SEMESTER I

PHAR-IIIM

REMEDIAL MATHEMATICS

Unit-I
   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: Integration as inverse of differentiation indefinite integrals of standard form,
integration by parts. [12]

BOOKS RECOMMENDED
**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.

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

**BOOKS RECOMMENDED**

PHARMACEUTICAL ANALYSIS-1

THEORY

Unit-I:
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**:
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:** Dentifrices- anti-caries agents (Sodium fluoride).

**Unit-II: Gastrointestinal Agents:** Acidifying agents (Dilute Hydrochloric acid), antacids (Bismuth subcarbonate, Alumium 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).

**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.

**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).

**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.
List of Experiments

<table>
<thead>
<tr>
<th>No. of Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To perform limit test of chloride, sulphate, Iron, Heavy metal and arsenic in the given sample.</td>
</tr>
<tr>
<td>2. Salt analysis</td>
</tr>
<tr>
<td>3. Preparation of following compounds:-</td>
</tr>
<tr>
<td>Boric acid</td>
</tr>
<tr>
<td>Magnesium sulphate</td>
</tr>
<tr>
<td>Heavy magnesium carbonate</td>
</tr>
<tr>
<td>Calcium Carbonate</td>
</tr>
<tr>
<td>Alum</td>
</tr>
<tr>
<td>Zinc sulphate</td>
</tr>
</tbody>
</table>

BOOKS RECOMMENDED:


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 reducting 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  
2. Camphor Water BP  
3. Rose Water NF

b) Solutions  
1. Lysol solution IP  
2. Strong Ammonium Acetate solution BP

c) Syrups  
1. Simple syrup BP  
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  
2. Absorbable dusting powder USP/NF

g) Lotions  
1. Calamine lotion IP  
2. Amino benzoic acid lotion BP

h) Liniments  
1. Methyl salicylate liniment BP  
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:

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
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:
PHAR-116

PROFESSIONAL COMMUNICATION-I

UNIT-I

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

UNIT-II

  Letter writting, Precis and Essay writting
  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

2. Robbins, S “Organisational Behaviour”
SEMESTER-II

PHAR-121

PHYSICAL CHEMISTRY

Unit-I

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.

Unit-II

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.

Unit-III


Unit-IV


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-H₂O, NaCl-H₂O system), Distribution law & application to solvent extraction.
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.

BOOKS RECOMMENDED:
5. Glasstone S. & Lewis D, Elements of Physical Chemistry, Macmillan Education.

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 absolut alcohol. 4
3. Synthesis of compounds involving benzoylation, acetylation, bromination, reduction & oxidation. 5
   Synthesis of following compounds
   Picric acid
   Aniline
   Acetanilide
   Aspirin
   Hippuric acid
   P-Bromo acetanilide
   Iodoform
   Oxalic Acid
BOOKS RECOMMENDED:

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.

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, algorithm, 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:

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 registration analysis, method of least squares, statistical inference, application of statistical concepts in pharmaceutical sciences. [10]

BOOKS RECOMMENDED
4. Boltan’s Pharmaceutical Statistics, Practical and Clinical Application, Marcel Dekker, N.Y.

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

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


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

PHAR-232

PHARMACEUTICAL JURISPRUDENCE & ETHICS

Unit-I : Introduction
1. Pharmaceutical Legislations – A brief review.
2. Drugs & Pharmaceutical Industry – 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.
(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.

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]
PHAR-233P

PHARMACOGNOSY - I

PRACTICAL

1. Morphological characteristics of plant families mentioned in theory.
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 Linserd oil.

PROJECT WORK:

Preparation of herbarium sheets.

BOOKS RECOMMENDED


**PHAR-234**

**PHARMACEUTICAL CHEMISTRY - III**

**(ORGANIC CHEMISTRY -II)**

**Unit-I**: α, β- Unsaturated carbonyl compounds, cycloaddition.

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

Polynuclear hydrocarbons-Napthalene, anthracene and phenantherene.

**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, Knoevenegal 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.
3. Workshop on molecular modelling of some organic molecules.

BOOKS RECOMMENDED
   New 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.

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

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 & Pharmacoeconomics – Brief introduction
12. Rational drug therapy – Brief introduction

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.
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:**

5. I.P., Govt of India Publication.
7. Carter S.J., Cooper and Gunn’s Tutorial Pharmacy, CBS Publishers, Delhi.

**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
SEMESTER IV

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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]

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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:  

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.  

Unit-II  

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.  

Unit-IV  
A. Sterility testing as per I.P.  
B. Preservative efficacy
C. Personal microbiology

Unit-V :

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

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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:
3. Davis, Dulbetco, Eisen Microbiology.
7. Sykes, Disinfection and Sterilization.
9. Virella G. Microbiology and Infectious Diseases, William & Wilkins.
10. Ananthanarayan R & Paniker CKJ, Textbook of Microbiology, Orient Longman.

PHAR-243

PHARMACOGNOSY - 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, Coriandars, 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.
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 (Soffron).
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 indentification of Glycosides (Saponin and Anthraquinone).
13. Test for identification of Tannins.

**PROJECT WORK :**
Utilization of Aromatic plants; ((Monograph).
BOOKS RECOMMENDED:

**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
2. Complexometric Titrations: Preparation and standardization of EDTA solution some exercise related to pharmacopoeial assays by Complexometric titrations.

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 :**


2. Pharmacopoeia of India, published by The Controller of Publications, Delhi.


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, Bronchits, 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, hypertropy, 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, physisosis, epilepsy, Parkinson & Alzeimer’s diseases pathophysiology of cataract, glaucoma etc. [06]

BOOKS RECOMMENDED

Re-revised Syllabus

1\textsuperscript{st} and 2\textsuperscript{nd} Year

[Applicable from the session 2005-06]

BACHELOR OF PHARMACY