

# **SYLLABUS**

## **For**

# **Bachelor of Pharmacy**



**Faculty of Pharmacy,  
Integral University,  
Dasauli, Kursi Road,  
Lucknow-226026**

**w.e.f. session 2015-2016**

## SEMESTER – I

### MT107

#### PHARMACEUTICAL MATHEMATICS AND BIOSTATISTICS

##### Unit I

Limit of functions, differentiation of logarithmic, trigonometric and exponential function (not proof), chain rule, integration as reverse of differentiation, method of substitution. [08]

##### Unit II

Linear differential equation with constant coefficients: complementary function and particular integral ( $e^{ax}$ ,  $x^n$ ,  $\sin ax$ ,  $\cos ax$ ). [08]

##### Unit III

Methods of collection of data, diagrammatic representation of data (Pie, Histogram, Bar diagram), types of sampling; mean, median, mode and standard deviation. [08]

##### Unit IV

Karl Pearson's coefficient of correlation, regression, method of least square of straight line, t test,  $\chi^2$  test, F test. [08]

##### Unit V

Probability: Simple probability, addition and multiplication of probabilities, binomial, Poisson's and normal distributions. [08]

#### BOOKS RECOMMENDED

1. Blair R.C., Taylor, R.A. Biostatistics for the Health Sciences, Dorling Kindersley India Pvt., Ltd.
2. Gupta S.P. Statistical Methods, Sultan Chand & Sons.
3. Khan I.A. and Khanum, A. Biostatistics for Pharmacy, Ukaaz Publications.
4. Prasad G. Textbook of Differential Calculus, Pothishala Pvt. Ltd.
5. Prasad G. Textbook of Integral Calculus, Pothishala Pvt. Ltd.
6. A Textbook of Mathematics for XI-XII Students, Vol. I-IV, NCERT Publications.

### PR111

#### PHARMACEUTICAL ANALYSIS-I

##### 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. [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-dichlorophenolindophenol. [10]

#### Unit – IV

##### **Precipitation Titrations:**

Precipitation reaction, 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]

### PR112

## 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.

**PR113**  
**PHARMACEUTICAL CHEMISTRY-I**  
**(INORGANIC PHARMACEUTICAL CHEMISTRY)**

**THEORY**

**Unit – I**

An outline of methods of preparation, uses, sources of impurities, tests for 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**.

Inhalants (Oxygen), anesthetics (Nitrous oxide).

Dental Products: Dentifrices (Calcium carbonate, Calcium phosphate), anti-caries agents (Sodium fluoride). [08]

**Unit – II**

Gastrointestinal Agents: Acidifying agents (Dilute hydrochloric acid), antacids (Bismuth sub-carbonate, Aluminium hydroxide, Calcium carbonate, Magnesium hydroxide, Magnesium oxide {light and heavy}, Magnesium carbonate {light and heavy}, protectives and adsorbents (Activated charcoal), cathartics ( Magnesium sulphate).

Pharmaceutical Acid & Necessities: Acids and bases (Sodium hydroxide, Hydrochloric acid), buffers, anti-oxidants (Hypophosphorus acid, Sodium metabisulphite), water and pharmaceutically acceptable glass. [08]

**Unit – III**

Major intra & extracellular electrolytes: Physiological ions, Electrolytes used for replacement therapy (Sodium chloride, Potassium chloride, Calcium gluconate, Calcium lactate, Magnesium chloride), Physiological acid-base balance (Sodium dihydrogen phosphate, Sodium acetate, Sodium bicarbonate) & combination therapy including ORS. [08]

**Unit-IV**

Essential and Trace Elements: Iron and hematinics (Ferrous fumarate, Ferrous gluconate, Ferrous sulphate, Ferric ammonium citrate), mineral supplements (Cu, Zn, Cr, Mn, I).

Co-ordination theory, chelates and their pharmaceutical importance.

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

**Unit –V**

Topical Agents: Protectives (Calamine, Titanium dioxide, Talc, Kaolin), astringents (Zinc sulphate, Alum) and anti infectives (Boric acid, Hydrogen peroxide, Iodine, Povidone-Iodine, Potassium permanganate, Silver nitrate).

Miscellaneous Agents: Respiratory stimulants (Carbon dioxide), sclerosing agents (Sodium tetradecyl sulphate), expectorants (Ammonium chloride, Potassium iodide), emetics (Zinc sulphate), poison antidotes (Sodium thiosulphate, Sodium nitrite), sedatives (Potassium bromide). [08]

**PR-114**  
**PHARMACEUTICAL CHEMISTRY-I**  
**(INORGANIC PHARMACEUTICAL CHEMISTRY LAB)**

**List of Experiments**

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

**BOOKS RECOMMENDED**

1. Block, J.H., Roche, E., Soine, T., and Wilson, C. Inorganic Medicinal & Pharmaceutical Chemistry, Lea & Febiger.
2. Discher, C.A., Medwick, T., Bailey, L.C. Modern Inorganic Pharmaceutical Chemistry, Hardcover, Import, Jan 1985.
3. Indian Pharmacopoeia, Ministry of Health and Family Welfare, Govt. of India, 2012.
4. Chatwal, G.R. Pharmaceutical Chemistry-Inorganic. Himalaya Publishing House.

**PR-115**  
**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.

**Pharmaceutical Additives:** Colouring, flavouring & sweetening agents, co-solvents, preservatives, surfactants, antioxidants & their applications. [07]

**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.

**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. [10]

### PR116 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 Tynhall.
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.

## **PR117**

### **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. [08]

##### **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]

**PR118**  
**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, & Anagnostikos 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.

**Essential Professional Communication**

**Course Code: LN 104**

**L T P**

**Teaching hours/week: 4**

**3 1 0**

**Total No. of Hours: 40**

**UNIT I: Professional Communication (8 hours )**

Professional Communication: Its meaning & importance, Essentials of Effective Communication, Barriers to Effective Communication, The Cross Cultural Dimensions of Professional Communication

**UNIT II: Language through Literature (8 hours )**

**A. Essays:**

“The Effect of the Scientific Temper on Man” by Bertrand Russell

“The Aims of Science and Humanities” by Moody E. Prior

**B. Short Stories:**

“The Meeting Pool” by Ruskin Bond

“The Portrait of a Lady” by Khushwant Singh

**UNIT III: Basic Vocabulary (8 hours )**



Euphemism , One-word Substitution, Synonyms, Antonyms, Homophones, Idioms and Phrases, Common mistakes, Confusable words and expressions, Portmanteau words, Foreign words and expressions.

**UNIT IV: Basic Grammar** (8 hours )

Articles, Prepositions, Tenses, Concord (Subject-Verb agreement), Modal Auxiliaries, Verbs: its Kind & Uses, Degrees of Comparison, Punctuation.

**UNIT V: Basic Composition** (8 hours )

Report writing: What is a report? Kinds and objectives of reports, writing reports.

Business Letter writing: Introduction to business letters, types of business letters, Layout of business letters, Letter of Enquiry / Complaint

Proposal writing

**Books Recommended:**

1. Lata , Pushp & Kumar, Sanjay .*Communication Skills* , Oxford University Press-2012
2. Quintanilla ,Kelly M. & Wahl ,Shawn T.*Business and Professional Communication* , Sage Publications India Pvt. Ltd-2011
3. Juneja, Om P & Mujumdar, Aarati .*Business Communication :Techniques and Methods*, Orient Black Swan-2010
4. Arora, V. N. & Chandra, Lakshmi . *Improve Your Writing: From Comprehensive to Effective Writing*, Oxford University Press-2010 (For the prescribed essays- “The Effect of the Scientific Temper on Man” by Bertrand Russell &“The Aims of Science and Humanities” by Moody E. Prior)
5. Mukherjee, Meenakshi .*Let’s Go Home and Other Stories*, Orient Black Swan-2009 (For the prescribed short stories-“The Meeting Pool” by Ruskin Bond, “The Portrait of a Lady” by Khushwant Singh)
6. Quirk , Randolph & Greenbaum ,Sidney .*A University Grammar of English*,Pearson-2013
7. Bolton, David & Goodey, Noel .*English Grammar in Steps*, Orient Black Swan.
8. Sethi, J. *Standard English And Indian Usage: Vocabulary and Grammar*, PHI Learning Pvt. Ltd . -2011
9. Bhaskaran, M. P. & Horsburgh, D .*Strengthen Your English*, Oxford University -1973
10. Greenbaum, Sidney . *The Oxford English Grammar* ,Oxford University Press, New York - 1996
11. Bovee, Courtland L. & Thill, John V.*Business Communication Essentials* ,Pearson
12. Board of Editors. *Written and Spoken Communication in English*, University Press-2007
13. Gairns, R. & Radman, S. *Working with Words: A Guide to Teaching and Learning Vocabulary Building*. Cambridge: Cambridge University Press-1986
14. Lewis, M. H. *Words Power Made Easy*, Goyal Publishers and Distributors Pvt. Ltd-1979
15. McCarthy, M. *Vocabulary*, Oxford University Press-1990

## SEMESTER – II

### PR121

## PHYSICAL CHEMISTRY IN PHARMACY

### 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 adsorption 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 – H<sub>2</sub>O, NaCl – H<sub>2</sub>O 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]

### PR122

## 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.

### PR123

## 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, arenes, 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]

### PR124

## PHARMACEUTICAL CHEMISTRY – II

### (ORGANIC CHEMISTRY – II)

#### PRACTICAL

1. Identification of elements and functional groups in given sample.
2. Purification of solvents like Benzene, chloroform, acetone, preparation of absolute alcohol.
3. Synthesis of compounds involving benzylation, acetylation, bromination, reduction & oxidation.
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".

### PR125

## 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. [11]

#### 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]

### PR126

## 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, Anagnostokos 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.
10. Keele CA, Niel E, Joel N, Samson Wright's Applied Physiology, Oxford University, Press.

## CS111

### 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, application of computers in pharmacy. [07]

##### Unit - II

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

**Linux (Ubuntu):** Introduction, basic Linux commands such as creating, remove, change directory command, file related commands like- creating & copying file, LS, renaming file.

**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. [08]

##### Unit - III

**Word:** Word Essentials, the word workplace, Parts of MS Word screen, , Finding and Replacing, use of spell-check & grammar, thesaurus and scientific symbols, viewing of document by various ways, Editing Tools, Page Setup, Working with Tables, Protecting Documents, Use of Mail Merge.

**Excel:** Introduction to EXCEL worksheet, Edit spreadsheet using formula and functions, Format spreadsheet, print spreadsheet, 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.

**PowerPoint:** Creating and viewing a presentation, adding animations and managing slide shows etc. [08]

##### Unit - IV

**Networking & Internet:** Computer networks, Basic components for creating network. Definition of Internet, software and hardware requirement for internet, uses of Email, study of pharmaceutical web sites. [4]

##### Unit – V

**Programming: Introduction of algorithm & flowchart.**

**'C' Language:** Introduction to 'C' Language, types of languages, 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. [13]

## CS112

### COMPUTER FUNDAMENTALS & PROGRAMMING

#### Exercises based on the following are to be dealt:

1. Computer operating system like Linux(Ubuntu)\Windows.
2. Simple Program in 'C' Language.
3. Introduction to Open Office (Word, 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.

## PR127

### PHARMACEUTICS – II (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

**Micromeretics and Powder 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]

**PR128**  
**PHARMACEUTICS – II**  
**(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 – III

### PR231

## PHARMACEUTICS – III

### (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]

### PR232

## PHARMECEUTICS – III

### (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.

### **PR233**

## **PHARMACEUTICS – IV (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 & Pharmacoeconomics
13. Rational drug therapy. [10]

### **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.

## PR234

### 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, Kjeldahl 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]

## PR235

### 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.

## FUNDAMENTALS OF PATHOPHYSIOLOGY

### THEORY

#### Unit – I

- a) **Cell injury:** Causes, 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. [06]

#### 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. [08]

#### 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.

# ENVIRONMENTAL STUDIES

## (ES-101)

L T P  
2 1 0

### Unit-I

Multidisciplinary nature of Environmental studies. Definition, Scope and Importance , Need for public awareness.

#### Natural resources:

#### Renewable and non-renewable resources :

Natural resources and associated problems.

- a. Forest Resources:** Use and over exploitation, deforestation, case studies.  
Timber extraction, mining, dams and their effects on forests and tribal people.
- b. Water Resources:** Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.
- c. Mineral Resources:** Use and exploitation, environmental effects of extracting and using minerals resources, case studies.
- d. Food Resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer -pesticide problems, Water-logging, Salinity, case studies.
- e. Energy Resources:** Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, case studies.
- f. 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 life styles.

### Unit-II

#### Ecosystems

4. Concept of an Ecosystem.
5. Structure and Function of an Ecosystem.
6. Producer Consumer and decomposers.
7. Energy flow in the Ecosystem.
8. Ecological Succession.
9. Food chains, Food webs and Ecological Pyramids.
10. Introduction, types, characteristics features ,structure and function of the following ecosystem:
  - a- Forest Ecosystem
  - b- Grassland Ecosystem
  - c- Desert Ecosystem,
  - d- Aquatic Ecosystem: (Ponds, streams, lakes, rivers, oceans, estuaries)

## **Unit-III**

### **Biodiversity and its conservation**

1. Introduction - Definition: Genetic, Species and Ecosystem diversity.
1. Bio-Geographical classification of India,
2. Value of Bio-diversity: Consumptive use, productive use, Social, ethical, aesthetic and option values
3. Biodiversity at Global, National & Local levels.
4. India as a Mega Diversity Nation.
5. Hotspots of Biodiversity
6. Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts
7. Endangered and endemic species of India
8. Conservation of Biodiversity: In-situ and Ex-situ conservation of biodiversity.

## **Unit-IV**

### **Environmental Pollution**

#### Definition

1. Causes, effects and control measures of
  - a) Air Pollution
  - b) Water Pollution
  - c) Soil Pollution
  - d) Marine Pollution
  - e) Noise Pollution
  - f) Thermal Pollution
  - g) Nuclear Hazards
1. Solid Waste Management: Causes, effects and control measures of urban and Industrial Wastes.
2. Role of an Individual in prevention of pollution.
3. Pollution case studies
4. Disaster Management: floods, earthquake, cyclones and landslides.

## **Unit-V**

### **Social Issues and the Environment**

1. From unsustainable development to sustainable development
2. Urban problems related to Energy
3. Water conservation, Rain water Harvesting, Watershed management
4. Resettlement and Rehabilitation of people; its problems and concerns, case studies.
5. Environmental ethics: issues and possible solutions
6. Green house effect and global Warming, effects of acid Rain and their remedial measures and ozone Layer depletion.
7. Wasteland reclamation,
8. Consumerism and waste products
9. 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, case studies.

## Human Population and the Environment

11. Population growth variation among nations, Population Explosion, Family welfare programme,
12. Environment and Human Health,
13. Human Rights.
14. Value education
15. HIV/AIDS, Women and Child welfare
16. Role of Information Technology in Environment and Human Health, Case studies.

### Suggested field work

Visit to local area to document environment assets river/ forest/ grassland/ hill/ mountain, visit to local polluted site urban/ rural/ industrial/ agricultural, study of common plants, insects, birds, study of simple ecosystems pond river, hill slopes etc.

### References:

5. Agarwal, K.C. 2001 Environmental; Biology, Nidi Pub. Ltd. Bikaner.
6. Bharucha Erach, The Biodiversity of India, Mappin Pub. Pvt. Ltd., Ahmedabad-380, India.
7. Brunner R.C. 1989. Hazardous waste incineration, Mc Graw Hill.
8. Clark R.S. Marine Pollution, Clarendon Press Oxford (TB).
9. Cunningham W.P. 2001. Cooper, T.H. Gorhani, E&Hepworth, Environmental encyclopedia, Jaicob Publication House, Mumbai.
10. De . A.K. Environmental chemistry Willey Eastern Limited.
11. Down to Earth, Centre for Science and Environment(R).
12. Glick, H.P. 1993 water in crisis, Pacific Institute for studies in dev, Environment & security, Stockholm Env, Institute, Oxford Univ, Press 473 p.
13. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).
14. Heywood, V.H. & Watson, R.T. 1995. Global biodiversity Assessment .Cambridge Univ. Press 1140 p.
15. Jadhav, H. and Bhosale, V.M. 1995 Environmental protection and laws, Himalaya pub, house, Delhi. 284 p.
16. Mckinnery, M.L. and school, R.M. 1996 Environmental science systems and solutions, web enhanced edition 639 p.
17. Mhaskar A.K. Matter Hazardous, Techno Science Pub (TM)
18. Miller T.G. Jr, Environmental Ecology, W.B. Saunders Co. USA, 574 p.
19. Odum, E.P. 1997. Fundamental chemistry, Goel Pub House Meerut.
20. Survey of the Environment, The Hindu (M).
21. Sharma B.K. 2001. Environmental Chemistry, Goel Pub .House Meerut.
22. Survey of the Environment, The Hindu (M).
23. Townsend C, Harper J, and Michel Begon, Essentials of Ecology, Blackwell Science (TB).

### BOOKS RECOMMENDED:

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.

**PR237**  
**PHARMACOGNOSY – I**

**THEORY**

**Unit – I**

Definition, history, scope and development of pharmacognosy.

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.

2. **Classification of Drugs:** Alphabetical, Morphological, taxonomical, chemical & pharmacological. [08]

**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. [05]

**Unit – III**

4. **Systematic Pharmacognostic Study of following:**

- a) Carbohydrates & derived products: Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia & Tragacanth.
- b) Lipids: Beeswax, Castor oil, Cocabutter, kokum butter, Hydnocarpus oil, Cod liver oil, Shark liver oil, Linseed oil, Wool fat, rice – bran oil, Lard & Suet. [15]

**Unit – IV**

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

**Pharmaceutical aids:** Study of pharmaceutical aids like Talc, Diatomite, Kaolin, Bentonite, Fullers earth, Gelatine and Natural Colours. [05]

**Unit – V**

6. **Cultivation, Collection, Processing & Storage of Crude Drugs:**

- a) Factors influencing cultivation of medicinal plant, type of soils & fertilizers of common use.
- b) Pest management & natural pest control agents.
- c) Poly Houses / Green Houses for cultivation.

7. **Herbal formulations & cosmetics** [07]

**PR238**  
**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.

## **PROFESSIONAL COMMUNICATION LAB**

**Course Code: LN 151**  
**Teaching hours/week: 3**

**L T P**  
**0 0 3**

### **1.Introduction**

Difference between Introduction and Description, SWOT Analysis

### **1.Software –I**

Listening exercises, Pronunciation improvement through self- testing, Vocabulary improvement through word games

### **1.Software – II**

Conversational skills, Exercises based on Language Skills/ Small talk, Cultural movies

## **1. Phonetic Alphabet and Phonetic Transcriptions**

### **1.Intonation and Stress**

#### **1.Framing Questions**

Yes/ No questions, Wh- questions, Question tags, Rhetorical questions

#### **1.Group Discussion and Group Presentation**

(theory and practice sessions , visual aids)

#### **1.Situational Conversation**

Social language, Emergency situation, Seeking help, Inquiries, Communicating bad news

#### **1. Negotiation**

Common fears about negotiations, Building Momentum, Bargaining with more powerful opponents, Opening Tactics, Countering your opponents' moves

#### **1.Mock Interview Sessions**

### **Books Recommended:**

- 1.*Oxford Advanced Learner's Dictionary*, Oxford University Press (latest edition)
- 2.Jones, Daniel. *The Cambridge English Pronouncing Dictionary*: (latest edition)
- 3.Dixon, Robert J. *Everyday Dialogues in English* ,PHI Learning Pvt. Ltd.-2011
- 4.O'Connor, J. D. *Better English Pronunciation*, Universal Books Stall-1991
- 5.Mitra, Barun K. *Personality Development & Soft Skills*, Oxford University Press-2011
- 6.Thorat, Ashok. *Enriching Oral & Written Communication in English*, Orient Black Swan - 2012
- 7.Lata, Pushp & Kumar, Sanjay . *Communicate or Collapse :A Handbook of Effective Public Speaking , Group Discussions and Interviews*, PHI Learning Pvt. Ltd -2011
- 8.Lee, Michael Soon. *Black Belt Negotiating*, BPI India Pvt. Ltd.-2012
- 9.Hames, S David. *Negotiation*, Sage Publication Pvt. Ltd.-2012

## **SEMESTER – IV**

### **PR240 PHARMACEUTICS – V (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]

### **PR241 PHARMACEUTICS – V (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, Banchemo 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.

## **PR242**

### **ESSENTIAL OF PHARMACEUTICAL MICROBIOLOGY**

#### **THEORY**

##### **Unit – I**

Introduction and scope of microbiology, Structure of bacterial cell, Classification of microbes and their taxonomy: Bacteria and viruses. [08]

##### **Unit – II**

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

##### **Unit – III**

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

##### **Unit – IV**

Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation. Physical and chemical methods to control microbes. Sterilization, different methods, validation of sterilization methods & equipments, Preservative efficacy, Personal microbiology. [10]

##### **Unit – V**

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

## **PR243**

### **ESSENTIAL OF 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. Gunasekaran 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, Klein 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

### **PR244**

## **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. [11]

#### **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]

## PR245

## 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.

### BOOKS RECOMMENDED:

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

16. Kokate CK, Gokhale AS, Gokhale SB, "Cultivation of Medicinal Plants", Nirali Prakashan.  
17. "British Herbal Pharmacopoeia".  
18. "Indian Herbal Pharmacopoeia".  
19. Chaudhary R.R., "Herbal Drug Industry".

**PR246**

**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:**

- a) Monosaccharides – Glucose and fructose.  
b) Disaccharides – Sucrose, lactose and maltose.  
c) 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 Meerwin– Ponndorf Verley reduction, Oppenauer oxidation, Beckmann rearrangement, Mannich reaction, Diel's - alder reaction, Michael reaction, Reformatsky reaction and Knoevenagal reaction. [08]

**Unit – V**

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

PR247

**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.

PR248

**BASIC OF PHARMACOLOGY**

**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. [08]

**Unit – II**

**General Pharmacological Principles– II:**

Drug-receptor interactions, 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. [08]

**Unit – III**

**Drugs affecting Autonomic Nervous System– I:**

Neurohumoral transmission and action potential, Cholinergic drugs, Cholinesterase inhibitors, Anticholinergics. [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 H<sub>1</sub>-Antagonists, 5-HT and its antagonist, Prostaglandins, Renin-angiotensin system, Kalikrien – Kinin system, Cytokines. [08]



## 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 & Pharmacotherapeutics., 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

### PR350 PHARMACEUTICAL CHEMISTRY – IV (BIOCHEMISTRY)

#### THEORY

##### Unit – I

1. **Enzymes:** Nomenclature, enzymes kinetics and its mechanism of action, mechanism of inhibition of enzymes, isoenzymes of LDH, CPK, ALP and ADP 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, Glycogenesis Gluconeogenesis and Glycogenolysis. Metabolism of galactose and galactosemia. The citric acid cycle, significance, reactions and energetics of the cycle. [08]

##### Unit – III

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

##### Unit – IV

6. Biosynthesis of amino acids: Catabolism of amino acids and conversion of amino acids to specialized products, biosynthesis of purine and pyrimidine nucleotide, formation of deoxyribonucleotides.
7. 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

8. Genetic Code and Wobble hypothesis, Protein synthesis: components of protein synthesis, inhibition of protein synthesis.
9. Regulation of gene expression, Lac Operon and Trp Operon. [08]

### PR351 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.

**PR352**

**PHARMACEUTICS – VI**  
**(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]

**PR353**  
**PHARMACEUTICS – VI**  
**(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<br>Chloral Hydrate BP                         |
| (ii) Suspensions | : | Magnesium sulphate oral suspension BP<br>Milk of magnesia IP Aluminium Hydroxide gel IP |
| (iii) Emulsions  | : | Liquid paraffin oral emulsion BP  |

**B. Semi – Solids:**

- |                    |   |   |
|--------------------|---|---|
| (i) Ointments      | : | Salicylic acid ointment BP<br>Whitfield ointment BP<br>Compound benzoic acid ointment |
| (ii) Suppositories | : | Glycerine suppositories BP<br>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.  
Mittal BM, Saha RN, A Handbook of Cosmetics, Vallabh Prakashan

### PR354

## FUNDAMENTALS OF PHARMACOLOGY

### THEORY

#### Unit – I

Drugs used in rheumatoid arthritis and gout, NSAIDs. [05]

#### 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:

Drugs used in congestive heart failure, Antihypertensives, Antianginals, Antiarrhythmics, Hypolipidemics, Diuretics & Antidiuretics. [11]

#### 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 and Ulcerative colitis, Laxatives, Antidiarrhoeals, Emetics & Antiemetics. [08]

### PR355

## FUNDAMENTALS OF PHARMACOLOGY

### 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, Ritter 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.
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.

**PR356**  
**PHARMACOGNOSY – III**

**THEORY**

**Unit – I**

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 & genin moiety)**

1. **Saponins:** Liquorice, Ginseng, Dioscorea, Coleus species.
2. **Cardioactive sterols:** Digitalis, Squill, Strophanthus & Thevetia.
3. **Anthraquinone Cathartics:** Aloe, Senna, Rhubarb & Cascara. [10]

**Unit – II**

**a) Food stuff analysis**

Study of the sources, chemical compositions, adulterants, uses and estimation of carbohydrate, protein, lipid, milk and vitamin products.

**b) Utilization and production of phytoconstituents such as calcium sennosoides, Diosgenin, Solasodine & Podophyllotoxin.** [07]

**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. [08]

**Unit – IV**

Punarnava, Chitrak, Apamarg, Gokharu, Shankhpushpi, Brahmi, Methi, Lehsun, Guggul, Gymnema, Shilajit, Tulsi, Malkanguni, Psoralia, Ammi majus, Ammi visnaga, Gentian, Saffron, Chirata, Quassia, Kalmegh 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]

**PR357**  
**PHARMACOGNOSY – III**

**PRACTICAL**

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

**SUGGESTED PRACTICALS**

1. Morphology and microscopy (powder) of liquorice along with its chemical tests.
2. Morphology of Aloe and chemical tests on Aloe extracts.
3. Morphology and Microscopy (powder and T.S.) of Thevatia
4. Morphology and Microscopy (powder) of Rhubarb.
5. Morphology of Psoralia, Saffron and Chirata
6. Morphology of Amla, Kantkari, Shatavari and Bach
7. 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. "Pharmacopial 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".

## PR358

# FUNDAMENTALS OF 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. [08]

### 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. [08]

### 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. [08]

### 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. [08]

### 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. [08]

## 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.

## PR359

# PHARMACEUTICAL MARKETING

### Unit-I

Principles of marketing management, Introduction to pharmaceutical marketing, Identification of the marketing, Market behavior, Prescribing habits of physician, Patient motivation, Market analysis.[08]

### Unit-II

Drug development and the marketing research interface, Diversification and specialization, Marketing generic drugs. [08]

### Unit-III

Economic and competitive aspects of pharmaceutical industry- Advertising, Detailing, Retail competition, International marketing. [08]



**Unit-IV**

Distribution channels in pharmaceutical marketing – Manufacturer, Wholesaler, Retailer, Hospital & Government agencies, Selection of stockists and distributors. [08]

**Unit-V**

Controls- Internal control and external control. [08]

**BOOKS RECOMMENDED:**

1. Smith Mickey, "Principle of pharmaceutical Marketing", CBS Publisher & Distributor.
2. Kothler, Phillips "Marketing Management" Pearson education Asia.

**PR360****DRUG DESIGN AND LEAD MODIFICATIONS****Unit I**

Introduction to drug design and discovery, phases involved, different methods in brief, some case studies e.g. development of ciprofloxacin, antidiabetics, and recent cephalosporins. Introduction to QSAR, Lead discovery & optimization. Introduction to different target sites of bacteria, fungi, viruses, parasites with respect chemical composition, comparison with mammalian targets, enzymes, receptors. [08]

**Unit II**

Principles of Drug Design including some case studies from following categories- antihistaminic, antihypertensive, psychotherapeutics. QSAR, Hansch & Free Wilson Analysis. [08]

**Unit III**

Mechanism based Drug Design including Quantum Mechanics, Computer Aided Drug Designing (CADD), Molecular Mechanics and Molecular Modeling. [08]

**Unit IV**

Drug Metabolism: Study of drug metabolizing enzymes, phase I & phase II reactions with selected examples of following drugs, Diazepam, Tolbutamide, Cyclobarbital, Paracetamol, Imipramine, Amphetamine, Mesoridazine and Sulindac. Applications of drug metabolism studies in new drug discovery. [08]

**Unit V**

Retrospective synthesis. Recent Advances in Drug discovery and Designing Process. [08]

**BOOKS RECOMMENDED:**

1. The Organic Chemistry of Drug Synthesis, Vol.1,2,3,4 by Lednicer Daniel, 1<sup>st</sup> edition, John Wiley & Sons INC.
2. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry by Wilson and Gisvold, J. Lippincott Co. Philadelphia.
3. Foye's Principles of Medicinal Chemistry by Foye, 6<sup>th</sup> edition, Lippincott William & Wilkins.
4. Comprehensive Medicinal Chemistry by Hansh C, Vol 1-VI, Elsevier Pergamon.
5. Burger's Medicinal Chemistry by Wolff M E, John Wiley & Sons, New York.
6. An Introduction to Drug Design by S N Pandeya & I R Dimmock, 1<sup>st</sup> edition, New Age International Publishers.

**PR361**  
**NOVEL DRUG DELIVERY SYSTEM (NDDS)**

- Unit 1 Control Drug Delivery System:** Theory of controlled release drug delivery systems. Release and diffusion of drugs from controlled drug delivery system, General methods of design and evaluation of controlled drug delivery system. [08]
- Unit 2 Advances in drug delivery systems.** An Introduction to buccal, nasal, ocular, delivery. [08]
- Unit 3 Sustained Release Formulations:** Introduction, terminology/definitions and rationale, advantages and disadvantages. Types of control release products, factors influencing the design and performance of SR formulations. Physicochemical and biological properties of drugs relevant to sustained release formulations. [08]
- Unit 4 Targeted Drug delivery systems:** Concept of drug targeting, importance in therapeutics, methods in drug targeting, drug immobilization techniques, nanoparticles, liposomes, neosomes, and resealed erythrocytes. [08]
- Unit 5 Transdermal drug delivery systems:** Theory, formulation and evaluation, iontophoresis.  
**Implants and inserts:** Types, design and evaluation methods, Osmotic pumps. [08]

**BOOKS RECOMMENDED:**

1. L. Xiaoling, B.R. Jasti, "Design of Controlled Release Drug Delivery Systems" McGraw-Hill
2. Robinson and Vincent, Controlled Drug Delivery. Marcel Dekker
3. Y W Chien, Novel Drug Delivery Systems. Marcel Dekker

## SEMESTER – VI

### PR362 PHARMACEUTICAL CHEMISTRY-V (MEDICINAL CHEMISTRY-I)

#### THEORY

##### Unit – I

**Basic Principles of Medicinal Chemistry:** Physicochemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action. Drug receptor interactions 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, 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, Meprobamate, Diazepam, Chlordiazepoxide.

iv) Opioid Analgesics: Pethidine, Methadone, Pentazocine.

v) Antitussives: Caramiphen, Dextromethorphan. [08]

##### Unit – IV

i) Anticonvulsants: Phenytoin, Carbamazepine, Ethosuximide, Valproic Acid.

ii) Antiparkinsonism drugs: Carbidopa, Levodopa.

iii) CNS Stimulants: Caffeine, Nikethimide. [08]

##### Unit – V

i) Psychopharmacological Agents:

a) Neuroleptics: Chlorpromazine, Haloperidol.

b) Antidepressants: Imipramine, Amitriptyline, Doxepin, Phenelzine.

c) Antispasmodic and anti ulcer drugs: Dicyclomine, Ranitidine, Omeprazole, Pirenzepine.

d) Neuromuscular Blocking Agents: Gallamine triethiodide, Mephenesin. [8]

### PR363 PHARMACEUTICAL CHEMISTRY – V (MEDICINAL CHEMISTRY - I)

#### 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, 10<sup>th</sup> 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.

### **PR364 PHARMACEUTICS – VII (PHARMACEUTICS TECHNOLOGY – II)**

#### **Unit – I**

**1. Capsules:** Material for production of hard gelatin 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**

##### **4. Parenteral Products:**

a) Water for injection, pyrogenicity, non-aqueous 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. [08]

#### Unit – IV

#### 5. 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. [05]

#### Unit – V

#### 6. 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.

[07]

### PR365

## PHARMACEUTICS – VII

### (PHARMACEUTICS 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.

**PR366**  
**PHARMACOLOGY – III**

**THEORY**

**Unit – I**

**Drugs Acting on CNS – I:** Narcotic analgesic, Sedatives, Hypnotics and Anxiolytics, Drugs in convulsive disorders, Drugs in Parkinson's disease. [08]

**Unit – II**

**Drugs Acting on CNS – II:** Antidepressant, Anti-psychotics and Antimaniacs, CNS stimulants, Cognitions enhancer. [09]

**Unit – III**

General anesthetics, Local anesthetics, Skeletal muscles relaxants. [06]

**Unit – IV**

**Drugs acting on endocrine system – I:** Drug used in Diabetes mellitus (Insulins and Oral hypoglycemic), Corticosteroids, Thyroid and Antithyroid drugs. [08]

**Unit – V**

**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]

**PR367**  
**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.

**PR368**

**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**

- a) **Imidazole:** Pilocarpus.
- b) **Steroidal:** Veratrum & Kurchi.
- c) **Alkaloidal Amines:** Ephedra & Colchicum.
- d) **Glucoalkalid:** Solanum.
- e) **Purines:** Coffee, Tea & Cola.
- f) **Quinazoline:** Vasaka. [07]

**Unit – III**

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

**Unit – IV**

4. **Biological sources, preparation, Identification tests and uses of following enzymes:** Diastase, papain, pepsin, trypsin & Pancreatin.

5. Plant bitters & Sweeteners.
6. Chemistry & therapeutic activity of penicillin, Streptomycin & tetracycline.
7. Natural Allergens and Photosensitizing agents and fungal toxins. [08]

**Unit – V**

8. Historical development of plant tissue culture, type of cultures, nutritional requirement, growth & their maintenance. Application of plant tissue culture in Pharmacognosy.
  - a) Plant hormones and their applications.
  - b) Polyploidy, Mutation & hybridization with reference to medicinal plants. [09]

**PR369**

**PHARMACOGNOSY – IV**

**PRACTICAL**

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

**SUGGESTED PRACTICES:**

1. To study the morphology and microscopy of Datura and Withania.
2. To study the morphology and microscopy of Ipecac and Rauwolfia.
3. To study the morphology and microscopy of Catharanthus and Nux Vomica.
4. To study the morphology and microscopy of Ephedra and Kurchi.
5. To study the morphology and microscopy of Solanum and Vasaka.
6. To study the
  - a. Morphology of Areca, Colchicum.
  - b. Transverse section of Catharanthus leaf and Kurchi bark.
7. To study the TLC profile of Catharanthus leaf.
8. To study the TLC profile of Withania root.
9. Chemical test of Tea, Tobacco, Datura and Withania.
10. Chemical test of Nux Vomica, Ephedra and Kurchi.
11. Introduction of plant tissue culture techniques on laboratory scale.
12. Preparation of agar slants.
13. To grow callus culture in any defined media.
14. Maintenance of callus culture.

**PROJECT:**

World wide trade of medicinal plants (Monograph).

**BOOKS RECOMMENDED:**

5. Kokate CK, "Practical Pharmacognosy" Vallabh Prakashan, New Delhi.
6. Wallis TE, "Analytical Microscopy J&A Churchill Ltd., London.
7. Gamburg & Wetter, Plant Tissue Culture methods, National Research Council of Canada, Saskatchewan.
8. Clarke ECG, Isolation and Identification of drugs. The Pharmaceutical Press, London.
9. Trease GE, Evans WC, "Pharmacognosy", Bailliere Tindall, East Borne, U.K.
10. Tyler VE et al, "Textbook of Pharmacognosy", Lea & Febiger, Philadelphia.
11. Wallis TE, "Textbook of Pharmacognosy", J & A Churchill Ltd., London.



12. Kokate CK et al, "Pharmacognosy", Nirali Prakashan, Pune.
13. Atal CK, Kapur BM, "Cultivation & Utilization of Medicinal Plants", RRL, Jammu.
14. Stahl E, Thin Layer Chromatography – A laboratory handbook, Springer Verlag, Berlin.
15. Henry TA, The Plant Alkaloids, McGraw hill, New York.
16. Vapoorte, Swedson, "Chromatography of Alkaloids".
17. Dixit VK, Vyas SP, Pharmaceutical Biotechnology, CBS Publication, ND.
18. Street HE, Tissue Culture & Plant Science, Academic Press, London.
19. Kokate CK, Gokhale AS, Gokhale SB, "Cultivation of Medicinal Plants", Nirali Prakashan.
20. "British Herbal Pharmacopoeia".
21. "Indian Herbal Pharmacopoeia".
22. Chaudhary R.R., "Herbal Drug Industry".
23. Peach K. & Tracey MV, "Modern Methods of Plant Analysis".

### PR370

## 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

- a) Medicinal & Toilet preparations (Excise duties Act 1955)
- b) Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
- c) 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.

**PR371**  
**FOOD TECHNOLOGY**

- Unit 1** Microbiology of milk & milk products like cheese, butter, ice-cream, milk powder; Microbiology of meat, fish, poultry & egg and their products. **[08]**
- Unit 2** Sources of food carbohydrates; Physico-chemical and functional properties; chemistry and structure of homosachharides and heterosachharides. **[08]**
- Unit 3** Objectives and techniques of food preservation; Canning: classification of cans, can specification, structure of cans, lacquering, canning of food items, Thermal process time calculations for canned foods, spoilage in canned foods. **[08]**
- Unit 4** Water activity of food and its significance in food preservation; dehydration and drying of food items; IMF; Low temperature preservation: cold storage and freezing including cryogenic freezing. **[08]**
- Unit 5** Preservation by fermentation: curing and pickling; Hurdle technology. **[08]**

**PR372**  
**IPR & DRUG REGULATORY AFFAIRS**

- Unit 1** Drug Regulatory Aspects (India) –
1. Indian drug regulatory authorities, Central and State regulatory bodies (FDA)
  2. Drugs and Cosmetics Act and Rules with latest Amendments (Selective)
  3. Special emphasis – Schedule M and Y
  4. New Drugs – Importation, Registration, Development, Clinical Trials, BE NOC & B.E. studies
- [08]**
- Unit 2** Good Manufacturing Practices (GMP) –
1. Indian GMP certification, WHO GMP certification
  2. ICH guidelines for stability testing and other relevant ones (Q1 – Q10)
  3. Understanding of the plant lay-outs with special emphasis on the environment & safety. (HVAC, Water systems, Stores management, Effluent etc.)
  4. Quality Assurance and Quality Control, GMP audits.
- [08]**
- Unit 3** Drug Regulatory Aspects (International & highly regulated markets) –
1. CDER, INDA, NDA, ANDA's (types), CTD Formats of dossiers, E-submission, US DMF (various types), Orphan Drugs, Various Guidance issued by CDER, Orange Book (and patents), RLD (Reference listed drug) for BE studies and the norms for US submission, Bioequivalence and dissolution recommendations, US FDA Inspection (audits), Pre-approval Inspections and approvals.
  2. US Requirements and European Union Requirements for Registration of formulations for generic drugs sale in the US and European markets. USFDA & EMEA guidelines.
- [08]**
- Unit 4** **Introduction to IPR & Patents** – Development of IP law in India, IPR regime, Introduction to IP laws in India, Role of IP in pharma industry growth.  
**Patenting in India** – Introduction, Patent legislation, Indian Patents Act 1970 and amendments, Procedure for patent application, Grant and opposition proceedings, Patent licensing, Patent infringement proceedings.
- [08]**
- Unit 5** **International treaties and conventions on IPR** - Paris convention, PCT – an introduction, PCT application & general rules, WTO / GATT system & Uruguay TRIPS, WIPO, **Hatch Waxman Act and amendments, Introduction to Geographical indication / Trademark/ copyright: Filing procedures,**
- [08]**

**Reference books :**

1. CDSO publications and updates of drug and Cosmetics act and rules (Govt. of India).
2. CDER Publications and Guidance
3. EMEA Publications and Guidance
4. Orange Book, ICH guidelines, Indian Patents Act
5. Country specific Regulatory Guidelines (available from internet)
6. Govt. Publications on issues affecting sales, distribution, manufacturing, excise, etc.
7. J. D. Nally, "Good manufacturing Practice for Pharmaceuticals" Informa Healthcare.
8. I. Kanfer & L. Shargel, "Generic Product Development BE issued" Informa Healthcare.
9. R. A. Guarino, "New Drug Approval Process. The Global challenges". Informa Healthcare.
10. Watcher and Nash, "Pharmaceutical Process Validation". Marcel Dekker.

## SEMESTER – VII

### PR470 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, 4<sup>th</sup> 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.

**PR471**  
**PHARMACEUTICS – VIII**  
**(BIOPHARMACEUTICS & PHARMACOKINETICS)**

- Unit 1**
1. Introduction to Biopharmaceutics & Pharmacokinetics & their role in formulation, development and clinical setting.
  2. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
  3. Factors influencing absorption – Physicochemical, physiological and pharmaceutical.
  4. Drug distribution in the body, plasma protein binding. [08]
- Unit 2 Pharmacokinetics:**
1. Compartment model & non – compartment model: Definition & Scope.
  2. Pharmacokinetics of drug absorption – zero order & first order absorption rate constant using Wagner – Nelson & Reigelman method. [08]
- Unit 3 Pharmacokinetics:**
3. Volume of distribution and distribution coefficient
  4. 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 4 Clinical Pharmacokinetics:**
1. Definition and scope Dosage adjustment in patients with and without renal and hepatic failure.
  2. Pharmacokinetic drug interactions and their significance in combination therapy [08]
- Unit 5 Bioavailability & Bioequivalence:**
1. Measures of bioavailability, C – max, area under the curve (AUC)
  2. Review of regulatory requirements for conditions of bioequivalent studies [08]

**PR472**  
**PHARMACEUTICS – VIII**  
**(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”.

**PR473**  
**PHARMACOLOGY – IV**

**THEORY**

**Unit – I:**

**Anti-infective drugs – I**

Introduction to antibiotics, Penicillins, Cephalosporins, Aminoglycosides, Macrolides Vancomycin. [09]

**Unit – II:**

**Anti-infective drugs – II**

Sulphonamides and Trimethoprim, Quinolones and Flouroquinolones, Tetracyclines, Chloramphenicol & Antifungals. [09]

**Unit – III:**

Antiprotozoals, Anthelmintics, Antivirals, Immunosuppressants, Chemotherapy of Cancer. [10]

**Unit – IV:**

**Bioassays:** Definition and terminology, Condition under which bioassay should be done, Principles of bioassay, Types of bioassay, Important Pharmacopoeal bioassays (eg. Oxytocin, D-tubocurarine, Digoin). [06]

**Unit – V:**

**Toxicology**

Basic principles of toxicology, Measurements in toxicology, Heavy metal toxicity, Chelating agents, Poisoning and its management. [06]

**PR474**  
**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, 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.
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.

## 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, Stanozolol.
  - b) Estrogens and Progestational agents: Progesterone, Estradiol.
  - c) Adrenocorticoids: Prednisolone, Dexamethasone, Betamethasone. [08]

#### Unit – II

2. **Autocoids:**
  - a) **Antihistaminics:**
    - i. H<sub>1</sub> antagonists: Diphenhydramine, Mepyramine, Promethazine, Cyproheptadine, Cetirizine.
    - ii. H<sub>2</sub> antagonists: Ranitidine, Famotidine.
  - b) **Antineoplastics:** Chlorambucil, Thiotepea, Fluorouracil, Methotrexate, Busulphan. [08]

#### Unit – III

- a) **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, Tetracyclin, Chloramphenicol).
5. **Antimycobacterial Agents:** Paraamino Salicylic acid, Ethambutol, Isoniazid, Dapsone. [08]

#### Unit – V

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

## PHARMACEUTICAL CHEMISTRY – VI (MEDICINAL CHEMISTRY – II)

### PRACTICAL

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

### BOOK RECOMMENDED:

9. Mann PG, Saunders BC, “Practical Organic Chemistry”, ELBS/Longman, London.
10. Furniss BS, Hannaford AJ, Smith PWG and Tathell AR, Vogel’s “Textbook of Practical Organic Chemistry”, The ELBS/Longman, London.
11. Pharmacopoeia of India”, Ministry of Health, Govt. of India.
12. Wolff ME, Ed. Burger’s “Medicinal Chemistry”, John Wiley & Sons, New York.
13. Delagado JN, Remers WAR, Eds., Wilson and Gisworld’s “Textbook of Organic Medicinal Chemistry”, J. Lippincott Co., Philadelphia.
14. Foye WC, “Principles of Medicinal Chemistry”, Lea & Febiger, Philadelphia.



15. Singh Harkishan and Kapoor, V.K. "Organic Pharmaceutical Chemistry", Vallabh Prakashan, Delhi.
16. Nogrady T, "Medicinal Chemistry – A Biochemical Approach", Oxford University Press, New York, Oxford.
17. Finar IL, "Organic Chemistry", Vol. I & II, ELBS/Longman, London.

### PR477

## PHARMACEUTICAL ANALYSIS – III

### THEORY

#### Unit – I

**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 and turbidimetry. [08]

#### Unit – II

**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.

**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

**Nuclear Magnetic Resonance Spectroscopy:** An introduction to the theory of  $^1\text{H}$  – NMR, chemical shift, spin – spin coupling, spectra of ( $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{Cl-CH}_2\text{OH}$ ,  $\text{CH}_3\text{CHO}$ ,  $\text{CH}_3(\text{CH}_2)_4\text{CH}_3$ ,  $\text{C}_6\text{H}_6$ ,  $\text{CH}_3\text{CH}_6\text{CH}_5$ ).

Principle, Instrumentation and Pharmaceutical applications of HPLC. [08]

#### Unit – IV

**Mass Spectrometry:** Introduction to mass spectra, molecular ion, peak, fragmentation peak, mass spectra of some simple compounds.

**Flame Photometry:** Origin of spectra, atomization and ionization, instrumentation, background emission, interference, qualitative & quantitative applications in pharmaceutical analysis. [08]

#### Unit – V

#### Emission Photometry

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

**PR478**

**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.

**PR479**

**Project Report on Summer Training**

## SEMESTER – VIII

### PR480 PHARMACOGNOSY – V (NATURAL PRODUCTS)

#### THEORY

##### Unit – I

##### Phytochemical Screening:

- a) Chemical & Spectral approaches to simple molecules of natural origin.
- b) Introduction & classification of different chromatographic methods & their application in evaluation of herbal drugs.
- c) Concept of Stereoisomerism with respect to the natural products. [07]

##### Unit – II

##### Biological Screening:

General methods of screening of natural products for following biological activity namely anti-inflammatory, hypoglycaemic, antibacterial, antifertility & psychopharmacological activity. [03]

##### Unit – III

General techniques of biosynthetic study & basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of Pharmaceutical Importance.

Chemistry, Biogenesis and pharmacological activity of medicinally important monoterpenes, Sesquiterpenes, diterpenes & triterpenoids. [08]

##### Unit – IV

Chemistry, Biogenesis, Isolation, Extraction and pharmacological activity of

- a) **Carotenoids:** Beta carotenoids, alpha carotene, vitamin A, xanthophylls of medicinal important.
- b) **Glycosides:** Digitoxin, Digoxin, Hecogenin, Sennosoides, Diosgenin, Sarsapogenin [11]

##### Unit – V

- a) **Alkaloids:** Atropine & related compounds, quinine, reserpine, morphine, papavarine, ephedrine, ergot, and vinca alkaloids.
- b) Medicinally important lignins, quassinoids, & flavanoids. [11]

### PR481 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", Bailliere 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.

**PR482**

**PHARMACEUTICAL CHEMISTRY – VII**  
(MEDICINAL CHEMISTRY – III)

**THEORY**

**Unit – I**

1. Drug metabolism and Concept of Prodrugs.  
QSAR and introduction to molecular modeling, 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, Furosemide, Triamterene, Spironolactone. [08]

**Unit – II & III**

**Cardiovascular Agents:**

3. **Antianginal, Vasodilators, Antihypertensives:** Propanolol, Atenolol, Methyldopa, Nifedipine, Guanethidine, Phentolamine, Captopril.
4. **Antiarrhythmics, Anticoagulants, Antihyperlipidemics, Cardiotonics:** Procainamide, Amiodarone, Clofibrate, Warferin, Phenindione, gemfibrozil.
5. **Diagnostic Agents:** Iopanoic acid. [14]

**Unit – IV**

6. **Anti HIV agents:** Zidovudine, Zalcitabine, Sequinavir.
7. **Antivirals:** Amantadine, Acyclovir, Lamivudine.
8. **Prostaglandins:** Misoprostol, Carboprost. [08]

**Unit – V**

9. **Thyroid and Anti-thyroids:** Carbimazole, Levothyroxine, Propylthiouracil, Methimazole.
10. **Insulin & Oral Hypoglycemics:** Chlorpropamide, Metformin, Tolbutamide, Glibenclamide. [10]

**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. Delagado 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.

### PR483

## CLINICAL PHARMACY AND DRUG INTERACTIONS

### THEORY

#### Unit – I

##### Clinical Pharmacy:

- a) Concept of Pharmacotherapy
- b) Pre – clinical evaluation of drugs
- c) Clinical Evaluation of drugs
- d) Drugs in elderly

[08]

#### Unit – II

##### Pharmacotherapeutics:

- a) Sampling Procedures
- b) Data collection in clinical test
- c) Application of statistical methods

[08]

#### Unit – III

##### Important Disorders of organ system & their management – I:

- e) Cardiovascular System: Hypertension, congestive heart failure, angina pectoris, myocardial infarction.
- f) Metabolic Disorders: Diabetes mellitus, rheumatoid arthritis, gout

[08]

#### Unit – IV

##### Important Disorders of organ system & their management – II:

- a) CNS Disorders: Epilepsy, Parkinsonism, Depression,
- b) Gastrointestinal Disorders: Peptic ulcer, Ulcerative colitis, infective & non infective diarrhoeal diseases

[08]

#### Unit –V

##### Infectious Diseases:

- c) Upper & lower respiratory tract infections.
- d) Neoplastic Disorders: Acute Leukaemias, Hodgkin's disease.

[08]

## 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 Phramacological 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, Riter 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. Parthasarthi G, Nyfort-Hansen K, Nahata MC, A Textbook of Clinical Pharmacy Practice: Essential Concept and Skills, Orient Longman.

## PHARMACEUTICAL INDUSTRIAL MANAGEMENT

**Unit 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. [08]

**Unit 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.  
**Accountancy:** Principles of Accountancy, Journal, Ledger posting, preparation of trial balance, profits and loss account, balance sheet, rectification of errors. [08]

**Unit 3 Pharmaceutical Marketing:**

- b. Introduction to pharmaceutical marketing, principles of marketing management, identification of the marketing. Market behaviour, prescribing habits of physician, patient motivation, market analysis.
- c. Channels of distribution, wholesale, retail, department store, multiple shop and mail order business. Selection of stockist and distributors.
- d. Economic and competitive aspects in pharmaceutical marketing: Advertising, Detailing, Retail competition, International Marketing.

**Salesmanship:** Principles of sales promotion, advertising ethics of sales, merchandising, literature, detailing, Recruitment training, evaluation, compensation to the pharmacist. [08]

**Unit 4 Market Research:**

Drug development and the marketing research interface. Diversification and specialization, marketing of generic drugs. Market segmentation & Market targeting. [08]

**Unit 5 Materials & Production Management:**

Introduction, Purchase, stores, inventory control, visible and invisible inputs, maintenance management. [08]

**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, Weihrich 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.

**PR486****THERAPEUTIC DRUG MONITORING AND PHARMACOVIGILANCE****Unit 1****Therapeutic drug monitoring**

1. Needs for TDM
2. Essentials of TDM.
3. Criteria for valid TDM.
4. Loading and maintenance dose.
5. TDM of some potent drugs.

[08]

**Unit 2****Introduction to Clinical trials and Surveillance**

2. Types of therapeutic trials
3. Definition and Phases of clinical trial.
4. Significance
5. Surveillance system.

[08]

**Unit 3 Investigational Drugs & clinical research.**

1. Investigational drugs
2. Clinical trial of drug substances.
3. The design of clinical trial.
4. Plans of clinical trial.
5. Pitfalls of clinical trials

[08]

**Unit 4 Pharmacotherapy of diseases**

- Cardiovascular diseases
- Oropharyngeal disorders.
- CNS disorders
- Respiratory disorders

[08]

**Unit 5 Clinical laboratory tests and their significance in diseases**

- Diagnostic tests significance
- Tests performed on blood.
- Tests performed on cerebrospinal fluid.
- Some miscellaneous & specific tests.
- Adverse reactions.
- Pharmacological effects

[08]

**BOOKS RECOMMENDED:**

1. Hardman J. G., Limbird L. E. 2001. "Goodman and Gilman's The Pharmacological Basis of Therapeutics" 10th Ed. McGraw-Hill Professional.
2. H. P. Rang and M. M. Dale, "Pharmacology" 5<sup>th</sup> Ed. Churchill Livingstone.
3. B. G. Katzung, "Basic and Clinical Pharmacology" 9<sup>th</sup> Ed. McGraw-Hill Medical.
4. Annual Reviews of Pharmacology series.
5. Harvey R. A, Champe P. C., "Pharmacology-Lippincott's illustrated Reviews" 4<sup>th</sup> Ed. Lippincott Williams & Wilkins.
6. Pharmacology reviews.
7. H.P Tipnis . Clinical Pharmacy career publications. 4<sup>th</sup> ED.,

**PR487**

**Industrial Tour, Project report & presentation**