

## SEMESTER I

**PHAR-IIIM**

### **REMEDIAL MATHEMATICS**

#### **Unit-I**

**1. Algebra:** Equations reducible to quadratics, simultaneous equations (linear & quadratic). Determinants, Properties of determinants, solution of simultaneous equations by Cramer's rule, matrices, properties of matrices, solution of simultaneous equations by matrices, pharmaceutical applications of determinants and matrices. [08]

#### **Unit-II**

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

#### **Unit-III**

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

#### **Unit-IV**

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

#### **Unit-V**

**Calculus:** Differential: Limits and functions, definition of differential coefficient, differentiation of standard functions, including function of a function (chain rule).

Integral: Intregation as inverse of differentiation indefinite integrals of standard form, intergration by parts. [12]

#### **BOOKS RECOMENDED**

1. A textbook of Mathematics for XI-XII Students, NCERT Publication Vol. I-IV.
2. Loney, S.L "Plane Trigonometry" AITBS Publishers.
3. Loney, S.L "The elements of coordinate geometry" AITBS Publishrs.
4. Gupta S.P. Statistical Methods, Sultan Chand and Co., New Delhi.
5. Narayan Shanti, Integral calculus , Sultan Chand & Co.
6. Prasad Gorakh Text book on differential calculus, Pothishala Pvt. Ltd., Allahabad.
7. Narayan Shanti, Differential calculus , Shyamlal Charitable Trust, New Delhi.
8. Prasad Gorakh Text book on integral calculus , Pothishala Pvt. Ltd., Allahabad.

***PHAR-IIIB***

**REMEDIAL BIOLOGY**

**THEORY**

**Unit-I**

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

**Unit-II**

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

**Unit-III**

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

**Unit-IV**

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

**Unit-V**

Methods of classification of plants. [04]

***PHAR-IIIP***

**REMEDIAL BIOLOGY PRACTICAL**

**PRACTICAL**

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

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

**BOOKS RECOMMENDED**

1. Dutta A.C. “ Botany for Degree students” Oxford.
2. Marshall & Williams “Text Book of Zoology” CBS Publishers & Distributors, Delhi.
3. Fahn “Plant Anatomy” Aditya Books Private Limited, New Delhi.
4. Weiz, Paul B “Laboratory Manual in Science of Biology” Mc Graw-hill book company.

**PHARMACEUTICAL ANALYSIS-1**

**THEORY**

**Unit-1 :**

Significance of quantitative analysis in quality control different techniques of analysis, preliminaries and definitions, precision and accuracy. Fundamentals of volumetric analysis, methods 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 of 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, oxidation reduction curves, iodimetry and iodometry, titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate. [10]

**Unit-IV: Precipitation Titrations:**

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

**Unit-V : Gravimetric Analysis:**

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

**PHARMACEUTICAL ANALYSIS - 1**

**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 also 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 also be covered.
3. **Oxidation Reduction Titrations** : Preparation & 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 and ceric ammonium sulphate.
4. **Precipitation Titrations** : Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, titrations according to Mohr's, Volhards 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 Pharmacopocia, Her Majesty's Stationary Office, University Press, Cambridge.
5. Alexeyev V. "Quantitative Analysis". CBS Publishers & Distributors.
6. The Pharmacopoeia of India.

**PHAR – 113**

### **PHARMACEUTICAL CHEMISTRY-1 (INORGANIC PHARMACEUTICAL CHEMISTRY)**

#### **Unit-I**

- A. Sources of impurities & their control, limit test for iron, arsenic, lead, heavy metals, chloride & sulphate
- B. An outline of methods of preparation, uses, sources of impurities, tests of purity and identification and special tests, if any, of the following classes of inorganic pharmaceuticals included in **Indian Pharmacopoeia. (1996)**

**Gases and Vapours:** Inhalants (Oxygen), Anaesthetics( Nitrous oxide)

**Pharmaceutical aids and necessities:** water(purified water, water for injection and sterile water for injection), pharmaceutical acceptable glass, acids and bases (Sodium hydroxide, phosphoric acid).

**Topical Agents :** Protectives (Calamine, titanium dioxide, talc, kaolin), astringents(Zinc oxide, Zinc Sulphate) and anti infectives (Boric Acid, Hydrogen peroxide, Iodine, Povidone Iodine, Potassium permanganate, Silver nitrate).

**Dental Products :** Dentrifices- anti-caries agents (Sodium fluoride). [08]

**Unit-II:Gastrointestinal Agents :** Acidifying agents (Dilute Hydrochloric acid), antacids(Bismuth subcarbonate, Aluminium hydroxide, Calcium carbonate, Magnesium hydroxide, Magnesium oxide{ light and heavy}, Magnesium carbonate{ light and heavy}, Magnesium trisilicate ), cathartics ( disodium hydrogen phosphate, Magnesium sulphate and other Magnesium compounds), protective and adsorbents( Activated Charcoal, Light Kaolin, Aluminium sulphate

**Miscellaneous Agents:** Expectorants (Ammonium chloride, Potassium Iodide), antioxidants (Sodium metabisulphite). [08]

**Unit-III : Major intra and extra- cellular electrolytes :** Physiological ions, Electrolytes used for replacement therapy, acid-base balance & combination therapy( Calcium chloride, Calcium gluconate, Calcium lactate, Calcium levulinate, Sodium dihydrogen phosphate, sodium acetate, sodium bicarbonate, sodium chloride, potassium chloride, magnesium chloride).

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

**Unit-IV : Essential and Trace Elements :** Transition elements and their compounds of pharmaceutical importance. Iron and haematinics(Ferrous fumarate, Ferrous gluconate, Ferrous sulphate, Ferric Ammonium citrate), mineral supplements (Cu, Zn, Cr, Mn, Sb, S, I).

**Co-ordination compounds and complexation-** study of such compounds used in therapy including poison antidotes(Calcium folinate, Sodium thiosulphate). [08]

#### **Unit-V**

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

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

<u>List of Experiments</u>	<u>No. of Labs</u>
1. To perform limit test of chloride, sulphate, Iron, Heavy metal and arsenic in the given sample.	5
2. Salt analysis	7
3. Preparation of following compounds:-	
Boric acid	3
Magnesium sulphate	
Heavy magnesium carbonate	
Calcium Carbonate	
Alum	
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., et.al Modern Inorganic Pharmaceutical Chemistry, waveland press.
3. Pharmacopoeia of India, 1996 edition.
4. Atherden L.M., Bentley and Drivers' "Text Book of Pharmaceutical Chemistry", Oxford University Press, London.

**PHAR – 114**

**PHARMACEUTICS- 1  
(GENERAL PHARMACY)**

**Unit-I**

**History of Pharmacy :** Origin & development of pharmacy, scope of pharmacy, introduction to pharmacopoeias with special reference to I.P, B.P., U.S.P, & International Pharmacopoeia. [04]

**Pharmaceutical Additives :** Coloring, flavouring & sweetening agents, cosolvents, preservatives, surfactants & their applications, antioxidants. [03]

**Unit-II**

**Size Reduction :** Definition, factors affecting size reduction, principles, laws & factors affecting energy requirements, different methods of size reduction, study of hammer mill, ball mill, fluid

energy mill & disintegrator, various methods & equipments employed for size separation e.g. sieving, sedimentation, cyclone separator, elutriation methods. [06]

**Unit-III : Pharmaceutical calculations** : Posology, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipes percentage solutions, alligation, alcohol dilution, proof spirit. [10]

#### **Unit-IV**

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

#### **Unit-V**

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

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

### **PHAR-114P**

## **PHARMACEUTICS-I (GENERAL PHARMACY)**

**I** – Preparation of following classes of Pharmaceutical dosage forms (involving the use of calculations in metrology) as official in IP, BP, USP/NF.

- |                    |   |
|--------------------|---|
| a) Aromatic Waters | 1. Chloroform water BP<br>2. Camphor Water BP<br>3. Rose Water NF |
| b) Solutions       | 1. Lysol solution IP<br>2. Strong Ammonium Acetate solution BP    |
| c) Syrups          | 1. Simple syrup BP<br>2. Simple syrup USP/NF                      |
| d) Elixirs         | 1. Aromatic Elixirs USP/NF  |
| e) Spirits         | 1. Aromatic Ammonia spirit BP                                     |
| f) Powders         | 1. ORS Powder IP<br>2. Absorbable dusting powder USP/NF           |
| g) Lotions         | 1. Calamine lotion IP<br>2. Amino benzoic acid lotion BP          |
| h) Liniments       | 1. Methyl salicylate liniment BP<br>2. Turpentine liniment BP     |

- |                         |                                 |
|-------------------------|---------------------------------|
| i) Mucilage             | 1. Starch Mucilage IP           |
| j) Glycerins            | 1. Kaolin Poultice BP           |
| k) Inhalation           | 1. Benzoin Inhalation BP        |
| l) Tinctures & Extracts | 1. Infusion of Tea              |
|                         | 2. Decoction of Ispaghula       |
|                         | 3. Compound benzoin tincture BP |
|                         | 4. Strong Ginger tincture BP    |
|                         | 5. Liquorice liquid extract BP. |

**II** - Experiments to illustrate principles of size reduction using Ball Mill.

- Effect of size of balls, number of balls and time on the efficiency of ball mill.

**III** - Experiments to illustrate mixing efficiency.

- 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 S.J., "Cooper and Gunn's Tutorial Pharmacy", CBS Publishers, Delhi.
4. Rawlins E.A., "Bentley's Text Book of Pharmaceutics", ELBS Bailliere Tyndall.
5. Lachman L, Liberman H.A and Kanig J.L., "Theory and Practice of Industrial Pharmacy", Lea and Febiger.
6. Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.
7. Aulton, M.E, Text Book of Pharmaceutics, Vol., I & II. Churchill Livingstone.
8. United States Pharmacopoeia (National Formulary).
9. Remington – "The science and practice of pharmacy" Vol. I & II. Mack Publishing Co., Pennsylvania.

**PHAR-115**

**ANATOMY & PHYSIOLOGY-I**

**Unit –I**

- a. Introduction to human body & organisation of human body.
- b. Functional & structural characteristics of cell.
- c. Detailed structure of cell membrane & physiology of transport process.

Structural & functional characteristics of tissues- epithelial, connective, muscle and nerve. [08]

**Unit-II Skeletal system**

Structure, composition & functions of skeleton. Classification of joints, types of movements of joints. [08]

### **Unit-III**

Anatomy & physiology of skeletal & smooth muscle, neurotransmission, physiology of skeletal muscle contraction, energy metabolism, types of muscle contraction, muscle tone. [08]

### **Unit-IV**

Haemopoietic system : Composition & function of blood & its elements, erythropoiesis, blood groups, blood coagulation. [08]

### **Unit-V**

- a) Concepts of health & disease: Disease causing agents & prevention of disease.
- b) Classification of food requirements : Balanced diet, Nutritional deficiency disorders, their treatment & prevention, specification for drinking water. [08]

## ***PHAR-II5P***

### **HUMAN ANATOMY, PHYSIOLOGY & HEALTH EDUCATION-I**

#### **PRACTICAL**

1. Study of human skeleton.
2. Microscopic study of different tissues.
3. Estimation of haemoglobin in blood, Determination of bleeding time, clotting time, R.B.C. Count, Total leucocyte count, D.L.C. and E.S.R.
4. 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 S.H. "Atlas of Normal Histology" – Lea & Febiger Philadelphia.
3. Chaurasia B.D, 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. Chatterjee C.C. "Human Physiology", Medical Allied Agency, Calcutta.
6. Ross & Wilson "Anatomy & Physiology in Health & Illness", Churchill Livingstone.
7. Tortora GJ, & Anagnodokos NP "Principles of Anatomy & Physiology", Harper & Row Publishers, New Delhi.
8. Parmar N.S. "Health Education & Community Pharmacy" CBS Publishers, Delhi.
9. Shalya Subhash "Human Physiology" CBS Publishers & Distributors.
10. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.

**UNIT-I**

English Grammar

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

**UNIT-II**

Letter writing, Precis and Essay writing

Comprehension

Speed reading, scanning & swimming. [08]

**UNIT-III**

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

**UNIT-IV**

Presentation techniques, - Tips.

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

**UNIT-V**

Personality types.

Decision making

Motivation

Attitude

Thinking [06]

**BOOKS RECOMMENDED**

1. Wren P.C and Martin H., "High School Grammar and Composition", S. Chand & Co.
2. Robbins, S "Organisational Behaviour"

## SEMESTER-II

*PHAR-121*

### PHYSICAL CHEMISTRY

#### 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. **Amorphous and crystalline solids** : geometry & symmetry of crystals, Millers indices, types of crystals, Physical properties of crystals, crystal diffraction. [08]

#### Unit-II

4. **Thermodynamics** : Fundamentals, first, second, third and zeroth law, Joule-Thompson's effect, absolute temperature scale.
5. **Thermo chemistry** : Definition & conventions, heat of reaction, heat of formation, heat of solution, heat of neutralisation, heat of combustion, Hess law of constant summation, Bomb calorimeter, bond energies, Kirchoffs equation. [08]

#### Unit-III

6. **Solutions** : Ideal and real solutions, solutions of gases in liquids, colligative properties.
7. **pH** : Its determination, buffer, theory of buffers.
8. **Adsorption** : Freudlich and Gibbs adsorption Isotherms, Langmuir theory of adsorption. [08]

#### Unit-IV

9. **Electro chemistry** : Faraday's Laws of Electrolysis, Electrolytic conductance & its measurement, molar & equivalent conductivity, its variation with dilution. Kohlrausch law, Arrhenius theory, degree of ionisation & Ostwald dilution law. Transport number & migration of ion, Hittorfs theoretical device, theory of strong electrolytes (Debye Huckle theory). [08]

#### Unit-V

10. **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.
11. **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. [08]

**PHAR-121P**

**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 S.R., and Prabartak, S.K.D.E., Practical Physical Chemistry, Haltone Limited, Calcutta.
2. Shoemaker, D.P. Garland, C.W., Experiments of Physical Chemistry, MC Graw Hill Book Co.
3. Bahl B.S., Tuli G.D. & Bahl Arun, Essential of Physical Chemistry, S. Chand & Co.
4. Negi A.S. & Anand S.C. "Textbook of Physical Chemistry" Wiley Eastern Ltd.
5. Glasstone S. & Lewis D, Elements of Physical Chemistry, Macmillan Education.
6. Atkins P & Paula, J.D. "Atkins Physical Chemistry" Oxford University Press.

**PHAR-122**

**PHARMACEUTICAL CHEMISTRY-II**

**(ORGANIC CHEMISTRY- I)**

**Unit-I**

Structure and Properties : Atomic Structure, atomic orbital, molecular orbital, hybridization, sigma & Pi bond, covalent, electrovalent and co-ordinate 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, Alcohols. [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]

### ***PHAR-122P***

## **PHARMACEUTICAL CHEMISTRY –II (ORGANIC CHEMISTRY-I)**

### **SUGGESTED LIST OF PRACTICALS**

1. Identification of elements and functional groups in given sample. 6
  2. Purification of solvents like Benzene, chloroform, acetone and preparation of absolute alcohol. 4
  3. Synthesis of compounds involving benzylation, acetylation, bromination, reduction & oxidation. 5
- Synthesis of following compounds
- Picric acid
  - Aniline
  - Acetanilide
  - Aspirin
  - Hippuric acid
  - P-Bromo acetanilide
  - Iodoform
  - Oxalic Acid

### **BOOKS RECOMMENDED:**

1. Mann, F.G, & Saunders, B.C., Practical Organic Chemistry, ELBS/ Longman.
2. Vogel A.I., Textbook of Practical Organic Chemistry, ELBS/Longman.
3. Morrison, R.T., and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt. Ltd, New Delhi.
4. Finar, I.L., Organic Chemistry, Vol. I & II, ELBS/Longman.
5. Jain, M.K. Organic Chemistry, Sohan Lal Nagin Chand & Co. 60 B, Bunglaw Road, Delhi.
6. Hendrikson, Organic Chemistry.

### **PHAR-123**

## **ANATOMY, PHYSIOLOGY & PATHOPHYSIOLOGY-II**

**Unit-I : Central Nervous System :** Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, specialized functions of the brain. Cranial nerves and their functions. [06]

**Autonomic Nervous System :** Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission the A.N.S. [04]

**Unit-II : Sense Organs :** Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell), and skin (superficial receptors). [06]

**Unit-III : Lymphatic System :** Composition , formation and circulation of lymphs, lymph node and spleen. [05]

**Unit-IV :** .

**Demography and Family Planning,** Medical termination of pregnancy.

**First Aid :** Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods. [07]

**Unit-V Communicable Diseases :** Brief outline, their causative agents, modes of transmission and prevention (Chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelities, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea, and AIDS). [12]

### **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 B.D, 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. Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
6. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
7. Tortora GJ, & Anagnodokos NP, Principles of Anatomy & Physiology, Harper & Rave Publishers, New Delhi.
8. Parmar N.S., Health Education & Community Pharmacy CBS Publishers, Delhi.
9. Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
10. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.

***PHAR-124***

**COMPUTER FUNDAMENTALS AND  
PROGRAMMING**

**Unit-I :**

Basic computer organization functionality computer codes computer classification boolean algebra, primary storage, secondary storage devices, input-output devices, computer software, computer languages, operating system, business data processing concepts, data communication and networks and advances [08]

**Unit-II**

Planning the computer program, alogrithm, flowcharts, decision tables. [07]

**Unit-III**

Writing simple programs in 'C', Numeric constants and variables. Arithmetic Expressions, Input & Output in 'C' Programs, conditional statements, implementing loops in programs, arrays, logical expressions, and control statements such as switch, break and continue functions, processing character strings, files in 'C'. [12]

**Unit-IV**

Introduction to Fortran 77, Writing simple programme in Fortran 77.  
Fortran constants & variables, arithmetic expressions, input-output statements, control statements. Do statement, subscripted variables and elementary format specifications. [08]

**Unit-V**

Basic Database concept and classification, operations performed on database, eg- addition, deletion etc using MS-Access.  
Computer applications in Pharmaceutical and clinical studies. [05]

**PHAR-124P**

**COMPUTER FUNDAMENTALS & PROGRAMMING PRACTICAL**

Exercise based on the following are to be dealt:

1. Computer operating system like DOS and Windows.
2. Simple Program in 'C' Language.
3. Simple Program in Fortran 77.
4. Introduction to MS-OFFICE (MS-Word, MS-Excel, Power Point).
5. Internet features.

**BOOKS RECOMMENDED:**

1. Sinha, R.K., Computer Fundamentals, BPB Publications.
2. Raja Raman, V, Computer Programming in 'C', PHI Publication.
3. Raja Raman, V, Computer Programming in Fortran 77, PHI Publication.
4. Hunt N and Shelley J. "Computers and Common Sense" Prentice Hall of India.

**PHAR-125**

**ADVANCED MATHEMATICS**

**Unit-I**

**Differential Equation:** Revision of integral calculus, definition & information of different equations, equations of first order & first degree. [04]

**Unit-II**

Variable separable homogenous & Linear differential equations & equations reducible to such types. [04]

**Unit-III**

Linear differential equation of order greater than one with constant coefficients, complimentary function and particular integral, simultaneous, pharmaceuticals applications. [10]

**Unit-IV**

**Biometrics :** Significant digits and rounding off numbers, data collection, random and non random sampling methods, sample size, data organization diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams measures of central tendency, measures of dispersion, standard deviation and standard error of means, coefficient of variation, confidences (fiducial) limits. [10]

## Unit-V

Probability and events, Bayes theorem, probability theorems, probability, distributions, elements of binomial and poisson distribution, normal distribution, curve and properties, kurtosis and skewness, correlation and regression analysis, method of least squares, statistical inference, application of statistical concepts in pharmaceutical sciences. [10]

### **BOOKS RECOMMENDED**

1. A textbook of Mathematics for XI-XII Students, NCERT Publication Vol. I-IV.
2. Gupta S.P. Statistical Methods, Sultan Chand and Co., New Delhi.
3. Greval B.S., Higher Engineering Mathematics, Khanna Publication, New Delhi.
4. Boltan's Pharmaceutical Statistics, Practical and Clinical Application, Marcel Dekker, N.Y.
5. Narayan Shanti, Integral calculus , Sultan Chand & Co.
6. Prasad Gorakh, Text book on differential calculus, Pothishala Pvt. Ltd., Allahabad.
7. Narayan Shanti, Differential calculus , Shyamlal Charitable Trust, New Delhi.
8. Prasad Gorakh, Text book on integral calculus , Pothishala Pvt. Ltd., Allahabad.
9. Ayres Frank "Theory & problems of differential equations" Mc Graw Hill Book Co., Singapore.

## **SEMESTER-III**

### ***PHAR-231***

### **PHARMACEUTICS-II (UNIT OPERATIONS-I)**

#### **Unit-I**

1. **Unit Operations** : Introduction, basic laws.
2. **Fluid Flow** : Types of flow, Reynold's number, Viscosity, Concept of boundary layer, basic situations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.

#### **Unit-II**

3. **Water systems** – Raw water, soft water, purified Water, water for injection , quality requirement and treatment of water. washing , cleaning and standardisation 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, and 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 Crystallizer, 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 Systems** : 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 dermitits, t record. [06]

#### ***PHAR-231P***

### **PHARMACEUTICS-II**

#### **UNIT OPERATIONS-I**

#### **PRACTICAL**

1. Measurement of rate of flow of fluids and pressure by:
  - a) Simple and differential manometers
  - b) Venturimeter
  - c) Orifice meter
2. Determination of Reynold 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 suspension.
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 W.L. and Banchemo J.T. Introduction to Chemical Engineering Mc Graw Hill International Book Co., London.
2. Perry R.H. & Chilton C.H. Chemical Engineers Handbook, Mc Graw Kogakusha Ltd.
3. McCabe W.L. and Smith J.C. Unit Operation of Chemical Engineering Mc Graw Hill International Book Co., London.
4. Sambhamurthy, Pharmaceutical Engineering, New Age Publishers.
5. Gavhane, K.A. "Unit Operation-I", Nirali Prakashan.

### **PHAR-232**

#### **PHARMACEUTICAL JURISPRUDENCE & ETHICS**

##### **Unit-1 : 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 : An elaborate study of the following:**

- (A) Pharmacy Act 1948
- (B) Drugs and Cosmetics Act 1940 and Rules 1945 [14]

##### **Unit-III : (C) Medicinal & Toilet preparations (Excise duties Act 1955)**

- (D) Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
- (E) Drugs Price Control Order 1995. [08]

##### **Unit-IV : A brief study of the following with special reference to the main provisions.**

- (A) Poisons Act 1919
- (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 and Federal D&C Act [07]

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

## **BOOKS RECOMMENDED :**

1. B.M., Mittal, Textbook of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta.
2. Relevant Acts & Rules Published by the Govt. of India.
3. N.K. Jain, A Textbook of Forensic Pharmacy, Vallabh Prakashan, N. Delhi.
4. Singh, Harkishan "History of Pharmacy in India- Vol.-I, II & III" Vallabh Prakashan.

## **PHAR-233**

### **PHARMACOGNOSY - I**

**Unit-I :** Definition history, scope & development of Pharmacognosy. [02]

**1. Source of Drug :** Biological, marine, mineral and plant tissue cultures as source of drugs.

With Marine pharmacognosy, Novel medicinal agents from marine sources. [04]

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

**Unit-II : 3. Plant taxonomy :** Study of following families with special reference to medicinally important plants – Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, Leguminasae, Rubiaceae, Liliaceae, Labiatae, Acanthaceae, Compositae, Papavereceae. [04]

**Unit-III : 4. Cultivation, Collection, Processing & Storage of crude drugs :**

A. Factors influencing cultivation of medicinal plants, Type of Soils & fertilizers of common use. [02]

B. Pest Management & natural pest control agents. [02]

C. Plant hormones and their applications. [01]

D. Polyploidy, Mutation & hybridization with reference to medicinal plants. [02]

E. Poly Houses/ Green Houses for cultivation.

**Unit-IV : 5. 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. WHO guidelines for standardisation of medicinal plants. [08]

**Unit-V : 6. Systematic pharmacognostic study of following :**

a) Carbohydrates & derived products : Agar, Guargum, acacia, Honey, Isabgol, pectin, starch, sterculia & tragacanth. [07]

b) Lipids – Beeswax, castor oil, Cocabutter, Kokum butter, hydnocarpus oil, Codliver oil, sharkliver oil, Linseed oil, wool fat Rice-bran oil, Lard & Suet. [08]

**PHARMACOGNOSY - I**

**PRACTICAL**

1. Morphological characteristics of plant families mentioned in theory.
2. Microscopical Measurements of cell & cell contents Starchgrains, Calciumoxalate Crystals & Phloem Fibres.
3. Determination of leaf Constants such as Stomatal index, Stomatal numbers, Veinislet numbers, Vein termination number and palisade ratio.
4. Identification of crude drugs belonging to carbohydrates & lipids.
5. Preparation of herbarium sheets.

**SUGGESTED PRACTICALS**

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 Umbilliferae.
5. Microscopical measurements of starch grains (Wheat, Maize).
6. Microscopical measurements of starch grains (Rice, Potato).
7. Various types of calcium-oxalate crystals, their study and microscopical measurements (Rhubarb, Senna, Liquorice etc.)
8. Study of various types of phloem fibres.
9. Determination of stomatal number with the help of camera lucida along with the working of instrument.
10. Determination of stomatal index.
11. Determination of vein-islet and vein termination number.
12. Determination of palisade ratio.
13. Chemical Tests of Agar, Acacia, Sterulia and Tragacanth.
14. a) Chemical tests of Pectin, Starch and Honey.  
b) Swelling factor of Isapaghula husk.  
c) Average weight of Ispaghula husk.
15. Physical characteristics of Caster oil, Cod-liver oil, Shark-liver oil and Linseed oil.

**PROJECT WORK :**

Preparation of herbarium sheets.

**BOOKS RECOMMENDED**

1. Trease, G.E. & Evans, W.C., "Pharmacognosy" Bailleire tindall East bourne, U.K.
2. Wallis, T.E., Text book of Pharmacognosy, J.A. Churchill, Ltd.

3. Kokate, C.K. "Practical Pharmacognosy" Vallabh Prakashan, Delhi.
4. Wallis T.E., Analytical Microscopy, J&A Churchill Limited, London.
5. Brain K.R. and Turner T D. "The Practical Evaluation of Phyto Pharmaceutical", Wright, Scientechica- Bristol.
6. Kokate, C.K. Pharmacognosy, Nirali Prakashan, Pune.
7. Schewer PJ, "Marine Natural products", Academic press, London.

**PHAR-234**

**PHARMACEUTICAL CHEMISTRY - III  
(ORGANIC CHEMISTRY -II)**

**Unit-I** :  $\alpha$ ,  $\beta$ - Unsaturated carbonyl compounds, cycloaddition.

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

Polynuclear hydrocarbons-Naphthalene, anthracene and phenanthrene.

**Unit - II** : Heterocyclic Compound – Nomenclature, Chemistry, preparation, properties and pharmaceutical importance of pyrrole, furan, thiophene, pyridine, pyrimidine, imidazole, pyrazole, thiazole, benzimidazole, indole, phenothiazines. [08]

**Unit-III** : Name reactions – Definition, reaction mechanism and synthetic application of Merwin –Pondorff, Verley reduction, Oppeneaur oxidation, Bechmann rearrangement, Mannich reaction, Diel's alder reaction, Michel, Reformatsky, Knoevanegal reaction, Benzoin condensation. [08]

**Unit-IV**: Classification, structure, reactions, structure elucidation, identification of :

**a) Carbohydrates**

i) Monosaccharides – Glucose and fructose.

ii) Disaccharides – Sucrose, lactose and maltose.

iii) Polysaccharides – Starch. [08]

**Unit-V** : Classification, identification, general methods of preparation and reactions of amino acids and proteins.

Structure of Nucleic Acids.

Chemistry & identification of oils, fats and waxes. [08]

Polymers and polymerisation.

**PHAR-234P**

**PHARMACEUTICAL CHEMISTRY-III  
(ORGANIC CHEMISTRY-II)**

**PRACTICAL**

1. Identification of organic compounds with derivatization.
2. Synthesis of Organic Compounds involving two steps.
3. Workshop on molecular modelling of some organic molecules.

**BOOKS RECOMMENDED**

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.
2. Furniss B S, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Morrison, T.R. and Boyd, R.N., Organic Chemistry, Prentice Hall of India, Private Limited, New Delhi.
4. Finar, I.L., Organic Chemistry Vol. I & II, ELBS/Longman.
5. Jain, M.K. and Sharma S.C, Organic Chemistry, Shoban Lal Nagin Chand & Co., Delhi.

**PHAR-235**

**PHARMACEUTICS – III  
(COMMUNITY PHARMACY)**

**Unit-I**

1. Definition, scope of community pharmacy  
Roles and responsibilities of Community pharmacist, code of Ethics.
2. Community Pharmacy Management
  - i) Selection of site, Space layout, and design
  - ii) Staff, Materials- coding, stocking
  - iii) Legal requirements
  - iv) Maintenance of various registers
  - v) Use of Computers

[06]

**Unit-II**

3. Prescriptions- 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.

[06]

#### 9. OTC Medication- Definition, OTC medication list & Counselling

### **Unit-V**

#### 10. Health Education

WHO Definition of health, and health promotion, care for children, pregnant & breast feeding women, and geriatric patients.

Role of Pharmacist in family planning, prevention of communicable diseases, nutrition.

#### 11. Pharmacoepidemiology & Pharmacoconomics – Brief introduction

#### 12. Rational drug therapy – Brief introduction

[10]

### ***PHAR-235P***

## **PHARMACEUTICS – III (COMMUNITY PHARMACY)**

### **PRACTICAL**

1. Categorization and storage of Pharmaceutical products bases on legal requirements of labeling and storage.
2. Project report on visit to the nearby Community for Counseling on the rational use of drugs and aspects of health care.
3. Prescription handling and identification of drug interactions, incompatibilities.
4. Health screening services and study of equipments for:-
  - Blood glucose determination (Glucometer)

- Blood pressure (BP apparatus)
  - Lung function test (Peak flow meter)
5. Design of community pharmacy to incorporate all pharmaceutical care services (as per schedule N).
  6. Study of OTC medications  
List & Available brands
  7. Interpretation of various pathological report of blood and urine.

**BOOKS RECOMMENDED :**

1. Carter S.J. Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers, Delhi.
2. Ansel H.C., Introduction to Pharmaceutical Dosage Forms, K.M. Varghese & Co., Bombay.
3. Aulton M.E. 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 S.J., Cooper and Gunn's Tutorial Pharmacy, CBS Publishers, Delhi.
8. Drugs & Cosmetics Act & Rules.
9. Parmar N.S. Community Pharmacy & Health Education, CBS Publishers.
10. Parthasarathi G, Nyfort-Hansen K, Nahata MC, A textbook of Clinical Pharmacy practice- Essential concepts & skills, Orient Longman.

**PHAR -236**

**ANATOMY, PHYSIOLOGY AND  
PATHOPHYSIOLOGY – III**

**Unit I – Digestive system** –Parts of digestive system, their structure and functions. Various gastrointestinal secretions & their role. [08]

**Unit II** –Pathology of disorders related to digestive system Peptic Ulcer, Ulcerative colitis, Crohns disease, Zollinger- Ellison syndrome, Amoebiasis, typhoid, Hepatitis, Cirrhosis of liver, pancreatitis. [06]

**Unit-III – Urinary System** – Anatomy & physiology of urinary system, physiology of urine formation, acid- base balance, pathophysiology of renal feature, glomerulonephritis, Urinary tract infection. [08]

**Unit-IV-Reproductive system**–Male & female reproductive system. Menstruation, Pathophysiology of sexually transmitted diseases, spermatogenesis, oogenesis, pregnancy. [08]

**Unit-V – Endocrine system** – Anatomy & Physiology of pituitary, thyroid, parathyroid, adrenal, pancreas, control of hormone secretion, pathophysiology of hypo & hyper secretion of endocrine glands & their disorders e.g. – Diabetes mellitus. [10]

#### **BOOKS RECOMMENDED**

1. Difore SH, “Atlas of Normal Histology” Lea & Febiger Philadelphia.
2. Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
3. Guyton AC, Hall JE., Text book of Medical Physiology, WB Saunders Company.
4. Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
5. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
6. Tortora GJ, & Anagnostikos NP, Principles of Anatomy & Physiology, Harper & Row Publishers, New Delhi.
7. Parmar N.S., Health Education & Community Pharmacy CBS Publishers, Delhi.
8. Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
9. Keele, C.A., Niel, E and Joels N, Samson Wright’s Applied Physiology, Oxford University Press.
10. Dipiro JL, Pharmacotherapy – A Pathophysiological Approach, Elsevier.
11. Robbins SL, Kumar V, Basic Pathology, WB Saunders.

## SEMESTER IV

**PHAR-241**

### **PHARMACEUTICS – IV (UNIT OPERATIONS – II)**

- 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, Fluidised bed dryer, spray dryer and special drying methods. [08]
- Unit-V : Automated Process Control Systems** : Process variables, temperature, pressure, flow level and vacuum and their measurements. Elements automatic process control and introduction to automatic process control systems. Elements of computer aided manufacturing (CAM)  
Reactors and fundamentals of reactors design for chemical reactions. [08]

**PHAR-241P**

### **PHARMACEUTICS-IV (UNIT OPERATIONS-II)**

#### **PRACTICAL**

1. Determination of overall heat transfer coefficient.
2. Study of factors affecting rate of evaporation :-
  - a) Effect of surface area
  - b) Effect of temperature
3. Study of factors affecting rate of drying
  - a) Surface area
  - b) Temperature
4. Determination of rate of drying, free moisture content and bound moisture content.
5. Experiments based on

- a) Steam distillation
  - b) Extractive distillation
  - c) Azeotropic distillation
5. Elementary knowledge of engineering drawing
- Alphabets/ letters writing
  - Scales
  - Orthographic projections – First and third angle projection methods
  - Simple Isometric views

**BOOKS RECOMMENDED :**

1. Badger W.L. and Banchero J.T. Introduction to Chemical Engineering Mc Graw Hill International Book Co., London.
2. Perry R.H. & Chilton C.H. Chemical Engineers Handbook, Mc Graw Kogakusha Ltd.
3. McCabe W.L. and Smith J.C. Unit Operation of Chemical Engineering Mc Graw Hill International Book Co., London.
4. Gavhane, K.A. “Unit Operation-II”, Nirali Prakashan.
5. Sambhamurthi Pharmaceutical Engineering, New Age Publishers.

**PHAR-242**

**PHARMACEUTICAL MICROBIOLOGY**

**Unit-I :**

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

**Unit-II :**

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

**Unit-III :**

7. Control of microbes by physical and chemical methods.
  - A. Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
  - B. Sterilization, different methods, validation of sterilization methods & equipments. [08]

**Unit-IV :**

- A. Sterility testing as per I.P.
- B. Preservative efficacy

**Unit-V :**

8. Aseptic techniques and clean area classification

9. Microbial assays of antibiotics, vitamin B12.

10. Environmental microbiology

[08]

**PHAR-242P**

**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. Subculturing of common bacteria, fungi, yeast.
3. Isolation of bacteria.
4. Identification and staining of bacteria
  - Simple staining
  - Gram staining
  - Acid fast staining
  - Negative staining
  - Hanging drop preparation
5. Evaluation of disinfectants and antiseptics.
  - Phenol coefficient test, minimum inhibitory concentration.
6. Study of sterilization methods & equipments
  - Dry heat
  - Moist heat
7. Test for sterility of pharmaceutical products as per IP
8. Microbial assay of antibiotics as per IP.

### **BOOKS RECOMMENDED :**

1. Aneja K.R. 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 R.Y., Ingraham, J.L., Wheelis M.L. & Painter P.R. General Microbiology, Macmillan Press Limited.
5. Hugo and Russell, Pharmaceutical Microbiology, Black Well Scientific Publication, Oxford.
6. Prescott L.M., Harley J.P. & Klien D.A. Microbiology, McGraw Hill.
7. Sykes, Disinfection and Sterilization.
8. Pelczar & Reid, Microbiology, Tata Mc Graw Hill, Delhi.
9. Virella G. Microbiology and Infectious Diseases, William & Wilkins.
10. Ananthanarayan R & Paniker CKJ, Textbook of Microbiology, Orient Longman.

### **PHAR-243**

#### **PHAMACOGNOSY - II**

**Unit-I : Resins** : Study of drugs containing Resins and Resin Combination like Podophyllum, Cannabis, Capsicum, Shellac, Asafoetida, Balsam of tolu, Balsam of peru, Benzoin, Turmeric, Ginger. [05]

**Unit-II : 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, Spearming, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamon, Valerian, Musk, Palmarosa, Gaultheria, Sandalwood. [10]

**Unit-III : Phytochemical Screening** : An introduction to active constituents of drugs : Their isolation, classification and properties with Qualitative chemical tests of the followings – Alkaloids, Saponins, Cardenolides and bufadienolides, flavanoids and Leucoanthocyanidine, cynogenetic glycosides. [14]

**Unit-IV : Fibres** : Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glasswool, polyester and asbestos. [03]

**Pharmaceutical aids :-** Study of Pharmaceutical aids like Talc, Diatomite, Kaolin, Bentonite, Fullers earth, Gelatin and Natural colors. [02]

**Unit-V : Tannins** : Study of tannins & tannin containing drugs like Gumbir (Pale Catechu), Black Catechu, Gall and Myrobalans (Harde, Baheda, Arjuna & Ashoka). [03]  
Utilization of aromatic plants & desired products will special reference to Sandalwood oil, Mentha oil, Lemon grass oil, Vetiver oil, Geranium oil & Eucalyptus oil. [03]  
Role of aromatic plants in national economy.

**PHAR-243P**

**PHARMACOGNOSY - II**

**PRACTICAL**

1. Identification of crude drugs mentioned in theory.
2. Study of fibres and pharmaceutical aids.
3. Microscopic study of seven selected drugs and their powders mentioned under the category of volatile oils in theory with their chemical tests.
4. General chemical test for Alkaloids, Glycosides, Steroids, Flavonoids & Tannins.

**SUGGESTED PRACTICALS**

1. Morphology of Mentha, Lemangrass, 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.
5. Morphology and microscopy of Cardamom and Fennel.
6. Morphology and microscopy of Clove and to study its transverse section.
7. Study of Cotton, Silk and Wool along with their chemical Tests.
8. To study the morphology and chemical tests of Talc, Diatomite, and Kaolin.
9. Morphology and microscopy of Bentonite, Gelatin and natural colours (Saffron).
10. To perform the chemical tests of Balsam (Tolu and Peru) and Asafoetida.
11. Preparation of reagents for the chemical tests of Alkaloids and to perform the chemical tests on any Alkaloid containing drug.
12. Test for identification of Glycosides (Saponin and Anthraquinone).
13. Test for identification of Tannins.
14. Tests for identification of steroids.
15. Tests for identification of flavonoids.

**PROJECT WORK :**

Utilization of Aromatic plants; ((Monograph).

### **BOOKS RECOMMENDED :**

1. Trease G.E., & Evans W.C., "Pharmacognosy" Balliere Tindall East Bourne U.K.
2. Tyler V.E. et al "Pharmacognosy" Lea & febiger, Philadelphia.
3. Wallis, T.E. "Text Book of Pharmacognosy" J&A Churchill Ltd, London.
4. Kokate C.K. et al "Pharmacognosy" Nirali Prakashan, Pune.
5. Atal C.K. & Kapur BM, "Cultivation & utilization of Medicinal plant, RRL, Jammu.
6. Harborne J B, Phytochemical method, Chapman & Hall International Edition, London.

### **PHAR-244**

#### **PHARMACEUTICAL ANALYSIS- II**

**Unit-I :** Theoretical considerations and application in drug analysis and quality control by the following analytical techniques (assays included in the Indian Pharmacopia 1996)

(A) **Non-aqueous titrations**

(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 : 2. 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.

Paper Chromatography, column chromatography, TLC. [08]

**Unit-V:** Basic Principles, Instrumentation and Applications of GLC & HPLC. [08]

### **PHAR-244P**

#### **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, Karlfisher.
4. Exercise based on acid base titration 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. Exercises involving conductometric titrations.
6. Exercises based on paper, column and thin- layer chromatography.

**BOOKS RECOMMENDED :**

1. Beckett, A H and Stenlake, J.B, Practical Pharmaceutical Chemistry, Vol, I and 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, J.D. Thomas M.J.K. "Vogel's Text Book of Quantitative chemical" Pearson Education Asia.
5. Connors KA, A Textbook of Pharmaceutical Analysis, Wiley Interscience, New York.

**PHAR-245**

## **ANATOMY PHYSIOLOGY AND PATHOPHYSIOLOGY -IV**

**Unit-I – Respiratory System** – Anatomy & function of respiratory structures, Mechanism of respiration, regulation of respiration, pathophysiology of Asthma, Pneumonia, Bronchitis, Emphysema, Tuberculosis. [08]

**Unit-II – Cardiovascular System** – Functional Anatomy of heart, conducting system of heart, cardiac cycle, ECG (Electro cardiogram). Pathophysiology of hypertension, Angina, CHF, myocardial infarction, cardiac arrhythmias, Ischaemic heart disease, Arteriosclerosis. [10]

**Unit-III – Cell injury & Adaptation** – Courses of cell injury, pathogenesis & morphology of cell injury.

**Cellular Adaptation** – Atrophy, hypertrophy, aplasia, metaplasia, & dysplasia, intracellular accumulation & pathophysiology of Neoplasm. [08]

**Unit IV** – Basic mechanisms involved in the process of inflammation and repair

Alterations in vascular permeability and blood flow, migration of WBC's , mediators of inflammation. Brief outline of the process of repair [08]

**Unit-V- Pathophysiology of Joints disorder – Arthritis, gout, myasthenia gravis, spasticity, tetany, fatigue. Pathophysiology of anaemia, AIDS, hypersensitivity, allergic conditions, phlyososis, epilepsy, Parkinson & Alzheimer's diseases pathophysiology of cataract, glaucoma etc. [06]**

### **BOOKS RECOMMENDED**

1. Difore SH, "Atlas of Normal Histology" Lea & Febiger Philadelphia.
2. Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.
3. Guyton AC, Hall JE., Text book of Medical Physiology, WB Saunders Company.
4. Chatterjee C.C. Human Physiology, Medical Allied Agency, Calcutta.
5. Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.
6. Tortora GJ, & Anagnodokos NP, Principles of Anatomy & Physiology, Harper & Rave Publishers, New Delhi.
7. Parmar N.S., Health Education & Community Pharmacy CBS Publishers, Delhi.
8. Shalya Subhash, Human Physiology, CBS Publishers & Distributors.
9. Keele, C.A., Niel, E and Joels N, Samson Wright's Applied Physiology, Oxford University Press.
10. Dipiro JL, Pharmacotherapy – A Pathophysiological Approach, Elsevier.
11. Robbins SL, Kumar V, Basic Pathology, WB Saunders.

**U.P. TECHNICAL UNIVERSITY  
LUCKNOW**



**Re-revised Syllabus**

**1<sup>st</sup> and 2<sup>nd</sup> Year**

**[Applicable from the session 2005-06]**

**BACHELOR OF PHARMACY**