. [08]

Unit – III

Viscosity and Rheology: Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, non – Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary falling ball, rotational viscometers.

Complexation: Classification of complexes, methods of preparation and analysis, applications. [08]

Unit – IV

Dispersion Systems: Colloidal dispersions, definition, types, properties of colloids, protective colloids, application of colloids in pharmacy, suspensions & emulsions: interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, Controlled flocculation, flocculation in structured vehicles, rheological considerations. Emulsions – types, theories, physical stability. [08]

Unit – V

Quality Assurance & Validation: Concepts in validation, validation of manufacturing and analytical equipment, Process validation in manufacturing dosage formulations, applications of Process validation.

Basic concept of quality assurance, quality assurance systems. Source and control of quality variation – raw materials, containers, closures, personnel, environment etc. [08]

PHAR – 355 P PHARMACEUTICS – VI (PHYSICAL PHARMACY)

PRACTICAL

1. Determination of particle size, Particle size distribution and surface area using various methods of particle size analysis.
2. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
3. Study of rheological properties of various types of systems using different Viscometers.
4. Studies of different types of colloids and their properties.
5. Preparation of various types of suspensions and determination of their sedimentation parameters.
6. Preparation and Stability studies of emulsions.
7. Studies of different types of complexes and determination of their stability constants.
8. Accelerated stability testing, shelf – life determination and expiration dating of pharmaceuticals
9. Experiments involving tonicity adjustments.

BOOKS RECOMMENDED:

1. Martin A, Bustamante P, Chun AHC, “Physical Pharmacy”, Lea & Febiger, Philadelphia.
2. Shotten E, Ridgaway K, “Physical Pharmaceuticals”, Oxford University Press, London.
3. OPPI, “Quality Assurance”.
4. Loftus and Nash, Pharmaceutical Process Validation.
5. “Garfield Quality Assurance Principles for Analytical Laboratories”.
6. Willing, Tuckerman, and Hitchings, “Good Manufacturing Practices for Pharmaceuticals”.

SEMESTER – VI

PHAR – 361 PHARMACEUTICAL CHEMISTRY – V (MEDICINAL CHEMISTRY – I)

THEORY

Unit – I

Basic Principles of Medicinal Chemistry: Physicochemical aspects (Opticals, geometric and bioisosterism) of drug molecules and biological action. Drug receptor interaction including transduction mechanism. [08]

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only)

Unit – II

A. Drugs Acting at Synaptic and Neuro-Effector Junction Sites:

- i) Cholinergic, Anticholinergic & Anticholinesterases: Neostigmine, Physostigmine, Methacholine, Pilocarpine, Atropine.
- ii) Adrenergic Drugs: Ephedrine, Isoproterenol, Amphetamine, Salbutamol, Terbutaline, Adrenaline. [08]

Unit – III

B. Drugs Acting on the Central Nervous System:

- i) General Anaesthetics: Thiopental, Ketamine, Methohexital, Enflurane.
- ii) Local Anesthetics: Lignocaine, Benzocaine, Bupivacaine.
- iii) Hypnotics and Sedatives: Phenobarbitone, Pentobarbitone.
- iv) Opioid Analgesics: Pethidine, Methadone, Pentazocine.
- v) Antitussives: Caramiphen, Dextromethorphan. [08]

Unit – IV

- vi) Anticonvulsants: Phenytoin, Carbamazepine, Ethosuximide, Valproic Acid.
- vii) Antiparkinsonism drugs: Carbidopa, Levodopa.
- viii) CNS Stimulants: Caffeine, Nikethimide. [08]

Unit – V

- ix) Psychopharmacological Agents:
 - a) Neuroleptics: Imipramine, Amitriptyline.
 - b) Antidepressants: Doxepin, Phenelzine, Meprobamate, Chlordiazepoxide, Diazepam.
 - c) Antispasmodic and anti ulcer drugs: Dicyclomine, Ranitidine, Omeprazole, Pirenzepine.
 - d) Neuromuscular Blocking Agents: Gallamine, Triethiodide, Mephensin, Pancuronium..... [08]

PHAR – 361 P PHARMACEUTICAL CHEMISTRY – V (MEDICINAL CHEMISTRY)

PRACTICAL

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Establishing the pharmacopoeial standards of the drugs synthesized.

SUGGESTED PRACTICALS

1. Synthesis of Methyl salicylate.
2. To establish pharmacopoeial standards of Methyl salicylate.
3. Synthesis of Paracetamol

4. To establish pharmacopoeial standards of paracetamol.
5. To synthesize Benzocaine
6. To establish pharmacopoeial standards of Benzocaine
7. Synthesis of Phenytoin.
8. To establish pharmacopoeial standards of Phenyton.
9. Synthesis of Hydanation.
10. To establish pharmacopoeial standards of Hydantion.
11. Synthesis of Barbituric acid.
12. To establish pharmacopoeial standards of Barbituric acid.

BOOKS RECOMMENDED:

1. Mann PG, Saunders BC, "Practical Organic Chemistry", ELBS/Longman, London.
2. Furniss BA, Hannaford AJ, Smith PWG, Tatehell AR, Vogel's Textbook of Practical Organic Chemistry, ELBS/Longman, London.
3. Pharmacopoeia of India, Ministry of Health, Govt. of India.
4. Wolff ME, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
5. Degado JN, Remers WAR, 10th eds, Wilson and Giswold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott William & Willkins.
6. Foye WC, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh Harkishan, Kapoor VK, "Organic Pharmaceutical Chemistry", Vallabh Prakashan, Delhi.
8. Norgrady T, Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York, Oxford.
9. Finar IL, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.

PHAR – 362

PHARMACEUTICS – VII

(PHARMACEUTICS TECHNOLOGY – II)

Unit – I

1. **Capsules:** Material for production of hard gelatine capsule, methods of capsule filling, soft gelatin capsule shell and capsule content, quality control, stability testing and storage of capsule dosage forms.
2. **Micro Encapsulation:** Types of microcapsule, importance of micro encapsulation in pharmacy, micro encapsulation by phase separation, co-acervation, multi orifice spray drying, spray congealing, polymerization, complex, emulsion, air suspension technique, coating pan and other techniques, evaluation of microcapsules. [10]

Unit – II

3. **Tablets:**
 - a. Formulation of different types of tablets, granulation technology on large scale by various techniques, different types of tablet compression machinery and the equipments employed; evaluation of tablets.
 - b. Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablet, stability kinetics and quality assurance. [10]

Unit – III

Novel Drug Delivery systems:

4. **Control Drug Delivery System:**
 - a) Theory, release and diffusion of drugs from C.D.D.S. General methods of design and evaluation of C.D.D.S.
 - b) Carriers for drug delivery systems, Products, Physical, Chemical and biomedical engineering approach to achieve controlled drug delivery.

5. Transdermal Drug Delivery System:

- a. Theory, Formulation, evaluation of transdermal drug delivery systems, iontophoresis.
- b. Implants and inserts: Types, design and evaluation methods, Osmotic pumps.

6. Targeted Drug delivery systems:

Concept, importance and methods of drug targeting. Drug immobilization techniques- nanoparticles, liposomes, neosomes, pharmacosomes and erythrocytes.

7. Sustained Release Drug Delivery System:

Advance concepts in the design, development and production of sustained release products.[10]

Unit – IV

8. Parenteral Products:

- a) Water for injection, pyrogenicity, nonaqueous vehicles. Formulation details, containers and closures and their selection.

Pre-filling treatment, washing of containers and closures, preparation of solution and suspensions, filling and sealing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parental products.

- b) Ophthalmic, Nasal and Ear Products. [05]

9. Surgical Products:

Definition, primary wound dressing absorbents, surgical cotton, surgical gauzes etc. bandages, adhesive type, protective cellulosic hemostasis, official dressing, absorbable and non absorbable sutures, ligatures and catguts.

Unit – V

10. Packaging of Pharmaceutical Product:

- a) Packaging materials with special reference to polymers, metals glass and plastics, control of packaging materials.
- b) Blister and strip packaging.
- c) Testing of containers and closures. Pharmacopoeial tests and specifications, defects in packages.
- d) Stability of package and packaging material.
- e) Ancillary materials used in packaging.
- f) Sterilization of packaging materials.
- g) Packaging of parenterals, Ophthalmic and aerosols. [05]

PHAR – 362 P

PHARMACEUTICAL TECHNOLOGY – II

PRACTICAL

- 1. Experiments to illustrate preparation, stabilization & physical evaluation of pharmaceutical products like powders, capsules, tablets, parenterals & microcapsules.
- 2. Evaluation of Materials used in pharmaceutical packaging.

SUGGESTED PRACTICALS

- 1. Preparation, Evaluation Packing of the following dosage forms:

- a. Capsules : Chloramphenicol Capsules IP
- b. Microcapsules : Co – acervation (Temperature Change)
- c. Tablets : Uncoated – Paracetamol Tablets IP
- d. Tablets : Film Coated – Ibuprofen Tablets IP
- e. Tablets : Enteric Coated – Aspirin Tablets
- f. Parenteral : Disodium EDTA Injection IP (vials)
- g. Parenteral : Dextrose NaCl IV Infusion IP(Infusion boilers)
- h. Parenteral : Water for injection, IP (Ampoule)
- i. Eye Drops : Zinc Sulphate IP
- j. Eye Ointment : Sulphacetamide Sodium IP

2. Formulation and evaluation of sustained releases dosage forms – Aspirin Extended release (Matrix embedding method, granules (USP/NF coating of granules)
3. Evaluation of packages – containers & closures.

BOOK RECOMMENDED

1. Remington: “The Science and Practice of Pharmacy & Pharmaceutical Sciences”, Mack Publishing Company U.S.A.
2. Avis RE, “Pharmaceutical Dosage Forms: Parenteral Medication, Vol. – I, Marcel Dekker – Inc, New York & Basel.
3. Ansel HC, “Introduction to Pharmaceutical Dosage Forms”, Lea & Febiger, Philadelphia, U.S.A.
4. Juliano RC, Drug Delivery Systems, Oxford University Press, Oxford.
5. Libermann HA, Lachman L, Theory & Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.
6. Robinson and Vincent, “Controlled Drug Delivery”.
7. Robinson, “Sustained and Controlled Drug Delivery Systems”.
8. Chien, “Novel Drug Delivery Systems”.
9. Lisbeth, Illume & Davis “Polymers in Controlled Drug Delivery”.
10. Joseph D.O. Brien, Medical Device Packaging Handbook.
11. Griffin, Drug and cosmetic packaging.
12. Barail, Packaging Engineering.
13. Harburn, Quality – Control of Packaging Materials in Pharmaceutical Industry.
14. Kac Chensney, Packaging of Cosmetics and Toiletries.

PHAR – 363

PHARMACOLOGY – III

THEORY

Unit – I

1. **Drugs Acting on CNS – I:** Narcotic and non-narcotic analgesic, Drugs in convulsive disorders, Drugs in Parkinson’s disease, Sedatives, Hypnotics and Anxiolytics. [09]

Unit – II

2. **Drugs Acting on CNS – II:** Antidepressant, antimaniacs and anti-psychotic, General anesthetics, Local anesthetics. [08]

Unit – III

3. **Drugs acting on endocrine system – I:** Diabetes mellitus, Insulins, Oral hypoglycemics, Corticosteroids, Thyroid and Antithyroid drugs. [09]

Unit – IV

4. **Drugs acting on endocrine system – II:** Male sex hormones and Anabolics, Female sex hormones and Oral contraceptives, Fertility drugs, Hormones controlling calcium metabolism, Oxytocics and Tocolytics. [09]

Unit – V

5. **Bioassays:** Definition and terminology, Condition under which bioassay should be done, Principles of bioassay, Types of bioassay, Important Pharmacopoeal bioassays. [05]

PHAR – 363 P
PHARMACOLOGY – III

PRACTICAL

Use of software alternative to animals for practical where possible.

1. To study the analgesic effect of drug on experimental animal.
2. To record the locomotion activity of a given drug on experimental animal by using actophotometer.
3. To record the muscle grip of animal by using rota rod.
4. To study the hypnotic effect of Diazepam on mice.
5. To study the anticonvulsant activity of phenytoin sodium by using MES method.
6. To study the local anesthetic activity of lignocaine hydrochloride on rabbit eye.
7. Bioassay of insulin
8. Bioassay of oxytocin
9. To study the effect of insulin
10. Clinical cases-I
11. Clinical cases-II

BOOKS RECOMMENDED:

1. Goodman & Gilman, The Pharmacological basis of Therapeutics, Limbird, P.B. Molinos, R.W. Ruddon and A.G. Gil, Pergamon press.
2. Katzung, B.G. Basic & Clinic Pharmacology, Prentice Hall, International.
3. Siddiqui, H.H., Essentials of Medical Pharmacology; Globalmedik Publishers, Delhi
4. Siddiqui, H.H., Bioassay of drugs, Globalmedik Publishers, Delhi
5. Rang MP, Dale MM, Ritter JM, Pharmacology Churchill Livingstone.
6. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi
7. Satoskar & Bhandarkar; Pharmacology & Pharmacotherapeutics., Popular Prakashan Pvt. Ltd. Bombay.
8. Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
9. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.

PHAR – 364
PHARMACOGNOSY – IV

THEORY

Unit – I

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic, macroscopic & microscopic features, specific chemical tests of the following alkaloids containing drugs:
 - a. **Pyridine – piperidine:** Tobacco, Areca & Lobelia.
 - b. **Tropane:** Belladonna, Hyoscyamus, Datura, Coca, Duboisia and Withania.
 - c. **Quinoline & Isoquinoline:** Cinchona, Ipecac, Opium.
 - d. **Indole:** Ergot, Rauwolfia, Catharanthus, Nux Vomica and Physostigmine. [08]

Unit – II

- e. **Imidazole:** Pilocarpus.
- f. **Steroidal:** Veratrum & Kurchi.
- g. **Alkaloidal Amines:** Ephedra & Colchicum.
- h. **Glucoalkalid:** Solanum.
- i. **Purines:** Coffee, Tea & Cola.
- j. **Quinazoline:** Vasaka. [07]

Unit – III

- Utilization, production & world wide trade of phytocostituents such as Tropane Alkaloids, Isoquinoline (Ipecac) & Quinoline Alkaloids (cinchona). [04]
- World wide trade in Medicinal plants & derived products namely, Rauwolfia, Taxol, Diosgenin, Digitalis, Liquorice, Papain, Ginseng, Aloe, Valerian & Plant laxatives. [08]

Unit – IV

- Biological sources, preparation, Identification tests and uses of following enzymes:** Diastase, papain, pepsin, trypsin & Pancreatin.
- Plant bitters & Sweeteners. [04]
- Chemistry & therapeutic activity of penicillin, Streptomycin & tetracycline. [02]
- Natural Allergens and Photosensitizing agents and fungal toxins. [02]

Unit – V

- Historical development of plant tissue culture, type of cultures, nutritional requirement, growth & their maintenance. Application of plant tissue culture in Pharmacognosy. [06]
 - Plant hormones and their applications. [02]
 - Polyploidy, Mutation & hybridization with reference to medicinal plants. [01]

PHAR – 364 P

PHARMACOGNOSY – IV

PRACTICAL

- Identification of crude drugs listed above.
- Microscopic study of characters of any 8 selected drugs given in theory in entire and powder form.
- Chemical evaluation of powdered drugs & enzymes.
- Chromatographic studies of some herbal constituents.
- Some experiments in plant tissue culture.

SUGGESTED PRACTICES:

- To study the morphology and microscopy of Datura and Withania.
- To study the morphology and microscopy of Ipecac and Rauwolfia.
- To study the morphology and microscopy of Catharanthus and Nux Vomica.
- To study the morphology and microscopy of Ephedra and Kurchi.
- To study the morphology and microscopy of Solanum and Vasaka.
- To study the
 - Morphology of Areca, Colchicum.
 - Transverse section of Catharanthus leaf and Kurchi bark.
- To study the TLC profile of Catharanthus leaf.
- To study the TLC profile of Withania root.
- Chemical test of Tea, Tobacco, Datura and Withania.
- Chemical test of Nux Vomica, Ephedra and Kurchi.
- Introduction of plant tissue culture techniques on laboratory scale.
- Preparation of agar slants.
- To grow callus culture in any defined media.
- Maintenance of callus culture.

PROJECT:

World wide trade of medicinal plants (Monograph).

BOOKS RECOMMENDED:

- Kokate CK, "Practical Pharmacognosy" Vallabh Prakashan, New Delhi.
- Wallis TE, "Analytical Microscopy J&A Churchill Ltd., London.

3. Gamborg & Wetter, Plant Tissue Culture methods, National Research Council of Canada, Saskatchewan.
4. Clarke ECG, Isolation and Identification of drugs. The Pharmaceutical Press, London.
5. Trease GE, Evans WC, "Pharmacognosy", Bailliere Tindall, East Borne, U.K.
6. Tyler VE et al, "Textbook of Pharmacognosy", Lea & Febiger, Philadelphia.
7. Wallis TE, "Textbook of Pharmacognosy", J & A Churchill Ltd., London.
8. Kokate CK et al, "Pharmacognosy", Nirali Prakashan, Pune.
9. Atal CK, Kapur BM, "Cultivation & Utilization of Medicinal Plants", RRL, Jammu.
10. Stahl E, Thin Layer Chromatography – A laboratory handbook, Springer Verlag, Berlin.
11. Henry TA, The Plant Alkaloids, McGraw hill, New York.
12. Vapoorte, Swedson, "Chromatography of Alkaloids".
13. Dixit VK, Vyas SP, Pharmaceutical Biotechnology, CBS Publication, ND.
14. Street HE, Tissue Culture & Plant Science, Academic Press, London.
15. Kokate CK, Gokhale AS, Gokhale SB, "Cultivation of Medicinal Plants", Nirali Prakashan.
16. "British Herbal Pharmacopoeia".
17. "Indian Herbal Pharmacopoeia".
18. Chaudhary R.R., "Herbal Drug Industry".
19. Peach K. & Tracey MV, "Modern Methods of Plant Analysis".

PHAR – 365

PROFESSIONAL COMMUNICATION – II

Unit – I

1. Written Skills:

- Proposals writing formats.
- Report writings.
- Business letters.
- Applications.
- Covering letters.
- Curriculum Vitae designing [10]

Unit – II

2. Productivity, time management simulation exercise.
3. Leadership skills.
4. Team Work "BSC", Boss, Subordinate & Colleagues. [06]

Unit – III

5. Group Discussions (GD)
 - Tips
 - GD [08]

Unit – IV

6. Corporate behaviour, corporate expectations, office etiquettes.
7. Extempore. [06]

Unit – V

8. Interview Tips:
 - What a student is supposed to do before the interview, during the interview, after the interview and on the day of interview.
 - Various questions that may be asked in an interview.
 - Model interview (video shooting & displaying optional)
9. Exit Interview [10]

BOOKS RECOMMENDED:

1. Raman, Meenakshi & Sharma Sangeeta, Technical Communications – Principles & Practice, Oxford University Press.
2. Sharma, RC & Krishna Mohan, Business Correspondence & Report Writing, Tata McGraw Hill Co.
3. Lesikar RV, “Lesikar’s Basic Business Communication”.

SEMESTER – VII**PHAR – 471****PHARMACEUTICAL BIOTECHNOLOGY****Unit – I****Immunology & Immunological Preparations:**

Principles, Antigens and haptens, immune system, cellular, humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, standardization and storage of BCG. [08]

Unit – II**Genetic Recombination:**

Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications, development of hybridoma technique for monoclonal antibodies, study of drugs protested by biotechnology such as activase, humulin and humatrope. [08]

Unit – III**Antibiotics:**

Historical development of antibiotics, antimicrobial spectrum and methods used for their standardization. Screening of soil for organisms producing antibiotics fermenter, its design, control of different parameters. Isolation of mutants, factors affecting mutation. [08]

Unit – IV**Microbial transformations:**

Introduction, type of reactions mediated by micro organisms, design of bio – transformation process, selection of organisms, biotransformation processes and its improvements with special reference to steroids. [08]

Unit – V**Enzyme Immobilization:**

Techniques of immobilization of enzymes, factors affecting enzyme kinetics, study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylases and proteases. Immobilization of bacteria and plant cells. [08]

BOOKS RECOMMENDED:

1. SP Vyas, VK Dixit, Pharmaceutical Biotechnology, CBS Publication, New Delhi.
2. Prescott & Dunn’s Industrial Microbiology, 4th Ed., 1987, CBS Publishers & Distributors, Delhi.
3. PF Stanbury & A Ahhtar, Principles of Fermentation Technology.
4. K Kieslich, Ed. Biotechnology, Vol. 69, Verlag Chernie, Switzerland, 1984.

5. PF Stanbury & A Whitaker & Hall SJ. Principles of Fermentation, Aditya Book Private Ltd. New Delhi.
6. Crueger W, Crueger A, Biotechnology – A textbook of Industrial Microbiology, Panima Publishing Cooperation, Delhi.

PHAR – 472
BIOPHARMACEUTICS & PHARMACOKINETICS
PHARMACEUTICS – VIII

THEORY

Unit – I

1. Introduction to Biopharmaceutics & Pharmacokinetics & their role in formulation, development and clinical setting.
2. In process quality control tests, IPQC problems in pharmaceutical industries.
3. Sampling planes, sampling and operating characteristics curves. [08]

Unit – II

4. **Pharmacokinetics:**
 - a. Compartment model & non – compartment model: Definition & Scope.
 - b. Pharmacokinetics of drug absorption – zero order & first order absorption rate constant using Wagner – Nelson 100 – Reigelman method.
 - c. Documentation: Protocols, Forms and maintenance of records in Pharmaceutical industry.
 - d. Preparation of documents for new drug approval and export registration. [08]

Unit – III

- e. Volume of distribution and distribution coefficient
- f. Compartment Kinetics – One compartment & preliminary information of multicompartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route. [08]

Unit – IV

5. **Clinical Pharmacokinetics:**
 - a. Definition and scope Dosage adjustment in patients with and without renal and hepatic failure.
 - b. Development of new analytical methods. [08]

Unit – V

6. **Bioavailability & Bioequivalence:**
 - a. Measures of bioavailability, C – max, area under the curve (AUC)
 - b. Review of regulatory requirements for conditions of bioequivalent studies. [08]

PHAR – 472 P
BIOPHARMACEUTICS & PHARMACOKINETICS

PRACTICAL

1. Experiments designed for the estimation of various pharmacokinetic parameters with given data.
2. In vitro evaluation of different dosage forms for drug release.
3. Absorption studies In Vitro.
4. Statistical treatment of pharmaceutical data.

SUGGESTED PRACTICES:

1. In – Vitro drug release study of the given powder dosage form using various dissolution medium.
2. In – Vitro drug release study of the given uncoated tablet dosage form using different dissolution medium.

3. In – Vitro drug release study of the given capsule dosage form using various dissolution medium.
4. In – Vitro drug release study of the given film coated dosage form using various dissolution medium.
5. In – Vitro dissolution study of the given sustained release dosage form.
6. In – Vitro dissolution study of the given fast release (M.D, Dispersible etc) dosage form.
7. To study the effect of hardness of tablet on dissolution rate.
8. To study the effect of various diluents on dissolution rate of dosage form (tablets, capsules, ointments, etc).
9. To study the effect of formulation on drug release (powder, suspension etc).
10. To determine the effect of protein binding on drug bioavailability.
11. To calculate various pharmacokinetic parameters from the given zero order drug data.
12. To calculate various pharmacokinetic parameters from the given first order drug data.
13. To calculate the various Pharmacokinetic parameters from the given blood data of IV bolus injection (one compartment model).
14. To calculate the various Pharmacokinetic parameters from the given urinary excretion data of IV bolus injection using both methods (Rate of elimination & sigma minus method one compartment model).
15. To determine the various Pharmacokinetic parameters from the given blood data of oral administration of dosage form.

DEMONSTRATION EXPERIMENTS:

1. Dissolution apparatus.
2. Use of semi log paper.
3. Operation of colorimeter & UV spectrophotometer.

BOOKS RECOMMENDED:

1. Notari, R.E., “Biopharmaceutics and Pharmacokinetics – An Introduction”, Marcel Dekker, Inc N.Y.
2. Rowland M, and Tozer T.N. “Clinical Pharmacokinetics”, Lea and Febiger, N.Y.
3. Wagner J.G. “Fundamentals of Clinical Pharmacokinetics”, Drugs Intelligence Publishers, Hamillton.
4. Florey, “Analytical Profile of Drugs” (All volumes).
5. “Indian Pharmacopoeia”.
6. “United States Pharmacopoeia”.
7. “British Pharmacopoeia”.

PHAR – 473

PHARMACOLOGY – IV

THEORY

Unit – I:

Anti-infective drugs – I

Introduction to antibiotics, Penicillins, Cephalosporins, Aminoglycosides, Macrolides. [08]

Unit – II:

Anti-infective drugs – II

Quinolones, Tetracyclines, Chloramphenicol & Vancomycin, Sulphonamides and Trimethoprim, Antifungals. [08]

Unit – III:

Antiprotozoals, Anthelmintics, Antivirals, Immunosuppressants, Chemotherapy of Cancer. [09]

Unit – IV:

Toxicology

Basic principles of toxicology, Measurements in toxicology, Heavy metal toxicity, Chelating agents, Poisoning and its management. [07]

Unit – V:

Nuclear Pharmacy

Introduction to Radiopharmaceuticals, radioactive half-life, Units of radioactivity, Production of radio pharmaceuticals, Radiation hazards and their prevention, specifications for radio-active laboratory. [07]

**PHAR – 473 P
PHARMACOLOGY – IV**

PRACTICAL

1. To study the clinical cases.

BOOKS RECOMMENDED:

1. Goodman & Gilman, The Pharmacological basis of Therapeutics, Limbird, P.B. Molinos, R.W. Ruddon and A.G. Gil, Pergamon press.
2. Katzung, B.G. Basic & Clinic Pharmacology, Prentice Hall, International.
3. Siddiqui, H.H., Essentials of Medical Pharmacology; Globalmedik Publishers, Delhi.
4. Siddiqui, H.H., Bioassay of drugs, Globalmedik Publishers, Delhi
5. Rang MP, Dale MM, Riter JM, Pharmacology Churchill Livingstone.
6. Tripathi, K.D. Essentials of Medical Pharmacology, Jay Pee Publishers, New Delhi
7. Satoskar & Bhandarkar; Pharmacology & Pharmacotherapeutics., Popular Prakashan Pvt. Ltd. Bombay.
8. Ghosh, MN; Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta.
9. Kulkarni S.K., Hand Book of Experimental Pharmacology, Vallabh Prakashan, Delhi.
10. Hasan, Hospital Pharmacy, Lea & Febiger, Philadelphia.
11. Merchant H.S. and Qadry J.S. Text Book of Hospital Pharmacy, B.S. Shah Prakashan, Ahmedabad.

**PHAR – 474
PHARMACEUTICAL CHEMISTRY – VI**

THEORY

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only)

Unit – I

1. **Steroid and related drugs:** Introduction, classification, nomenclature & Stereochemistry.
 - a. Androgens and Anabolic steroids: Testosterone, Stanzolol.
 - b. Estrogens and Progestational agents: Progesterone, Estradiol.
 - c. Adrenocorticoids: Prednisolone, Dexamethasone, Betamethasone. [08]

Unit – II

2. **Autocoids:**
 - a. **Antihistaminics:**
 - i. H₁ antagonists: Diphenhydramine, Mepyramine, Promethazine, Cyproheptadine, Cetirizine.
 - ii. H₂ antagonists: Ranitidine, Famotidine.
 - b. **Antineoplastics:** Chlorambucil, Thiotepea, Fluorouracil, Methotrexate, Busulphan. [08]

Unit – III

- c. **Analgesics and Antipyretics:** Aspirin, Mefenamic Acid, Ibuprofen, Diclofenac, Piroxicam.
3. **Sulphonamides:** Suphamethoxazole, Sulphadiazine, Sulphacetamide. [08]

Unit – IV

4. **Antibiotics:** Penicillines, semi – synthetic penicillins, streptomycin, tetracyclines, cephalosporins, chloramphenicol, fluoroquinolones, (Penicillin G, Ampicillin, Tetracycline, Chloramphenicol).
5. **Antimycobacterial Agents:** PAS, Ethambutol, Isoniazid, Dapsone. [08]

Unit – V

6. **Antimalarials:** Chloroquine, Primaquine Pyrimethamine.
7. **Antiprotozoals:** Metronidazole, Tinidazole, Diloxanide.
8. **Antiseptics / Disinfectants:** Benzalkonium, Nalidixic Acid.
9. **Anthelmintics:** Mebendazole.
10. **Antifungals:** Nystatin, Chlorphenesin. [08]

PHAR – 474 P PHARMACEUTICAL CHEMISTRY – VI (MEDICINAL CHEMISTRY – II)

PRACTICAL

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Establishing the pharmacopoeial standards of the drugs synthesized.
3. Spectral analysis of the drugs synthesized.

BOOK RECOMMENDED:

1. Mann PG, Saunders BC, “Practical Organic Chemistry”, ELBS/Longman, London.
2. Furniss BS, Hannaford AJ, Smith PWG and Tathell AR, Vogel’s “Textbook of Practical Organic Chemistry”, The ELBS/Longman, London.
3. Pharmacopoeia of India”, Ministry of Health, Govt. of India.
4. Wolff ME, Ed. Burger’s “Medicinal Chemistry”, John Wiley & Sons, New York.
5. Delgado JN, Remers WAR, Eds., Wilson and Gisworld’s “Textbook of Organic Medicinal Chemistry”, J. Lippincott Co., Philadelphia.
6. Foye WC, “Principles of Medicinal Chemistry”, Lea & Febiger, Philadelphia.
7. Singh Harkishan and Kapoor, V.K. “Organic Pharmaceutical Chemistry”, Vallabh Prakashan, Delhi.
8. Nogrady T, “Medicinal Chemistry – A Biochemical Approach”, Oxford University Press, New York, Oxford.
9. Finar IL, “Organic Chemistry”, Vol. I & II, ELBS/Longman, London.

PHAR – 475 HOSPITAL PHARMACY

THEORY

Unit – I

Organization and Structure: Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist. Pharmacy and therapeutics committee, budget preparation and implementation.

Hospital Formulary: Contents, preparation and revision of hospital formulary.

Unit – II

Drug Store Management and Inventory Control: Organization of drugs, types of materials stocked, storage conditions.

Purchase and Inventory Control: Principles, purchase procedures, purchase order, procurement and stocking.

Unit – III

Central sterile supply Unit and their Management: Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, supply of sterile materials.

Manufacture of Sterile and Non sterile Products: Policy making of manufacturable items, demand and costing personnel requirements, manufacturing practice, Master formula card, production control, manufacturing records.

Unit – IV

Drug Information Service: Sources of information on drugs, treatment schedules, procurement of information, computerized services (e.g. MEDLINE), Retrieval of information, Medication error.

Record and Reports: Prescription filling, drug profile, patient medication profile, case on drug interaction & adverse reactions, idiosyncratic cases etc.

Unit – V

Drug distribution system in Hospitals: Out – patient dispensing, methods adopted, Dispensing of drug to in – patients. Types of drug distribution systems, Charging Policy, labelling, Dispensing of drug to ambulatory patients, Dispensing of controlled drugs.

PHAR – 475 P

HOSPITAL PHARMACY

PRACTICALS

1. Design of Hospital Pharmacy layout.
2. Design of Layout of a Hospital.
3. Design of Purchase Order.
4. Design of Central Sterile Supply Unit.
5. Preparation of Purchase Order.
6. Design of Drug Store Layout.

PROJECT WORK:

Project report on Hospital Pharmacy.

BOOKS RECOMMENDED:

1. Hasan, Hospital Pharmacy, Lea & Febiger, Philadelphia.
2. Merchant H.S. and Qadry J.S. Textbook of Hospital Pharmacy, B.S. Shah Prakashan Ahmedabad.

PHAR – 476 P

Project Report on Summer Training

SEMESTER – VIII

ES – 101 ENVIRONMENTAL STUDIES

Unit – I

Multidisciplinary nature of environmental studies:

Definition, scope and importance need for public awareness. [2]

Unit – II

Natural Resources:

Renewable and non – renewable resources: Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation. Timber extraction, mining, dams and their effects on forest and tribal people.

Water resources: Use and over – utilization of surface and ground water, floods, droughts, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer – pesticide problems, water logging, salinity.

Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles. [6]

Unit – III

Ecosystems:

Concept an ecosystem and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) [6]

Unit – IV

Biodiversity and its Conservation:

Introduction: Definition, genetic, species and ecosystem diversity, biogeographical classification of India.

Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and optional values. Biodiversity at global, national and local levels, India as a mega – diversity nation, Hot – spots of biodiversity.

Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts, endangered and endemic species of India.

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. [6]

Unit – V

Environmental Pollution:

Definition, Cause, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies.

Disaster management: floods, earthquake, cyclone and landslides. [6]

Unit – VI

Social issue and the Environment:

From unsustainable development, urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns.

Environmental ethics: Issue and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation, consumerism and waste products. Environment protection Act. Air (Prevention and control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation, public awareness. [6]

Unit – VII

Human Population and the Environment:

Population growth, variation among nations. Population explosion – Family welfare Programme. Environment and human health, human rights, value education. HIV/AIDS, women and child welfare. Role of information technology in environment and human health. [4]

Unit – VIII

Field Work:

Visit to a local area to document environment assets river/forest/grassland/hill/mountain. Visit to a local polluted site – Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems – pond, river, hill slopes, etc.

Suggested Reading:

1. Environmental Studies by Benny Joseph, Tata McGraw Hill, 2005.
2. Environmental studies by Dr. D.L. Manjunath, Pearson Education, 2006.
3. Principles of Environmental Science and engineering by P. Venugopal Rao, Prentice Hall of India.
4. Environmental Science and Engineering by Meenakshi, Prentice Hall of India.

PHAR – 481

PHARMACEUTICAL ANALYSIS – III

THEORY

Unit – I

1. **Ultraviolet and Visible Spectrophotometry:** Electronic excitation, quantitative laws, deviation from Beer's law, graphical presentation of data. Chromophores photometric error, instrumentation, single and double beam instruments step in spectrophotometric measurement. Colorimetric method: Chemistry of colorimetry, instrumentation, application (direct methods and indirect methods). Nephelometry, turbidimetry and densitometry. [08]

Unit – II

2. **Infra Red Spectrophotometry:** Theory, characteristics, absorbance, bands of organic functional groups, interpretation of infrared absorption spectra, preparation of sample, sample cells, IR instrumentation, qualitative and quantitative applications in pharmaceutical analysis.
3. **Fluorimetric Analysis:** Theory, quantitative description, experimental factors affecting fluorescence intensity, factors affecting IC and F directly, relationship of fluorescence to molecular structure, instrumentation, correction of spectra, pharmaceutical application. [08]

Unit – III

4. **Nuclear Magnetic Resonance Spectroscopy:** An introduction to the theory of ^1H – NMR, chemical shift, spin – spin coupling, spectra of ($\text{CH}_3\text{CH}_2\text{OH}$, $\text{Cl-CH}_2\text{OH}$, CH_3CHO , $\text{CH}_3(\text{CH}_2)_4\text{CH}_3$, C_6H_6 , $\text{CH}_3\text{CH}_6\text{CH}_5$).
5. Principle, Instrumentation and Pharmaceutical applications of HPLC. [08]

Unit – IV

6. **Mass Spectrometry:** Introduction to mass spectra, molecular ion, peak, fragmentation peak, mass spectra of some simple compounds.
7. **Flame Photometry:** Origin of spectra, atomization and ionization, instrumentation, background emission, interference, qualitative & quantitative applications in pharmaceutical analysis. [08]

Unit – V

8. **Emission Photometry**
9. **Atomic Absorption Spectroscopy:** Origin of spectra, atomization and ionization, instrumentation, background emission, interference, qualitative & quantitative applications in pharmaceutical analysis. [08]

PHAR – 481P

PHARMACEUTICAL ANALYSIS – III

PRACTICAL

1. Assay of at least 10 official formulations containing single and more active ingredients using instrumental techniques.
2. Study of interpretation of a few spectra.

BOOKS RECOMMENDED:

1. Pharmacopoeia of India, Ministry of Health Govt. of India.
2. Beckett AH, Stenlake JB, “Practical Pharmaceutical Chemistry”, Vol. I & II, The Athlone Press of the University of London.
3. Chatten L.G. “A Textbook of Pharmaceutical Chemistry”, Vol. I & II, Marcel Dekker, New York.
4. Willard H.H. and Merritt L. Jr and Dean J.A. Instrumental Methods of Analysis, Van Nostrand Reinhold, 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 RM & Webster FX, Spectrometric Identification of Organic Compounds, John Wiley & Sons.
8. Skoog V, “Principles of Instrumental Analysis”, Holler- Neimen.

PHAR – 482

PHARMACOGNOSY – V (NATURAL PRODUCTS)

THEORY

Unit – I

1. Phytochemical Screening:
 - a. Chemical & Spectral approaches to simple molecules of natural origin. [02]
 - b. Introduction & classification of different chromatographic methods & their application in evaluation of herbal drugs.
 - c. Concept of Stereoisomerism with respect to the natural products. [05]

Unit – II

2. Biological Screening:
General methods of screening of natural products for following biological activity namely anti-inflammatory, hypoglycaemic, antibacterial, antifertility & psychopharmacological activity. [02]

Unit – III

3. General techniques of biosynthetic study & basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of Pharmaceutical Importance. [05]
4. Chemistry, Biogenesis and pharmacological activity of medicinally important monoterpenes, Sesquiterpens, diterpenses & triterpenoids. [03]

Unit – IV

5. Chemistry, Biogenesis, Isolation, Extraction and pharmacological activity of
 - a. **Carotenoids:** Beta carotenoids, alpha carotene, vitamin A, xanthophylls of medicinal important. [04]
 - b. **Glycosides:** Digitoxin, Digoxin, Hecogenin, Sennosoides, Diosgenin, Sarsapogenin [07]

Unit – V

- c. **Alkaloids:** Atropine & related compounds, quinine, reserpine, morphine, papavarine, ephedrine, ergot, and vinca alkaloids. [08]
- d. Medicinally important lignins, quassinoids, & flavanoids. [03]

PHAR – 482 P PHARMACOGNOSY – V

PRACTICAL

1. Laboratory experiments on isolation, separation, purification of various groups of chemical constituents of Pharmaceutical significance.
2. Exercises on paper & thin layer chromatographic evaluations of herbal drug constituents.
3. Extraction of volatile oils & their chromatographic profiles.

SUGGESTED PRACTICALS

1. Isolation of caffeine from Tea leaves.
2. Isolation of Piperine from Black Pepper.
3. Isolation of Hesperidin from Orange Peel.
4. Isolation of clove oil from clove.
5. Isolation of Caraway oil from caraway.
6. Isolation of cumin oil from cumin
7. To study the TLC profile of extracted oils.
8. To perform the column chromatography of any available herb.
9. To study the paper chromatographic profile of glycone portion separated from senna.
10. To isolate the active constituents of any available drug with the help of preparative TLC.
11. Quantitative determination of Ascorbic acid present in Amla. (Fresh/Dry)

BOOKS RECOMMENDED:

1. Brain KR, Turner TD, “The Practical Evaluation of Phytopharmaceuticals”, Wright, Bristol.
2. Sim, “Medicinal Plant Alkaloids & Glycosides”.
3. Kokate CK, “Practical Pharmacognosy”, Vallabh Prakashan, New Delhi.
4. Stahl E, “Thin Layer Chromatography”, A Laboratory Hand Book, Springer Verlag, Berlin.
5. Lala PK, “Elements of Chromatography”.
6. Harborne JB, “Phytochemical Methods”, Chapman & Hall International Ed, London.
7. Pharmacopoeia of India.

8. Finar IL, "Organic Chemistry", Vol. I & II, ELBS, London.
9. Agarwal OP, "Chemistry of Organic Natural Products", Vol I & II, Goel Pub. House, Meerut.
10. Trease GE, Evans WC, "Pharmacognosy", Bailleire Tindall East Bourne, U.K.
11. Tyler VE et al "Pharmacognosy", Lea & Febiger, Philadelphia.
12. Kokate CK, "Pharmacognosy", Nirali Prakashan, Pune.
13. Pridham JB, Swain T, "Biosynthetic Pathways of Higher Plants", Academic Press, New York.
14. Mittal AC, Clerk's "Isolation & Identifications of Drugs"
15. Dhavan BN, Srimal RC, "The use of Pharmacological Techniques for Evaluation of Natural Products", CDRI, Lucknow.

PHAR – 483

PHARMACEUTICAL INDUSTRIAL MANAGEMENT

THEORY

Unit – I

1. **Concept of Management:** Administrative Management (Planning, Organising, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/Morale) Principles of Management (Co-ordination, Communication, Motivation, Decision making, leadership, Innovation Creativity, Delegation of Authority/Responsibility, Record Keeping). Identification of key points to give maximum thrust for development and perfection. [12]

Unit – II

2. **Economics:** Principles of economics with special reference to the Laws of demand and supply, demand schedule, demand curves, procedure of exporting and importing goods. [04]
Accountancy: Principles of Accountancy, Journal, Ledger posting, preparation of trial balance, profits and loss account, balance sheet, rectification of errors. [02]

Unit – III

3. **Pharmaceutical Marketing:**
 - a. Introduction to pharmaceutical marketing, principles of marketing management, identification of the marketing. Market behaviour, prescribing habits of physician, patient motivation, market analysis.
 - b. Channels of distribution, wholesale, retail, department store, multiple shop and mail order business. Selection of stockist and distributors. [04]
 - c. Economic and competitive aspects in pharmaceutical marketing: Advertising, Detailing, Retail competition, International Marketing. [04]
4. **Salesmanship:** Principles of sales promotion, advertising ethics of sales, merchandising, literature, detailing, Recruitment training, evaluation, compensation to the pharmacist. [04]

Unit – IV

5. **Market Research:**
 - a. Drug development and the marketing research interface. Diversification and specialization, marketing of generic drugs.
 - b. Market segmentation & Market targeting. [05]

Unit – V

6. **Materials & Production Management:**
 Introduction, Purchase, stores, inventory control, visible and invisible inputs, maintenance management. [05]

BOOKS RECOMMENDED:

1. Beri, Market Research, Tata McGraw Hill.
2. Chary SN, "Production and Operative Management", Tata McGraw Hill.
3. Datta AK, "Material Management", PHI.

4. Chadwick Lesile, "The Essence of Management Accounting", PHI.
5. Massaie L. Joseph, "Essentials of Management", PHI.
6. Barthwal RR, "Industrial Economics", New Age International.
7. Shreenivasan KR, "An Introduction to Industrial Management", Vikas.
8. Daver Rustam S. "Salesmanship and Publicity", Vikas.
9. Mohammad Ali, "Drug Store Management", CBS Publishers.
10. Mukopadhyay Sekhar, "Pharmaceutical Selling", Sterling Publisher.
11. Koontz H, Wehrich H, "Essentials of Management", Tata McGraw Hill.
12. Smith, Mickey C, "Principles of Pharmaceutical Marketing", CBS Publishers & Distributers.
13. Kotler, Philip, "Marketing Management", Pearson Education Asia.

PHAR – 484
PHARMACEUTICAL CHEMISTRY – VII
(MEDICINAL CHEMISTRY – III)

THEORY

Unit – I

1. Drug metabolism and Concept of Prodrugs.

QSAR and introduction to molecular modelling, Computer Aided Drug Design.

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic procedures of individually mentioned drugs only.)

2. Diuretics: Acetazolamide, chlorthiazide, Frusemide, Triamtrene, Spironolactone. [08]

Unit – II & III

3. Cardiovascular Agents: Antianginal & Vasodilators, antiarrhythmics, antihypertensives, anticoagulants, antihyperlipidemics.

4. Cardiotonics: Nifedipine, Procainamide, Propanolol, Atenolol, Methyldopa, Guanethidine, Captopril, Pentolamine, Clofibrate, Warfarin, Phenidione.

5. Diagnostic Agents: Iopanoic acid. [14]

Unit – IV

6. Anti HIV agents: Zindovudine, Zalcitabine, Saquinavir.

7. Antivirals: Amantadine, Acyclovir, Lamivudine.

8. Prostaglandins: Misoprostol, Carboprost. [08]

Unit – V

9. Thyroid and Anithyroids: Carbimazole, Levothyroxine, Propylthiouracil, Methimazole.

10. Insulin & Oral Hypoglycaemics: Chlorpropamide, Metformin, Tolbutamide, Glybenclamide. [10]

BOOKS RECOMMENDED:

1. "Pharmacopoeia of India", Ministry of Health, Govt. of India.
2. Wolff ME, Ed, Burger's "Medicinal Chemistry" John Wiley & Sons, New York.
3. Delagado JN, Remers W A R, Eds. "Wilson and Gisword's Text Book of Organic Medicinal and Pharmaceutical Chemistry", J. Lippincott Co. Philadelphia.
4. Foye WC, "Principles of Medicinal Chemistry", Lea & Febiger, Philadelphia.
5. Singh Harkrishan and Kapoor V.K. "Organic Pharmaceutical Chemistry", Vallabh Prakashan, Delhi.
6. Nogrady T, "Medicinal Chemistry- A Biochemical Approach", Oxford University Press New York, Oxford.
7. Finar IL, "Organic Chemistry", Vol. I & II, ELBS/Longman, London.

8. Hans C, "Comprehensive Medicinal Chemistry, Vol. IV Quantitative Drug Design", Pergamon Press Oxford.

PHAR – 485

CLINICAL PHARMACY AND DRUG INTERACTIONS

THEORY

Unit – I

1. Clinical Pharmacy:

1. Concept of Pharmacotherapy
2. Pre – clinical evaluation of drugs
3. Clinical Evaluation of drugs
4. Drugs in elderly

Unit – II

2. Pharmacotherapeutics:

- i. Sampling Procedures
- ii. Data collection in clinical test
- iii. Application of statistical methods

Unit – III

3. Important Disorders of organ system & their management – I:

1. Cardiovascular System: Hypertension, congestive heart failure, angina pectoris, myocardial infarction.
2. Metabolic Disorders: Diabetes mellitus, rheumatoid arthritis, gout

Unit – IV

4. Important Disorders of organ system & their management – II:

- i. CNS Disorders: Epilepsy, Parkinsonism, Depression,
- ii. Gastrointestinal Disorders: Peptic ulcer, Ulcerative colitis, infective & non infective diarrhoeal diseases

Unit – V

5. Infectious Diseases:

- i. Upper & lower respiratory tract infections.
- ii. Neoplastic Disorders: Acute Leukaemias, Hodgkin's disease.

PHAR – 485 P

CLINICAL PHARMACY AND DRUG INTERACTIONS

PRACTICAL

Clinical case discussions

BOOKS RECOMMENDED:

1. Barar FSK, "Text book of Pharmacology", Interprint, New Delhi.
2. Goodman & Gilman, "The Pharmacological Basis of Therapeutics", Ed. JG Harman, LE Limbird, PB Molinoss, RW Ruddon AG Gillo, Pergamon Press.
3. Katzung BG, "Basic & Clinical Pharmacology", Prentice Hall, International.
4. Laurence R, Bennet PN, "Clinical Pharmacology", Churchill Livingstone.
5. Tripathi KD, "Essentials of Medical Pharmacology", Jay Pee Publishers, New Delhi.

6. Rang MP, Dale MM, Ritter JM, "Pharmacology", Churchill Livingstone.
7. Satoskar & Bhandarkar, "Pharmacology & Pharmacotherapeutics", Popular Prakashan, Pvt. Ltd. Bombay.
8. Davidson's Principles and Practice of Medicine, ELBS Churchill Livingstone.
9. Herfindal ET, Hirashman JL, "Clinical Pharmacy and Therapeutics", Williams and Wilkins.
10. Parthasarathi G, Nyfort-Hansen K, Nahata MC, A Textbook of Clinical Pharmacy Practice: Essential Concept and Skills, Orient Longman.

PHAR – 486 P

Industrial Tour, Project report & presentation