## MARKS DISTRIBUTION PATTERN

Bachelor of Pharmacy 1\textsuperscript{st} year (1\textsuperscript{st} Semester) WEF 2014 – 2015 Session onwards

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<th>Course Code</th>
<th>Subject Name</th>
<th>Period (Hours)</th>
<th>Sessional Exam</th>
<th>ESE Subject Total</th>
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T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE
## Bachelor of Pharmacy 1st year (2nd Semester) WEF 2014 – 2015 Session onwards

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T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE
### Bachelor of Pharmacy 2nd year (3rd Semester) WEF 2014 – 2015 Session onwards

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#### Practical Day to Day Evaluation

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**Note:** Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

**0.6 Credits – Sessional**

**2.4 Credits – ESE**

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each
Bachelor of Pharmacy 2nd year (4th Semester) WEF 2014 – 2015 Session onwards

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**Practical Day to Day Evaluation**

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T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each
Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively
0.6 Credits – Sessional
2.4 Credits – ESE
Bachelor of Pharmacy 3rd year (5th Semester) WEF 2014 – 2015 Session onwards

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Practical Day to Day Evaluation

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T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each
Note:– Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively
0.6 Credits – Sessional
2.4 Credits – ESE
Bachelor of Pharmacy 3rd year (6th Semester) WEF 2014 – 2015 Session onwards

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**Practical Day to Day Evaluation**

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T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE
Bachelor of Pharmacy 4th year (7th Semester) WEF 2014 – 2015 Session onwards

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Practical Day to Day Evaluation

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T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each

Note: Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively

0.6 Credits – Sessional

2.4 Credits – ESE
Bachelor of Pharmacy 4th year (8th Semester) WEF 2014 – 2015 Session onwards

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<td>Elective (A)- Standardization of Herbal Drugs and Cosmetics Or (B)- Drug Design Or (C)- Pharmaceutical Marketing Or (D)- Pharmaceutical Packaging Or (E)- Novel Drug Delivery Systems Or (F)- GMP, Quality Assurance &amp; Validation Or (G)- Hospital Pharmacy Or (H)- Advanced Pharmacology Or (I)- Pharmaceutical Entrepreneurship</td>
<td>L P CT TA Total ESE</td>
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Practical Day to Day Evaluation

| 6    | PHR – 805P | Elective (A)- Standardization of Herbal Drugs and Cosmetics Or (B)- Drug Design Or (C)- Pharmaceutical Marketing Or (D)- Pharmaceutical Packaging Or (E)- Novel Drug Delivery Systems Or (F)- GMP, Quality Assurance & Validation Or (G)- Hospital Pharmacy Or (H)- Advanced Pharmacology Or (I)- Pharmaceutical Entrepreneurship | L P CT TA Total ESE | 50 200 250 2 |

T.A. – Teacher Assessment (Assignment 10 marks & Attendance 10 marks), ESE – End Semester Examination, CT – Two Sessional exams of 15 marks each
Note:- Duration in Theory & Practical of ESE shall be 3 (three) hours and 4 (four) hours respectively
0.6 Credits – Sessional
2.4 Credits – ESE
B.PHARM. I YEAR
SEMESTER-I

PHR-101

PROFESSIONAL COMMUNICATION-I

Unit-1. Grammar: Sequences of tenses, voice, articles, direct and indirect speech; degrees of comparison and preposition. [08]

Unit-2. Letter writing, Précis and Essay writing. Comprehension Speed reading, scanning & swimming. [08]

Unit-3. Role and importance of communication, verbal and non-verbal communication, Group communication, effective communication, barriers of communication, communication media, participating in discussions, conduct of seminars, conferences etc., interacting with learners and teachers, role of wit and humor in communication. [08]

Unit-4. Agreement and disagreements, how to use a dictionary; how to use a thesaurus; vocabulary development; synonyms; one word substitutes, use of appropriate words and vocabulary. [08]

Unit-5. Types and methods of learning and listening; learning and listening of knowledge, attitudes, skills, decision making, thinking, motivation and practices. [08]

BOOKS RECOMMENDED: (Latest Edition)
1. Wren P.C and Martin H., High School Grammar and Composition, S. Chand & Co.
PHR-102

COMPUTER FUNDAMENTALS AND
PROGRAMMING


Unit-2. Introduction: Operating system and function, Evolution of operating system, Batch, Interactive, Time sharing and Real Time System. Single user operating system and Multi-user operating system, Compare MS-DOS vs. UNIX, Various window features. Internal and External commands in MS-DOS.[08]

Unit-3. Introduction to MS-OFFICE, WORD Document creation, Editing, formatting table handling, mail merge, Excel, Editing, working Retrieval, Important functions, short cut keys used in EXCEL. [08]

Unit-4. MS-Power point -Job Profile, Elements of Power point, ways of delivering Presentation, concept of Four P’s (Planning, Preparation, Practice and Presentation) ways of handing presentations e.g. creating, saving slides show controls, Adding formatting, animation and multimedia effects. Database system concepts, Data models schema and instance , Database language, Introduction to MS Access 2003, main components of Access tables, Queries, Reports, Forms table handling, working on Query and use of database. Fundamentals of Structured Query Language (SQL) [08]

Unit-5. Computer applications in Pharmaceutical and clinical studies, uses of Internet in Pharmaceutical Industry. Fundamentals of C programming, Data structure using C, Queue, FIFO etc, Internet History, Characteristics, uses. [08]

PHR-102P

COMPUTER FUNDAMENTALS AND PROGRAMMING (LAB)

Software Lab to be used for the following:-
2. MS-Office 2003 (MS Word, MS Power point, MS Excel, MS Access).
4. Internet Features (E-mail, Browser etc.)
5. Data Structure using C

BOOKS RECOMMENDED: (Latest Edition)
5. Sinha PK “Fundamentals of Computers”.
6. Kanitkar Yashwant, Let us C.
PHARMACEUTICAL CHEMISTRY-1
(INORGANIC PHARMACEUTICAL CHEMISTRY)
Unit-1. Sources of impurities & their control, limit test for iron, arsenic, lead, heavy metals,
chloride & sulphate. [08]
Unit-2. 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 the latest Indian Pharmacopoeia.
Gases and Vapors: Inhalants (Oxygen), Anaesthetics (Nitrous oxide).
Topical Agents: Protective (Calamine, titanium dioxide, t alc, kaolin), astringents (Zinc oxide,
Zinc Sulphate) and anti infective (Boric Acid, Hydrogen peroxide, Iodine, Povidone Iodine,
Potassium permanganate, Silver nitrate).
Dental Products: Dentrifices- anti-caries agents (Sodium fluoride). [08]
Unit-3. 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.)
[08]
Unit-4. 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-5. 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).
Miscellaneous Agents: Expectorants (Ammonium chloride, Potassium Iodide), antioxidants
(Sodium metabisulphite, Sodium benzoate). [08]
PHARMACEUTICAL CHEMISTRY-I
(INORGANIC PHARMACEUTICAL CHEMISTRY) - LAB

Proposed list of experiments

1. To perform the limit test for chloride in the given sample (for e.g. Ammonium Carbonate calcium gluconate)
2. To perform the limit test for sulphate in the given sample (for e.g. Ammonium Chloride)
3. To perform the limit test for iron in the given sample (for e.g. calcium carbonate)
4. To perform the limit test for heavy metal in the given sample (for e.g. Calcium carbonate)
5. To perform the limit test for arsenic in the given sample (for e.g. Barium Sulphate)
6. To prepare Boric acid from borax and perform the limit test and identification test.
7. To prepare potash alum by using potassium sulphate and aluminium sulphate and perform the limit test and identification test.
8. To prepare calcium Carbonate by using calcium chloride and sodium carbonate and perform the limit test and identification test.
9. To prepare heavy magnesium carbonate by using sodium carbonate and magnesium sulphate and perform the limit test and identification test.
10. To prepare zinc sulphate by using zinc and sulphuric acid and perform the limit test and identification test.
11. To prepare Peritoneal Dialysis Solution.

BOOKS RECOMMENDED: (Latest Edition)
3. The pharmacopoeia of India.
5. Remington Pharmaceutical Sciences, Mack Publishing Co., Pennsylvania
INTRODUCTION TO PHARMACY

Unit-1. HISTORY OF PHARMACY: Origin & developments of pharmacy, scope of pharmacy, a brief review of development of Pharmaceutical Education and drugs, Pharmaceutical Industry in India, Pioneers who have contributed to the development of Pharmacy in India and Pharmaceutical legislations and ethics- a brief review. [08]

Unit-2. Introduction to pharmacopoeias with special references to I.P., B.P., U.S.P. & International Pharmacopoeia including general notices [08]

Unit-3. PHARMACEUTICAL CALCULATIONS: Posology, Latin terms, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipies percentage solution, alligation, alcohol dilution, proof spirit, Chelating agents. [08]

Unit-4. PHARMACEUTICAL ADDITIVES: Colouring, flavouring and sweetening agents, cosolvents, preservatives, surfactant and their applications, antioxidants, Natural and Semisynthetic Biopolymers. [08]

Unit-5. INTRODUCTION OF PHARMACEUTICAL DOSAGE FORMS –Definition, classification method of preparation, uses, advantages also including illustrative examples of equivalent Indian marketed formulations of the following- solutions, aromatic waters, mixtures, spirits, syrups, elixirs, powders, lotions, liniments, pastes, mucilage, glycerin, paints, mouth washes, and inhalations. [08]

INTRODUCTION TO PHARMACY (LAB)

The Practical based on the dosage forms, at least two experiments from each category mentioned below.

Preparation and Evaluation (Reference Present Edition)

1. Aromatic waters:
   - Concentrated Camphor Water BP
   - Strong rose water USP/NF
   - Peppermint water USP/NF

2. Syrups:
   - Syrup BP
   - Paracetamol Syrup IP
   - Codeine Syrup IP
   - Chloroquine Syrup IP

3. Linctus:
   - Simple Linctus BP
   - Pholcodine Linctus IP

4. Sprits
   - Peppermint spirit BP
   - Aromatic spirit of Ammonia BP
   - Lemon spirit BP

5. Elixir
   - Simple elixir BP
   - Piperazine citrate elixir BP
   - Ephedrine elixir IP
   - Aromatic elixir USP/NF

6. Solutions:
   A. Oral
      - Paediatric Ferrous sulphate solution BP
      - Iodine oral solution aqueous BP
      - Ascorbic acid oral solution USP/NF
   B. Topical
      - Hydrogen peroxide topical solution USP/NF
      - Strong ammonium acetate solution BP
      - Calcium hydroxide solution BP
- Povidone iodine solution IP
- Cresol with soap Solution IP
- Benzalkonium Chloride Solution IP

7. Mixtures
- Aromatic Magnesium Carbonate Mixture BP
- Ammonium Chloride mixture BP
- Magnesium hydroxide mixture BP
- Magnesium sulphate mixture BP

8. Powders
- Oral rehydration salts BP
- Compound magnesium trisillicate oral powder BP
- Talc dusting powder BP
- Sodium bicarbonate oral powder USP/NF
- Absorbable dusting powder USP/NF

9. Pastes
- Compound zinc paste BP
- Magnesium sulphate paste BP
- Salicylic acid and zinc paste USP/NF

10. Poultices
- Kaolin poultice BP

11. Liniments
- White liniment BP
- Methyl Salicylate liniment BP

12. Lotions
- Calamine lotion IP
- Zinc sulphate lotion BP
- Benzyl benzoate application IP

13. Mouth washes
- Compound sodium chloride mouthwash BP
- Chlorhexidine mouthwash BP
- Povidone iodine mouthwash BP

14. Inhalations
- Benzoin inhalation BP
- Menthol and benzoin inhalation IP

Books Recommended:
1. I.P. Latest Edition
2. B.P. Latest Edition
4. International Pharmacopoeia
5. Ansel’s HC, Pharmaceutical Calculations, 13th edition, Lipincott Williams and Wilkins
8. Singh Harkishan, History of pharmacy in India and related aspects, Volume 1-6, Vallabh Prakashan, New Delhi
PHR-105
ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-I
Unit-I
a) Introduction to human body and organization of human body.
b) Functional and structural characteristics of cell.
c) Detailed structure of cell membrane and physiology of transport process (Including enzymes and co-enzymes).
d) Structural and functional characteristics of tissue: epithelial, connective, muscle and nerve. (8)
Unit-II
a) Skeletal System- Structure, composition and functions of skeleton, classification of joints, types of movement of joints.
b) Anatomy and physiology of skeletal muscle and smooth muscle, neurotransmission, physiology of skeletal muscle.
c) Contraction, energy metabolism, types of muscle contraction, muscle tone. (08)
Unit-III
a) Haemopoietic system: - composition, and function of blood elements, erythropoiesis, blood groups, blood coagulation.
b) Lymphatic system: - composition, formation and circulation of lymph mode and spleen. (08)
Unit-IV
Endocrine System: Basic anatomy and physiology of pituitary, thyroid, parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones and functions. (08)
Unit-V
Sense organs: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin(superficial receptors). (08)

PHR105-P
APP-I Lab
Exp.1-3 Study of Human Skeleton
Exp.4-6 Microscopic study of different tissues.
Exp.7-10 Study of different systems of Human body with help of charts and Models.
Exp.11-15 Estimation of Haemoglobin and determination of clotting time and Bleeding time, RBC, WBC (Total), DLC and ESR
Books Recommended: (Latest Edition)
3. Robbins SL, Kumar V, Basic Pathology, WB Saunders.
5. Shalya,Subhas, Human Physiology, CBS Publisher, New Delhi.
6. Chaurasia,B.D, Human anatomy, Regional and applied.Part-1,CBS publisher, New Delhi
Unit-1. Structure and Properties: Atomic Structure, atomic orbital, molecular orbital, hybridization, sigma and Pi bond, convalent, electrovalent and co-ordinate bond, inductive effect, resonance, Classification and Nomenclature of organic compounds. [08]
Unit-2. Isomerism, geometrical isomerism, Stereochemistry including optical activity, stereoisomerism, specification of configuration and conformational analysis. [08]
Unit-3. Important methods of preparation, reactions with special reference to mechanism of the following classes of compounds: Alkanes, alkenes, alkynes and dienes, free radical substitution reaction, alkyl halides, Alcohols. [08]

Unit-4. Aromatic Compounds, aromatic character, structure of benzene, resonance, orientation of aromatic substitution, arenes, amines (aliphatic & aromatic), phenols, aryl halides. [08]
Unit-5. 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]

PHR-201P
PHARMACEUTICAL CHEMISTRY- II
(ORGANIC CHEMISTRY-I) LAB

1. Identification of elements and functional groups in given organic compounds.
2. Purification of solvents like Toluene Chloroform, Acetone and preparation of absolute Alcohol.
3. Synthesis of compounds involving benzoylation and acetylation.

BOOKS RECOMMENDED: (Latest Edition)
PHR-202
PHYSICAL PHARMACY – I
(PHARMACEUTICS- II)

Unit-1. MATTER, PROPERTIES OF MATTER: State of matter, change in the state of matter, latent heats and vapor pressure, sublimation critical point, Eutectic mixtures, gases, aerosols- inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solids crystalline, amorphous and polymorphism. [08]

Unit-2. SOLUBILITY AND DISTRIBUTION PHENOMENON: solute – solvent interactions, solubility of gases in liquids, solubility of liquids in liquids, solubility of solids in liquids, factors affecting solubility. [08]

Unit-3. BUFFERS: Buffers equations and buffer capacity in general buffers in pharmaceutical systems, preparation, stability buffered isotonic solutions measurements of tonicity, calculations and methods of adjusting isotonicity [08]

Unit-4. SOLUTIONS: Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement Debye Huckel theory. [08]

Unit-5. CHEMICAL KINETICS: Zero, first and second order reactions, complex reactions, theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid base and enzyme catalysis. [08]

PHR-202P
PHYSICAL PHARMACY – I
(PHARMACEUTICS- II) LAB

1. To determine the distribution coefficient (partition coefficient) of iodine between carbon tetrachloride and water.
2. To plot the mutual solubility curve of phenol- water system and report the critical solution temperature.
3. Determination of rate constant of simple reaction.
4. To determine the percent w/v composition of a sugar solution using polarimeter.
5. To compare theoretical pH values (using Henderson- Hasselbalch equation) with the experimental values (using ph meter).
6. Determine the pH given solution using universal indicator system.
7. To determine dissociation constant (ka or pKa) of a weak acid (acetic acid) using conductivity meter
8. To determine the molecular weight of a nonvolatile substance by ebullioscopic method (Landsberger’s method)
9. To determine the molecular weight of a substance using the principle of freezing point depression method (Rast- Camphor method).
10. To determine solubility of solids (benzoic acid) at different temperatures and to determine the molar heat of fusion of benzoic acid.
11. To determine solubilities of three liquids co-existing together (co-solvency effect).

BOOKS RECOMMENDED: (Latest Edition)
1. Martin A, Bustamante P. & Chun A.H.C- Physical Pharmacy, Lea & Febiger, Philadelphia
Unit-1. ENDOCRINE SYSTEM: Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones and functions. [08]
Unit-2. URINARY SYSTEM: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid -base balance. [08]
Unit-3. REPRODUCTIVE SYSTEM: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization, Sex differentiation, spermatogenesis and oogenesis demography and family planning. [08]
Unit-4. SENSE ORGANS: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors). [08]
Unit-5. a) Concepts of health & disease, agents causing communicable diseases & prevention of disease. b) Classification of food requirements, Balanced diet, Nutritional deficiency disorders, their treatment & prevention, specification for drinking water. [08]

BOOKS RECOMMENDED: (Latest Edition)
1. Ranade VG, Text Book of Practical Physiology, Pune Vidyarthi Griha Prakashan, Pune.
Unit -1. GENERAL CONCEPT OF ANALYSIS: 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. [08]

Unit 2. ACID BASE TITRATION: 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. [08]

Unit 3. 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, iodometry and iodometry, titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate, potassium dichromate. [08]

Unit 4 (A). 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, Gaylussac methods, Mohr’s method, Volhard’s method and Fajan’s methods.

(B). GRAVIMETRIC ANALYSIS: Precipitation techniques, Solubility products; Digestional 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]

Unit 5. Complexometric titrations: Introduction, titration curves, types of EDTA titrations, titration of mixtures, metal ion indicators, standard EDTA solutions. [08]

PHR-204P
PHARMACEUTICAL ANALYSIS–I (LAB)

Proposed list of experiments
1. To study the analytical balance and calibrate the weights provided in the weight box
2. To calibrate the given volumetric flask of 100ml. and 50ml.
3. To prepare 1 N HCL and standardize it.
4. To prepare 0.1N H2SO4 and standardize it.
5. To prepare 0.1 N NaOH and standardize it against succinic acid / oxalic acid.
6. To prepare 0.1N H2SO4 and standardize it against previously standardize NaOH.
7. To perform the assay of Boric Acid.
8. To perform the analysis of mixture of boric acid and borax.
9. To perform the analysis of mixture of Sodium bi carbonate and Sodium carbonate.
10. To perform the analysis of mixture of Sodium carbonate and Sodium Hydroxide.
11. To prepare 0.1N KMnO4 and standardize it against oxalic acid / sodium oxalate.
12. To perform assay of FeSO4.7H2O
13. To prepare 0.1N Na2S2O3 solution and standardize it.
14. To prepare and standardize 0.05N iodine solution.
15. Assay of ascorbic acid.
Precipitation and Complexometric methods
16. To prepare 0.1N AgNO₃. And standardize it.
17. To prepare 0.1 N NH₄SCN / NaCl solution and standardize it against previously standardized AgNo₃ solution.
18. Preparation and standardization of 0.05M disodium EDTA solution.
19. Determination of the percentage of CaCO₃ / MgSO₄

BOOKS RECOMMENDED: (Latest Edition)
2. Barner, J.D., Thomas,M.J.K., Mendham J. and Denney, R.C., Vogel’s Textbook of Quantitative Inorganic Analysis including Elementary Instrumental Analysis. The ELBS and Longman London,
4. Gary, D.C. Analytical Chemistry. John Wiley and Sons, New York,
Unit-1. 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]


(B) Size Separation: Standards for Powders, Pharmacopoeal classification, Sieves, Materials used for Sieves, Sieving Methods, Fluid Classification Methods, Sedimentation and Elutriation, Equipments used: Principle, material of construction, Applications advantages and disadvantages of cyclone separator, sedimentation tank . [08]

Unit-4. Mixing: Definition and objectives, Type of Mixtures, Liquid Mixing, powder Mixing, Semi solids, mixing equipment: Principle, material of construction, Applications advantages and disadvantages of shaker mixer, propeller mixer, turbine mixer, paddle mixer, planetary mixer, double cone mixer, V mixer, sigma mixer and colloid mill, ultrasonic mixer. [08]

Unit-5. Filtration: Factors Affecting, Rate of Filtration, Properties of the filter medium and filter cake, Mechanism of Filtration, Filter Media and aids, Principle, material of construction, Applications advantages and disadvantages of Industrial Filters, Filter Leaf, Filter Press, Rotary Filter, membrane filter, ultra filter, Edge Filter and filters for gases .
Centrifugation: principle, factor affecting, Principle, material of construction, Applications advantages and disadvantages of perforated basket centrifuge, tubular bowl centrifuge conical disc centrifuge, ultra centrifuge [08]

PHR-205P
PHARMACEUTICS – III
(Unit Operation- 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. 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.
7. Particle size analysis by sieving and microscopy.

BOOKS RECOMMENDED: (Latest Edition)
5. Gavhane, K.A. Unit Operation-I, Nirali Prakashan.
6. Cooper and Gunn's Tutorial Pharmacy, CBS Publishers, New Delhi
Unit-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-2. TRIGONOMETRY: Measurement of angle, T-ration, addition, substraction and transformation formulae, T-ration of multiple, submultiples, allied and certain angles, application of logarithms in pharmaceutical computations. [08]
Unit-3. 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. [08]
Unit-4. 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. [08]
Unit-5
Introduction to statistics : Mean, Types of means, Median, Mode-Measure of dispersion, Quartile, eviation, Mean deviation, Standard error of Mean (SEM) [08]
BOOKS RECOMMENDED: (Latest Edition)
9. Vishal Mehta, Remedial Mathematics for Pharmacy, Kamini Publication, Kanpur
PHR-206B
REMEDIAL BIOLOGY

Unit-1. Methods of classification of plants. [08]
Unit-2 Plant cell: It's detailed structure, mitosis, meiosis different types of plant tissues and their functions. An introduction to R.N.A and D.N.A. [08]
Unit-3. Simple and compound microscopes used in biology, section cutting, staining and mounting of sections. Morphology and histology of root, stem, bark, wood leaf, flower, fruit and seed. Modification of root and stem. [08]
Unit-4. General survey of animal kingdom; structure and life history of parasites illustrated by amoeba, Entamoeba, Trypanosoma, Plasmodium, Taenia, Ascaris, Schistosoma, Oxyuris and Ancylostoma. [08]
Unit-5. General structure of life history of insects including their relation to medicinal crops as illustrated by grasshopper, mite, silkworm and pests. [08]

PHR-206B(P)
REMEDIAL BIOLOGY (Practical)

(The Practical is based on demonstration only)
Morphology of plant parts indicated in theory.
Care, use and type of microscope.
Study of slides of structure and life cycle of lower plants/animal mentioned in theory.
Morphology, Preparation and study of slides of stem, root and leaf of monocot and dicot plants.
Study of structure and life cycle of human parasites mentioned in theory with the help of specimens.
BOOKS RECOMMENDED
1. Dutta A.C. Botany for Degree students Oxford University Press, New Delhi
UNIT-I:

METHODS OF PREPARATION WITH MECHANISM, PROPERTIES AND MECHANISM OF NAME REACTION ASSOCIATED WITH:

(i) Active methylene compounds (acetoacetic ester and malonic ester) and their synthetic importance.
(ii) α, β-unsaturated carbonyl compounds.
(iii) Polynuclear hydrocarbons-Napthalene, anthracene and phenantherene.
(iv) Polymers and polymerisation. (8)

UNIT-II:
Carbohydrate: Monosaccharide:- Glucose (mutarotation, ring structure of glucose,) configuration of monosaccharides), (08)

UNIT-III:
Disaccharides (Sucrose and maltose), Polysaccharides (Starch and cellulose) (08)

UNIT-IV:
HETEROCYCLIC COMPOUNDS: Nomenclature, Chemistry, preparation, properties of-5-membered heterocycles with one hetero atom (Pyrrole, Furan and Thiophene),5-membered heterocycles with two hetero atom (Imidazole, Thiazole, Oxazole, Pyrazole) (08)

UNIT-V:
Nomenclature, Chemistry, preparation, properties of 6-membered heterocycles with one hetero atom (Pyridine, Pyran),6-membered heterocycles with two hetero atoms (Pyrimidine, Piperazine) Benz fused heterocycles (Quinoline, Isoquinoline, Indole) (08)

PHR-301P
PRACTICAL
ORGANIC CHEMISTRY-II
(PHARMACEUTICAL CHEMISTRY-III) LAB.
1. Identification of organic compounds and their mixture with derivatization. (Not more then two)

BOOKS RECOMMENDED:-
3. Finar I.L. Organic chemistry, Pearson education, New Delhi
3
UNIT-I:
a) Selection of plant and equipments in unit operations
b) A study of the following Valves – Plug Cocks, Globe, Gate, Diaphragm, QO, Check valves
c) A study of the following Pumps- Air lift, Jet, Piston, Plunger, Diaphragm, Reciprocating, Rotary, Centrifugal pumps. (08)

UNIT-II:
HUMIDITY, VENTILATION AND AIR CONDITIONING SYSTEMS (HVAC):- Basic concepts & definitions, Wet bulb & Dry bulb thermometer, Adiabatic saturation temperature, Psychometric charts & Measurement of humidity, Application of humidity measurement in pharmacy, Equipment for dehumidification operations.
Principles, Materials of constructions and Applications of Refrigeration and Air-conditioning. (08)

UNIT-III:
DRYING: - Moisture content , Equilibrium relative humidity & Mechanism of drying, Rate of drying & time of drying calculations, Classifications of dryers, Principle , material of construction, applications advantages and disadvantages of tray , fluidized bed , Rotary , Drum , Vacuum ,Spray and Freeze dryer.
EVAPORATION: - Basic concepts of phase equilibrium, Factors affecting evaporation, principle, materials of construction, Applications, advantages and disadvantages of Climbing and falling film evaporators , Evaporating pan , Vacuum evaporators, Horizontal and Vertical evaporators. (08)

UNIT-IV:
DISTILLATION:- Raoult’ s law, Phase diagrams, Simple, Steam, & Flash distillation, Principle of McCabe Thiele method of calculation of number of theoretical plates, Equipment for rectification, Azeotropic, Extractive & molecular distillation . (08)

UNIT-V

PHR-302P
UNIT OPERATIONS-II

(08)
Experiments based on drying, distillation, evaporation, crystallization, and humidity charts to be performed.

BOOKS RECOMMENDED:--
4. Cooper J.W. & Gunn G., Tutorial Pharmacy, CBS Publisher & distributors New Delhi
7. 4. 5. Subramanian C.V.S, Pharmaceutical engineering, Vallabh Prakashan, Delhi.
UNIT-I:

PHYSICAL PHARMACY-II
(PHARMACEUTICS-III)

MICROMERETICS AND POWDER RHEOLOGY: Average particle size, Particle size distribution, number and weight distribution, particle number; methods for determining particle size – optical microscopy, sieving, sedimentation, particle volume measurement, shape, specific surface; methods for determining surface area, air permeability, adsorption; derived properties of powders– porosity, packing arrangement, densities, bulkiness and flow properties, pore size. (08)

UNIT-II:

RHEOLOGY: Newtonian systems-Newton’s Law, kinematics viscosity, effect of temperature; non-Newtonian systems- plastic, pseudo plastic, dilatant; thixotropy- thixotropy in formulation; determination of viscosity choice of viscometer, capillary, falling sphere, cup & bob, plate & cone viscometers, application of rheology in pharmacy. (07)

UNIT-III:

SURFACE AND INTERFACIAL PHENOMENA: Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions (capillary rise method, drop number method, drop weight method, Wilhelm plate method), spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid gas and solid-liquid interfaces, complex films, electrical properties of interface. (08)

UNIT-IV:

DISPERSION SYSTEMS:
(a) COLLOIDAL DISPERSIONS: Definition, types, properties of colloids-optical, kinetics, electrical; protective colloids, applications of colloids in pharmacy.
(b) SUSPENSIONS: Interfacial properties of suspended particles, settling in suspensions- theory of Sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation Parameters; wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, stability.
(c) EMULSIONS: Types, theories of emulsification, physical stability, preservation, rheological properties, pharmaceutical applications of emulsions, microemulsions. (10)

UNIT-V:

STABILITY: Decomposition of medicinal agents- Influence of light, temperature and medium, half life, shelf life; stabilization of medicinal agents, accelerated stability and stress testing, ICH guidelines. (07)

PHR- 303P

PHYSICAL PHARMACY-II
(PHARMACEUTICS-III) LAB.

Practicals based on the above mentioned theory topics.

BOOKS RECOMMENDED:
5. Lippincott, William and Wilkins, Philadelphia.
PHR-304

Unit-I: PHARMACOGNOSY-I

A) The origin of Pharmacognosy, Present status and scope.
B) Sources of Drug: Biological and geographical sources of drugs.
C) Classification of Drugs: Alphabetical, Morphological, taxonomical, chemical & Pharmacological, chemo taxonomical. (08)

Unit-II:
Plant Taxonomy: - Study of the following families with special reference to medicinally important plants: Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, and Papaveraceae, Compositae. (08)

Unit-III:
Cultivation, Collection, Processing & Storage of crude drugs:
A.- Factors influencing cultivation of medicinal plants, humidity, rainfall, irrigation, Type of Soils & fertilizers, fertilization, pest and pest control.
B.- Plant growth regulators. (08)

Unit-IV:
Adulteration and Quality Control of crude drugs:
A.- Causes and types of Adulteration, Organoleptic, Microscopic, Biological, Chemical and Physical method of evaluation.
B. –WHO and current Indian Pharmacopoeial guidelines for the standardization of medicinal plants. (08)

Unit-V:
Systematic Pharmacognostic Study of the Following:
a) Carbohydrates and derived products: Agar, Guar gum, Xanthum gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia, Tragacanth, Alginates, and Katir. (08)

PHR-304P

PHARMACOGNOSY-I LAB.

1. Study of Plants belonging to families Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, and Papaveraceae, Compositae
2. Microscopical measurement of starch grains (wheat, maize, starch, potato),
3. Various types of calcium-oxalate crystals, their study and microscopical measurements (Rhubarb, Senna, Liquorce etc.)
4. Determination of leaf constant such as Stomatal index, Stomatal numbers, Veinislet numbers, Veintermination numbers and Palisade ratio
5. Chemical Tests of Agar, Acacia, Sterculia and Tragacanth, Pectin, Starch and Honey.
6. Swelling factor and average wt. of Isapaghula husk.
7. Physical characteristics of fixed oils.
8. Preparation of herbarium sheets.

BOOKS RECOMMENDED:
1. Trease. GE & Evans WC, Pharmacognosy, Bailleire tindall East bourne. UK.
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. (08)

Unit-III
**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. (08)

Unit-IV
**Autonomic Nervous System** : Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission the A.N.S. (08)

Unit-V
**Demography and Family Planning**, Medical termination of pregnancy.

**First Aid** : Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods. (08)

**BOOKS RECOMMENDED**
1. Tortora, Principles of Anatomy & Physiology, Wiley
6. Zdanowich Martin, Essentials of Pathophysiology for Pharmacy, CRC
12. Ranade VG, Text Book of Practical Physiology, Pune Vidyarthi Griha Prakashan, Pune. 8
B.Pharm 2\textsuperscript{nd} year (IV Semester)

PHR-401
PHARMACEUTICAL ANALYSIS-II

Theoretical considerations and application in drug analysis and quality control by the following analytical techniques (assays included in the latest edition of Indian Pharmacopeia).

UNIT-I:
A. Non-aqueous titration
B. Diazotisation titrations (08)

UNIT-II:
Miscellaneous methods of analysis: Karl-Fischer titration, Oxygen flask combustion, Kjeldahl method of nitrogen estimation. (08)

UNIT-III:
Principle, Instrumentation and Applications of: Potentiometry, Conductometry, Polarography, Amperometry, Electrophoresis. (08)

UNIT-IV:
Theory, Instrumentation and Applications of: Atomic absorption spectroscopy, Flame Photometry. (08)

UNIT-V:
Principle, Instrumentation and pharmaceutical applications of chromatography such as Paper column, Chromatography, TLC. (08)

PHR-401P
PHARMACEUTICAL ANALYSIS-II LAB

2. Exercises based on paper, column and thin-layer chromatography.
3. Exercises involving diazotization, Karl-Fischer methods.
4. Determination of Sodium, Potassium and Calcium ion by Flame Photometry.

BOOKS RECOMMENDED:
2. Vidya Sagar, Basics of Drug Analysis, PharmaMed Press
5. Pharmacopoeia of India, published by The Controller of Publications, Delhi.
**PHR-402**

**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. (08)

**Unit-III –**

**Cell injury & Adaptation** – Courses of cell injury, pathogenesis & morphology of cell injury.
**Cellular Adaptation** – Atropy, 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, physisis, epilepsy, Parkinson & Alzheimer’s diseases pathophysiology of cataract, glaucoma etc. (08)

**BOOKS RECOMMENDED**

1. Tortora GJ, & Anagnodokos NP, Principles of Anatomy & Physiology, Wiley
2. Mc Corry, Essentials of Human Physiology for Pharmacy, 2nd Ed, CRC
10. Dipiro JL, Pharmacotherapy – A Pathophysiological Approach, Elsevier.11
PHR-403
PHARMACOGNOSY-II

Unit-I –
STUDY OF THE SOURCES, PHYSICAL AND CHEMICAL TEST OF IDENTITY, SALIENT MICROSCOPIC FEATURES AND USES OF THE FOLLOWING:

b) Fixed oil, Fats and Waxes: Almond, Castor oil, Cotton seed oil, Sesame oil, Olive oil, Cord liver oil, Arachis oil, Chaulmoogra oil, Neem oil, Fish liver oil, Lard, Lanolin, Bees wax, Lard, Cocoa butter, Kokum butter and wool fat. (08)

Unit-II –
PHYTOCHEMICAL SCREENING:
(a) Preparation of extract
(b) Screening of alkaloids, saponins, cardinolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and poly phenols, anthrquinones, cynogenetic glycoside, amino acid in plant extracts. (08)

Unit-III –
SYSTEMATIC PHARMACOGNOSTIC STUDY OF THE FOLLOWING DRUGS: Resins: Colophony, Podophyllum, Jalap, Canabis, Capsicum, Myrrh, Asafoetida, Balsam of tolu, Balsam of peru, Benzoin, Turmeric, Ginger, Guggle, myrrh, storax. (08)

Unit-IV –
Utilization and role of aromatic plant in national economic Volatile oil: Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamam, Valerian, Musk, Palamarosa, Gaultheria, Sandalwood, cumin, jatamansi. Cellulose and Cellulose derivative. (08)

Unit-V –
Tannins: Gambir, Black & Pale catechu, Gall, Myrobalam, Bahera, Arjuna, Tannic Acid, Amla, Ashoka Bark and Terocarpus. (08)

PHR-403P
PHARMACOGNOSY-II LAB

1. Study of fibers, along with chemical test.
2. Morphology and Microscopic evaluation of some medicinal crude drugs and their powders mentioned in theory with their chemical test.
3. General chemical test for alkaloids, glycosides, steroids, flavonoids and tannins.
4. To prepare a report on an allotted topic.
5. Study and chemical test of pharmaceutical aids

BOOKS RECOMMENDED:
1. Trease. GE & Evans WC, Pharmacognosy, Bailleire tindall East bourne. UK
2. Fischer, Modern Phytochemical Methods, Springer
10. Tyler.VE, Pharmacognosy, Le & Febiger, Philadelphia.13
Different techniques of extraction and isolation of natural compounds. Introduction, classification and chemistry of the mentioned compounds.

UNIT-I:
A: Glycosides: Salicin, amygdalin, digitalis & stropanthus (Structural features)
B: Alkaloids: Atropine, Nicotine, Quinine. Structural features of morphine & reserpine. (10)

UNIT-II:
Steroids: Structural elucidation of cholesterol & Vit D, Structural features of corticoids, sex harmones, ergosterol, and saponin. (08)

UNIT-III
B: Lipids and fatty acids: Physiochemical properties and significance of lipids and fats, Determination of acid, saponification, ester and iodine value and their significance in pharmacy. (06)

UNIT-IV
Terpenoids: Citral, menthol and camphor. (08)

UNIT-V
Amino acids, proteins: Preparation, properties and end group analysis. Protein structure (Primary, Secondary, tertiary and quaternary polypeptides) (08)

BOOKS RECOMMENDED:
1. Manitto, Biosynthesis of Natural Products, Wiley India
2. Praveen Kumar, Natural Products a Practical Manual, PharmaMed Press
5. Indian Pharmacopoeia (Latest Edition)
UNIT-I:
INTRODUCTION:

a) Pharmaceutical Legislations – A brief review.
b) Drugs and Pharmaceutical Industry – A brief review.
c) Pharmaceutical Education – A brief review.
d) Pharmaceutical Ethics – A brief review.
e) Pharmacy Act 1948. (08)

UNIT-II:
AN ELABORATE STUDY OF THE FOLLOWING:

a) Drugs and Cosmetics Act 1940 and rules 1945- Manufacturing, distribution and marketing, approval of manufacturing and quality control chemist, schedules.
b) Drugs Price Control Order 1995. (08)

UNIT-III:
AN ELABORATE STUDY OF THE FOLLOWING:

b) Drugs and Magic remedies (Objectionable Advertisements) Act 1954. (08)

UNIT-IV:
A BRIEF STUDY OF THE FOLLOWING WITH SPECIAL REFERENCE TO THE MAIN PROVISIONS.

a) Medicinal & Toilet preparations (Excise duties Act 1955)- relevant to drug and pharmaceuticals
b) Poisons Act 1919.
e) A.I.C.T.E. Act 1987. (08)

UNIT-V:

b) U.S Food and Federal D&C Act – CFR -21, CGMP; EuGMP,WHO,Orange book (08)

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

BOOKS RECOMMENDED:

1. CK Kokate, Text Book of Forensic pharmacy, PharmaMed Press
2. Mittal B.M, Textbook of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta.
3. Relevant Acts & Rules Published by the Govt. of India.
6. Relevant websites.
B.Pharm 3rd year (V Semester)

PHR-501
PHARMACEUTICAL CHEMISTRY-V
(BIOCHEMISTRY)

Unit-I:
a. **Enzymes:** Nomenclature, enzymes-kinetics and mechanism of action, mechanism of inhibition of enzymes and isoenzymes in chemical diagnosis.
b. **Co-enzymes:** Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance. [08]

Unit-II
a. **Carbohydrate metabolism:** Glycolysis, Gluconeogenesis and Glycogenolysis. Metabolism of galactose. [08]

Unit-III
a. Role of sugar nucleotides in biosynthesis and pentose phosphate pathway.
b. The citric acid cycle, significance, reactions and energetics of the cycle. [08]

Unit-IV
a. **Lipid metabolism:** Oxidation of fatty acid & energetics, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, regulation of lipid metabolism, essential fatty acids.
b. **Biological Oxidation:** The respiratory chain, its role in energy capture & control, energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation. [08]

Unit-V
a. **Protein metabolism:** Biosynthesis of amino acids, metabolism of amino acids and conversion of amino acids to specialized products, biosynthesis of purine and pyrimidine, formation of deoxyribonucleotides.
b. Biosynthesis of RNA, DNA replication, Biochemical aspects of Carcinogenesis & DNA repair mechanism.[08]

PHARM- 501P
PHARMACEUTICAL CHEMISTRY-V
(BIOCHEMISTRY) PRACTICAL

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
4. Separation of lipids by TLC.
6. Determination of glucose by means of the enzyme glucose oxidase.
7. Enzymatic hydrolysis of glycogen by α & β amylase.
13. Qualitative analysis of inorganic as well as organic constituents of Urine.

BOOKS RECOMMENDED:
2. Boyer, modern experimental biochemistry, Pearson education
3. Sharad chand bose, Biochemistry, a practical manual, PharmaMed Press, Hyderabad
4. Shrinivas, Textbook of Biochemistry, PharmaMed Press, Hyderabad
5. Moore, Biochemistry and physiology of plants,
Unit-I: Preformulation studies:
Study of physical properties of drug like physical form, polymorphism, particle size, shape, density, wetting, dielectric constant, dissociation constant, distribution coefficient, Solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability. [08]

Unit-II: Liquid Dosage Forms: Introduction, types of permissible additives, formulation, manufacturing, evaluation and packaging of clear liquids, suspensions permissible and emulsions. [08]

Unit-III: Semisolid Dosage Forms: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection, permissible additives, manufacturing procedure, evaluation and packaging and general formulation of semisolids, clear gels, permissible additives [08]

Unit-IV: Suppositories: Ideal requirements, bases, manufacturing procedure, evaluation and packaging [08]

Unit-V:
Pharmaceutical Aerosols: Definition, Propellants, general formulation and evaluation, manufacturing and packaging methods, pharmaceutical applications.

Cosmetology and cosmetic Preparations: Formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, sunscreen lotion, antiperspirants, deodorant. Shampoos, Conditioner, Shaving and after shaving products, Dentifrice Lipstick, Nail lacquer. [08]

PHR-502P
PHARMACEUTICS
(PHARMACEUTICAL TECHNOLOGY-I)

PRACTICAL

1. Preformulation studies of API. (As per pharmacopoeial requirements)
2. Preparation, evaluation and packing of liquid orals like solutions, suspensions and emulsions, ointments, suppositories, eye drops, eye ointments etc.

BOOKS RECOMMENDED

5. Harrys Cosmetology
10. Drugs and Cosmetics Act and Rules
11. Poucher “Cosmetics”. pharmed press, hyderabad
Unit-I: Basic Principles of Medicinal Chemistry: Physicochemical aspects (Optical, geometric and bioisostericism) of drug molecules and biological action. Drug-receptor interaction including transduction mechanism, concept of prodrug. [08]

Mode of action, uses, structure activity relationship of the following classes of drugs (Synthetic and assay procedures of individually mentioned drugs only) included in the latest edition of pharmacopoeia.

Unit-II: Drugs acting at Synaptic and neuro-effector junction sites:

Unit-III: Drugs acting on the Central Nervous System: [08]
General Anaesthetics-Thiopental, Ketamine
Local Anaesthetics- Lignocaine, Benzocaine.
Sedatives and Hypnotics- Phenobarbitone, Alprazolam.
Opioid Analgesics-Pethidine, Methadone, Pentazocine.

Unit-IV: [08]
Anticonvulsants-Phenytoin, Carbamazepine, Ethosuximide, Valproic Acid.
Antiparkinsonism drugs- Carbidopa, Levodopa.
CNS Stimulants-Caffeine, Nikethamide.

Unit-V: Psychopharmacological Agents: [08]
Antianxiety drugs- Diazepam, chlordiazepoxide.
Antidepressants – Imipramine, Amitriptyline Fluoxetine.
Skeletal muscle Relaxants- Gallamine Metheneshine,
Antipsychotic- Chlorpromazine, Haloperidol.

1. Synthesis of atleast five drugs from the course content involving two or more steps. eg Benzocaine, Phenytoin, Barbituric acid, Nikethamide etc
2. Establishing the pharmacopoeial standards of the drugs synthesized.

BOOKS RECOMMENDED:
6. Rama rao nadendla, Medicinal chemistry, PharmaMed Press, Hyd,
7. Vardanayan R. Synthesis of Essential Drugs, Academic press an imprint of sElsevier
8. Wermuth C G. The practice of Medicinal Chemistry-III, Academic press an imprint of Elsevier
9. Pharmacopoeia of India, Minsitry of Health, Govt. of India 2010
Unit-I: General Pharmacology – Introduction to pharmacology, routes of drug administration, combined effect of drugs, factors modifying drug action. [07]

Unit-II: Basic Concepts of Pharmacokinetics - Absorption, Distribution, Metabolism, Excretion Pharmacodynamics, Principles of drug action, Mechanism of drug action, Receptors, Dose Response curve, Therapeutics index - LD50 & ED50. [07]

Unit-III: Pharmacology of ANS
Drug acting on autonomic nervous system
I-Cholinergic system-
Parasympathomimetic (Cholinergic) drugs.
Parasympatholytic (anti Cholinergic) drugs.
Drug acting on autonomic ganglia (Stimulants and blocking agents)
II-Adrenergic system
Sympathomimetic (Adrenergic) drugs
Sympatholytic (Anti-adrenergic) drugs [08]

Unit-IV: Pharmacology of CNS

Unit-V: Drugs acting on PNS
Local anesthetics [06]
Skeletal muscle Relaxants Peripherally and centrally acting muscle Relaxants

PHR-504P
PHARMACOLOGY- I
PRACTICAL
Use of computer simulated CDs or Video cassettes for pharmacology practical where possible.
2. Study of different routes of administration of drugs in mice/rats. Practical related to DRC

BOOKS RECOMMENDED:
2. Friedman, Fundamentals of clinical trials, 3rd, ed., Springer Intl
10. Turner, Screening Methods in pharmacology, Elsiver
Unit-I:
Introduction to the scope of microbiology and microscopy
Structure of bacterial cell.
Classification of microbes and their taxonomy: Bacteria, fungi and viruses. [08]

Unit-II:
Identification of Microbes: Stains and types of staining techniques.
Nutrition, cultivation, isolation and purification of bacteria, fungi & viruses.
Different culture media and their classification-
Microbial growth and their curve, measurement of microbial growth, factor influencing
Microbial growth [08]

Unit-III:
Control of microbes by physical and chemical methods.
Disinfection, factors influencing disinfectants, dynamics of disinfection,
Disinfectants and antiseptics and their evaluation.
Preservative efficacy [08]

Unit-IV:
Sterilization, different methods, validation of sterilization methods & equipments.
Sterility testing as per I.P. Isolation and identification of contaminants in sterile and non-sterile
Products, Microbiological standards of non-sterile products, Equilibrium related to humidity
(ERH) in microbiological testing. [08]

Unit-V:
Microbial assays as per I.P. of antibiotics and vitamins. [08]

PHR-505P
PHARMACEUTICAL MICROBIOLOGY
PRACTICAL

1. Various staining methods, 2. Experiments designed to prepare various types of culture media
sub-culturing of common aerobic and anaerobic bacteria, fungus and yeast, 3. Various methods of
isolation and identification of microbes 4. Sterilization techniques and their validation, validation
of sterilization techniques 5. Evaluation of antiseptics and disinfectants 6. Testing the sterility of
pharmaceutical products as per I.P. requirements, 7. Microbial assay of antibiotics and vitamins,
8. preservative efficacy, 9. Microbiological testing of non-sterile products.

BOOKS RECOMMENDED:
2. Malathi, Manual of Practical Microbiology,PharMAmED Press, Hyderabad
3. Tortora, Microbiology An Introduction, 9TH. Ed, Pearson education
4. Glazer,”Microbial Biotechnology” Cambridge Univ. Press
5. Pelczar & Reid, Microbiology, Tata Mc Graw Hill, Delhi.
6 Ananthanarayan R & Paniker CKJ, Textbook of Microbiology, Orient Longman.
7 Aneja K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture &
Mushroom Cultivation, Vishwa Prakashan.
8 Gunasekaran P, Lab Mannual of Microbiology, New Age Publishers.
9. Latest edition of USP
10. Latest edition of IP
11. Latest edition of B.P.
Unit-I: Immunology and Immunological preparations:
Principles, Antigen and haptns, immune system, Cellular, and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, standardization and storage of BCG. Complementary system, Immunological disorder, Hypersensitivity reaction, Immunosuppression, Autoimmune disorders, immunodeficiency disorders [08]

Unit-II: Genetic Recombination
Genetic Code and inhibition of protein synthesis. Regulation of gene expression (Prokaryote and Eukaryote)
Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications, development of hybridoma for monoclonal antibodies, study of drugs produced by biotechnology such as Human Insulin, Somatotropin, Streptokinase, Urokinase. Isolation and uses of mutants and factors affecting mutation and genetic analysis of mutants [08]

Unit-III:
Microbial Transformation:
Introduction, types of reactions mediated by microorganisms, Design of Bio-transformation process, selection of organisms, biotransformation processes and its improvements with special reference to steroids [08]

Unit-IV:
Enzyme immobilization:
Techniques of immobilization of enzymes, factors affecting enzyme kinetics, multistep immobilized enzyme system. Application and future of enzyme engineering [08]

Unit-V:
Antibiotics:
Historical development of antibiotics, Screening of soil for organisms producing antibiotics Antimicrobial spectrum and methods used for their standardization. Fermentor, its design and control of different parameters [08]

BOOKS RECOMMENDED:
5. Crueger W. & Crueger A, Biotechnology-A Textbook of Industrial Microbiology,
7. IP (Latest edition)
8. BP (Latest edition)
9. USP (Latest edition)
Unit-I: Tablets: (A) Formulation of different types of tablets, granulation technology on largescale by various techniques, physics of tablets making, machinery and tooling and the equipments employed, evaluation of tablets including stability testing as per ICH guidelines
(B) Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablet. [09]

Unit-II: 1. Capsules: Introduction to capsules as a dosage form, hard and soft gelatin capsules, formulation and evaluation, machinery, packaging, stability testing and storage
2. Micro-encapsulation: Types of microcapsule, importance of micro-encapsulation in pharmacy, micro-encapsulation techniques, evaluation of micro capsules. [8]

Unit-III: (A) Approaches to Sustained and controlled release dosage forms. In-vitro methods of evaluation. [08]

Unit-IV: Parenteral Products:
Preformulation factors, routes of administration, water for injection, pyrogenicity, nonaqueous vehicles. Formulation and evaluation, equipments, containers and closures and their selection. [07]

Unit-V:
(A) Sterile products (ISI/ BS specification)
(B) Formulation and evaluation of Ophthalmic, Nasal and Ear products. [08]

PRACTICAL
1. Experiments to illustrate preparation, stabilization and evaluation of pharmaceutical products as per the theory syllabus
2. Evaluation of Materials used in pharmaceutical packaging (ISI/ BS specification)

BOOKS RECOMMENDED
3. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lippincott William Wilkins
4. Herbert A. Liebemann & Leon Lachman, Theory & Practice of Industrial Pharmacy,
7. IP (Latest edition)
8. BP (Latest edition)
9. USP (Latest edition)
10. Tutorial Pharmacy by Cooper and Gunn, CBS Publisher do
11. Senger, A primer on dosage form design, PharmaMed Press, Hyd,
Unit-I-Drug Design
Basic concept of drug design, Introduction to Analogues based drug design, Structure based drug design, and Introduction to QSAR & Computer aided drug design. [08]

Unit- II Mode of action, uses, SAR of the following classes of drugs included in latest edition of pharmacopoeia (synthetic procedures and assay of individually mentioned drugs only)
Cardiac glycosides & drug used for CHF- Digitoxin
Antiarrhythmic drugs- Propranolol, Procainamide
Antianginal drugs- Isosorbide mononitrate
Antihypertensive drugs-Captopril, methyldopa, Nifedipine. [08]
Anticoagulants- Heparin, warfarin
Antihyperlipedmics- Lovastatin, Clofibrate

Unit-III
Antispasmodic and Antiulcer drugs- Dicyclomine, Ranitidine, Omeprazole.
Antitussives- Dextromethorphen.
[08]

Unit-IV: Analgesics and Antipyretics – Aspirin, Mefanamic Acid, Ibuprofen, Diclofenac, Paracetamol [08]

Unit-V: Diuretics – Acetazolamide, Chlorthiazide; Furosemide, Spironolactone. [08]

BOOKS RECOMMENDED:
4. Shri ram./ Yogeeswari, medicinal chemistry, 2nd Ed, Pearson education
6. Korolkovas, Essentials of medicinal chemistry, Wiley India
7. 8. Wermuth C G. The practice of Medicinal Chemistry-III, Acaademic press an imprint of Elsevier
9. Pharmacopoeia of India 2010, Ministry of Health, Govt. of India.
12. Latest edition of B.P.
PHR-604
PHARMACOLOGY-II

Unit-I:
**Pharmacology of CVS:** Cardiac glycosides, Antihypertensive drugs, Antianginal drugs, Antiarrhythmics, Antihyperlipidemics [09]

Unit-II:
**Drugs Acting on Haemopoietic System**
Haematinics, Vit. K & anticoagulants, Fibrinolytics & antiplatelet drugs, Plasma Volume expanders

**Drugs Acting on Respiratory System**
Anti-asthmatic drugs, Anti-tussives & Expectorants, Respiratory Stimulants [08]

Unit-III: **NSAIDS & Anti-gout Drugs. Diuretics** [08]

Unit-IV: **Autocoids:** Histamine, 5HT and their antagonists, Prostaglandins, Thromboxane, Leukotrienes, Angiotensin and Bradykinin [08]

Unit-V: **Drugs acting on GIT**
Antacids and Antiulcer drugs, Laxatives and antidiarrhoeal Agents, Emetics and antiemetics [07]

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PHR-604P
PHARMACOLOGY-II
PRACTICAL

1. Relevant experiments based on theory syllabus

**BOOKS RECOMMENDED:**
3. Laurence, DR & Bannet PN; Clinical Pharmacology, Churchill Livingstone.
4. Rang MP, Date MM, Riter JM, Pharmacology Churchill Livingstone.
Unit-I: (A) Study of the biological sources, Commercial varieties cultivation, collection adulterants, uses, diagnostic macroscopic and microscopic features and chemical constituents, substitutes and specific chemical tests of following groups of drugs containing.

Glycosides:
1. Saponins: Liquorice, Ginseng, Dioscorea, Coleus species. [04]
2. Cardioactive sterols: Digitalis, Squill, & Thevetia [03]
3. Anthraquinone Cathartics: Aloe, Senna, Rhubarb & Cascara. [03]

Unit-II: Others: Psoralea, majus, Ammi visnaga, Gentian, Saffron, Quassia and Andrographis paniculata. [03]

(B) Production and Utilization of phytoconstituents such as calcium sennoids, Diosgenin, Solasodine & Podophylotoxins [03]

Unit- III: Studies on traditional drugs: Common Vernacular name, Biological sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and toxicological activity of marketed formulations of following indigenous drugs : Amla, Kantkari, Satavari, Bhiilwa, Vach, Rasna. [08]

Unit-IV: Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Brahmi, Methi, Lehsun, Guggul, Gymnema, Shilajit, Tulsi and Neem. [08]

Unit-V: Brief Introduction and principles of Ayurvedic, Unani, Siddha and Homeopathic systems of medicines. Introduction to Herbal Pharmacopoeia, study of Arishatas, Asavas, Gutikas, Tailas, Churnas, Lehyas and Bhasmas. [08]

PHR-605 P
PHARMACOGNOSY - III
PRACTICAL 11

1. Identification of atleast 10 crude drugs mentioned in theory
2. Powder microscopic study of atleast 5 drugs
3. Evaluation and standardization of atleast 3 marketed Ayurvedic formulations

BOOKS RECOMMENDED:
10. Indian Ayurvedic Pharmacopoeia, Govt. of India.
11. Kokate CK, Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan
12. Indian Pharmacopoeia.
15. Harborne J.B.- “Phytochemical methods” Springer International
16. WHO guidelines
17. BP (Latest edition)
18. Standard botanicals by P. Mukharejee
B.Pharm 4th year (VII Semester)

PHR- 701
PHARMACEUTICAL INDUSTRIAL MANAGEMENT

Unit-I
Concept of Management: Administrative Management (Planning, Organizing Staffing Directing and Controlling). Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/ Morale) [08]

Unit-II
Principles of Management (Coordination, Communication, Motivation, Decision making, leadership, Innovation Creativity, Delegation of Authority / Responsibility. Record Keeping), Identification of key points to give maximum thrust for development and perfection. [08]

Unit-III
Economics: Principles of economics with special reference to the Laws of demand and supply, demand schedule, demand curves labor welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.
DPCO Act: Cost Accounting, Formulation record rules [10]

Unit-IV
Pharmaceutical Marketing: Functions, buying, selling, transportation, storage financed feedback information, channels of distribution, wholesale, retail, department store, multiple shop and mail order business.
Salesmanship: Principle of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, Recruitment, training, evaluation, compensation to the pharmacist. [08]

Unit-V
Supply Chain Management: Procurement, Receipt, Analysis, Approval, Issuance, Production, Quality control, Distribution & Marketing [06]

BOOKS RECOMMENDED:
2. Massie L. Joseph Essentials of Management / PHI.
3. Vidya sagar Pharmaceutical Industrial Management, Pharma Book Syndicate
6. Datta A.K., Material Management / PHI.
7. Chadwick Leslie, The essence of management accounting / PHI.
Unit-1:
Introduction to Biopharmaceutics and Pharmacokinetics, Biopharmaceutics Classification System
- Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
- (B) Factors influencing absorption
- (C) Distribution, metabolism and excretion [08]

Unit-II:
Pharmacokinetics:
- Significance of plasma drug concentration measurement.
- Compartment model and Non-compartment model. Definition and Scope
- (C) Pharmacokinetics of drug absorption – zero order and first order absorption rate constant using Wagner – Nelson, Loo-Reigelman method. [08]

Unit-III:
- Volume of distribution and distribution coefficient.
- Compartment kinetics – One compartment and Preliminary information of multicompartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.
- Clinical Pharmacokinetics: Definition and scope [08]

Unit-IV:
(A) Dosage adjustment in patients with and without renal and hepatic failure.
(B) Pharmacokinetic drug interactions and their significance in combination therapy. [08]

Unit-V: Bioavailability and Bioequivalence:
(A) Measures of bioavailability, C-max, and area under the curve (AUC).
(B) Review of regulatory requirements for conduction of bioequivalent studies. [08]

PRACTICAL
1. Experiments designed for the estimation of various pharmacokinetic parameters with given data.
2. In vitro evaluation of different dosage forms for drug release.
4. Bioavailability and Bioequivalence studies
5. Permeability studies
6. Protein binding
7. Statistical treatment of pharmaceutical data.

BOOKS RECOMMENDED:
1. Notari, R.E, Biopharmaceutics and Pharmacokinetics – An introduction Marcel Dekker Inc. N.Y.
2. Rowland M, and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, N.Y.
Unit-I: Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Steroids and related drugs**: Special emphasis on Nomenclature, Stereochemistry
- (A) Androgens and Anabolic steroids – Testosterone, Stanazolol.
- (B) Estrogens and Progestogens – Progesterone, Estradiol.
- (C) Adrenocorticoids – Prednisolone, Dexamethasone, Betamethasone.
- (D) Anti-Fertility Drugs [08]

Unit-II: Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Antibiotics**: Penicillin, Amoxicillin, Methicillin, Streptomycin, Tetracyclines, Cephalosporins, Chloramphenicol, Gentamycin, Clavulanic acid

**Antimycobacterial Agents**: PAS, Ethambutol, Isoniazid, Dapsone

**Quinolones**: Nalidixic acid, Norfloxacin [08]

Unit-III: Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Antimalarials**: Chloroquine, Primaquine, Artemesinin

**Antiamoebics**: Metronidazole, Tinidazole, Diloxanide

**Antiseptics & Disinfectants**: Benzalkonium chloride

**Antihelmintics**: Mebendazole

**Antifungals**: Griseofulvin, Clotrimazole Amphotericin B

**Antibacterials**: Sulphamethoxazole, Sulphadiazine, Sulphacetamide. [08]

Unit-IV: Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Anti- HIV agents**: Zidovudine, Zalcitabine, Saquinavir.

**Antivirals**: Amantadine, Acyclovir, Lamivudine.

Prostaglandins – Misoprostol, Carboprost.

**Anti-cancer drugs**: Alkylating Agents- Chlorambucil, Carmustine

**Antimetabolites**: Methotrexate

6-Mercaptopurine

5-Fluorouracil [08]

Unit-V: Introduction, Classification, Mode of action, uses, structure-activity relationship of the following classes of drug (Synthetic procedures of individually mentioned drugs only).

**Thyroid and Antithyroids**: Carbimazole, Levothyroxine, Propylthiouracil, Methimazole.

**Hypoglycaemics**: Insulin Chlorpropamide, Metformin, Tolbutamide, Glibenclamide. [08]

**BOOKS RECOMMENDED:**
5. Patrick G L. Medicinal Chemistry, Oxford University Press NY
7. Pharmacopoeia of India, Ministry of Health, Govt. of India.
Unit-I: Pharmacology of Endocrine System
Hypothalamic & pituitary hormones, Thyroid hormones & Thyroid Drugs, Parathormone, Calcitonin & Vitamin D, Insulin, oral hypoglycemic agents & glucagon. [07]

Unit-II: ACTH & Corticosteroids, Androgens & anabolic steroids, Estrogens, Progesterone & Oral Contraceptives, Drugs acting on uterus. [08]

Unit-III: Chemotherapy
General Principles of Chemotherapy, Sulfonamides, Cotrimoxazole, Quinolones, Antibiotics – Penicillins, Cephalosporins, Chloramphenicol, Tetracyclines, Macrolides. [08]

Unit-IV: Chemotherapy of Parasitic infections, Tuberculosis, Leprosy, Malaria, Fungal infections, Viral diseases, Introduction to Immunomodulators and Chemotherapy of Cancer, Multi-drug resistance [10]

Unit-V:
A. Principles of Toxicology Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous & atropine poisoning, Heavy metal Anagagonists.
B. Bioassays- Basic Principles, Bioassay of oxytocin and acetylcholine [07]

PHARMACOLOGY-III
PRACTICAL
1. To calculate the pA2 value of Atropine & chlorpheniramine.
2. Bioassay of Ach, histamine & oxytocin on suitable isolated preparations using matching assay, bracketing assay, three point assay & four point assay.
3. Bioassay of histamine and acetylcholine using matching and interpolation method on rat guinea pig. All experiments will be conducted using software wherever possible.

BOOKS RECOMMENDED:
3. Laurene, DR & Bennet PN; Clinical Pharmacology, Churchill Livingstone.
**PHR-705**
**PHARMACOGNOSY-IV**

**Unit-I:** 1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitute’s adulterants, uses, diagnostic macroscopic & microscopic features & specific chemical tests of following alkaloid containing drugs included in Ayurvedic Pharmacopoeia
   Tobacco, Areca & Lobelia.
   **Belladonna**, Hyoscyamus, Datura, Coca & Withania
   Cinchona, Ipecac & Opium
   Ergot, Rauwolfia, Catharanthus & Nux-vomica. [08]

**Unit-II:**
Pilocarpus. Veratrum & Kurchi.
Ephedra & Colchicum.
Solanum. Coffee & Tea Vasaka
Biosynthesis, Utilization & production of phytoconstituents such as— Tropane, Quinoline Opium and Indole alkaloids. Techniques employed in elucidation of biosynthetic pathways [10]

**Unit-III**
(A) World wide trade in Medicinal plants & derived product. Tropane alkaloids containing drugs, Cinchona, Ipecac, Rauwolfia, Taxol, Diosgenin, Digitalis, Liquorice, Papain, Ginseng, Aloe, Valerian, & plant laxatives.
(B) Role of Medicinal & aromatic plants in National Economy. [08]

**Unit-IV**

**Biological sources, preparation, Identification tests and uses of following enzymes** – [08]

**Unit-V:**
Historical development of plant tissue culture, type of culture, Nutritional requirement, growth & their maintenance. Application of plant tissue culture in pharmacognosy. [08]

**PHR-705P**
**PHARMACOGNOSY -IV**
**PRACTICAL**

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

**BOOKS RECOMMENDED:**
11. Indian Pharmacopoeia.
B.Pharm 4th year (VIII Semester)

PHR- 801
ENVIRONMENT & ECOLOGY

Unit-I
Environment studies
A- Definition, scope & importance
B- Natural Resources – renewable & non renewable
C- Use, utilization, exploitation and associated problems of forests, Water resources, Mineral resources, Food resources, Energy resources, Land resources.
D- Equitable use of resources for sustainable life style, role of an individual in conservation. [08]

Unit-II
Ecosystems
A. Introduction, types features & functions of difference ecosystems- Forest Grassland, Desert and Aquatic.
B. Biodiversity & its conservation with special reference to India. [08]

Unit-III
Environmental pollution- Air, Water, Soil, Marine, Noise, Thermal, Nuclear- Introduction causes and control measures. [08]

Unit IV
Law related to Environmental Protection
Air (Prevention and Control of pollution )Act 1987
Water prevention & Control of Pollution Act. 1974 [08]

Unit-V
Environmental Protection Act -1986
Noise Pollution
Hazardous Wastes
Hazardous Chemical
Hazardous Microorganism
Biomedical Waste
Solid waste disposal
Provisions as applicable to drugs and cosmetics. [08]

BOOKS RECOMMENDED:
PHR- 802
CLINICAL PHARMACY AND DRUG INTERACTIONS

Unit-I
INTRODUCTION TO CLINICAL PHARMACY
Definition, development and scope

PATIENT DATA ANALYSIS
The patient’s case history, its structure and use in evaluation of drug therapy, Communication skills including patient medication history interview, patient counseling. Hematological, Liver function, renal function, Tests associated with cardiac disorders. Adverse drug reaction- Epidemiology, Classification, Risk factors, Monitoring a detecting adverse drug reactions, Assessing causality, Reporting adverse drug reactions. [10]

Unit-II
DAILY ACTIVITIES OF CLINICAL PHARMACISTS
Drug therapy monitoring (Medication chart view, clinical review, TDM pharmacist interventions. Drug utilization evaluation (DUE) and review (DRU). Quality assurance of clinical Pharmacy services, Prescription auditing and medication errors and monitoring [08]

Unit-III
CLINICAL PHARMACOKINETICS
Physiological determinants of drug clearance and volumes of distribution. Renal and non-renal clearance. Estimation and determinants of bioavailability. Calculation of loading and maintenance doses. Dose adjustment in renal failure, hepatic dysfunction, geriatric and paediatric patients. [08]

Unit- IV
CONCEPT OF ESSENTIAL DRUGS AND RATIONAL USE OF DRUGS
Definition, symptoms, classifications of the disease, treatment and parameters to monitor the therapy of following systems/diseases
☐ Cardiovascular systems- hypertension, congestive cardiac failure, ischemic heart disease
☐ Renal system- acute and chronic renal failure
☐ GI diseases [08]

Unit-V
RESEARCH DESIGN AND CONDUCT OF CLINICAL TRIALS- Research support including planning and execution of clinical trials. Guidelines for good clinical research practice and ethical requirements. Various phases of clinical trials. Categories of Phase IV studies. [06]

BOKS RECOMMENDED:
1. Basic skills in interpreting laboratory data- Scott LT, American Society of Health System Pharmacists, Inc., USA.
3. Clinical Pharmacokinetics-Rowland and Tozer, Williams and Wilkins Publication.
5. Relevant review articles from recent medical and pharmaceutical literature.
7. Davison’s Principles and Practice of Medicine, ELBS/Churchill Livingstone.
8. Herfindal E.T. and Hirashman J.L., Clinical Pharmacy and Therapeutics Williams and Wilkins
Unit-I:
Colorimetric Method- Chemistry, Instrumentation and applications
Ultra violet and Visible- Electronic excitation, spectrophotometry, quantitative laws, deviation from Beer’s law, instrumentation, single and double beam spectrophotometry.
Applications in pharmacopoeial analysis [08]

Unit-II:
Fluorimetric Analysis- Theory, Instrumentation and applications.
Infra- Red spectrophotometry-Theory, instrumentations, Interpretation of IR , spectra of simple compounds, FTIR, applications in pharmaceutical analysis. [08]

Unit-III
NMR Spectroscopy- Theory of 1H.NMR, chemical shift, Shielding & Desheilding, spin-spin coupling, spin-spin splitting spectra of simple compounds.
Applications in pharmacopoeial analysis [10]

Unit-IV
Mass Spectroscopy –Theory, Instrumentation & Applications, mass spectra of some simple compounds. Applications in pharmacopoeial analysis [08]

Unit-V
Basic Principles, Instrumentation and Application of GLC & HPLC.
Applications in pharmacopoeial analysis [06]

BOOKS RECOMMENDED:
2. Skoog V, Principles of Instrumental Analysis, Holler-Neimen
7. Pharmacopoeia of India, Ministry of Health, Govt of India.
Unit I
General notices, test methods- biological and chemical [8]

Unit II
Test methods- Physiochemical and Pharmaceuticals methods [8]

Unit III
Tests on herbal products, Vaccines & Blood related products, General tests [8]

Unit IV
Containers, general notices, general monographs on dosage forms [8]

Unit V
General monographs of veterinary products, general requirements for herbs and herbal products, vaccines and antisera, General monographs of biotechnology products, blood and blood related products
Illustrative studies of 2 monographs each for API (paracetamol, dexamethasone), excipients (lactose, starch) and dosage forms (amoxicillin dry syrup, betamethasone eye drop) [8]

BOOKS RECOMMENDED:
1. Indian Pharmacopoeia 2010
Any one of the following:
(A) Standardization of herbal drugs and cosmetics
(B) Drug design.
(C) Pharmaceutical Marketing
(D) Pharmaceutical Packaging
(E) Novel Drug Delivery System
(F) GMP, Quality Assurance & Validation
(G) Hospital Pharmacy
(H) Advanced Pharmacology
(I) Pharmaceutical Entrepreneurship

(A) STANDARDISATION OF HERBAL DRUGS and COSMETICS

Unit I – Commerce and quality control of natural medicinal plants products, organoleptic, microscopical, physical & chemical evaluation of crude drugs. [08]

Unit-II - Standardization of plant material as per WHO guidelines. [08]

Unit-III – Herbal Cosmetics:
Brief study of Phytocosmetics, Industrial significance and current status. Herbs used for different cosmetic formulations like shampoos, conditioners, hair darkeners and skin care products. Study of following drugs used in different cosmetic formulations: Soapnut, Amla, Henna, Hibiscus, Tea, Aloe vera, Glycyrrhiza, turmeric, sandalwood etc. Basic evaluation parameters for skin care products and shampoos. [08]

Unit-IV - Analysis of official formulations derived from crude drugs including some ayurvedic preparations. [08]

Unit-V – Role of markers in the standardization of herbal products [08]

BOOK RECOMMENDED
1. Trease, G.E. Evans W.C., Pharmacognosy ELBS.
2. Tyler Varro. E., Brady Lynn. R. Robbers J.E. Pharmacognosy
4. Harborne Phytochemical methods of chemical analysis.
5. Pharmacopoeial standards for Ayurvedic formulations CCRAS, Delhi.
7. Mottal.A.C. Clerk’s isolation & identifications of drugs
10. Peach K. & Tracey MV, Modern methods of plant analysis
12. Indian herbal pharmacopoca.
13. Chaudhary.R.R., Herbal drug industry

(B) DRUG DESIGN

Unit-I
Introduction to Drug Design, Lead Discovery, Interactions (Forces) involved in drug receptor complex, Physiochemical properties in relation to biological action, Sterechemical aspects in drug design, Bioisosterism. [08]

Unit-II
Drug metabolism-Phase I & Phase II Metabolic Reactions, Prodrugs & Soft drug concepts [08]

Unit-III
a. Analogous based drug design concept with suitable examples
b. Structure Based drug design concept with examples [08]

Unit-IV
Combinatorial chemistry-Introduction, Parallel and Split & Mixed synthesis. [08]

Unit-V QSAR
Introduction, parameters, Quantitative models- Hansch method & Software’s in QSAR. [08]
BOOKS RECOMMENDED:

(C) PHARMACEUTICAL MARKETING

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


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

Unit-IV Distribution channels in pharmaceutical marketing – Manufactur er, Wholesaler, Retailer, Hospital & Government agencies, Selection of stockists and distributors. [08]

Unit-V Controls- Internal control and external control. [08]

BOOKS RECOMMENDED

(D) PHARMACEUTICAL PACKAGING

Unit-I New concepts in pharmaceutical packaging.
Package systems, package design research, package design for international transit [08]

Unit-II
3. Packaging materials with special reference to polymers, metals, glass and plastics, control of packaging materials and their specifications
4. Blister and strip packaging materials, their testing and specifications including microbiology [08]

Unit-III
5. Testing of containers & closures, Pharmacopoeial tests and specifications, Defects in packages.
6. Stability of package and packaging material
7. Ancillary materials used in packaging, their design and specifications [08]

Unit-IV
8. Sterilization of packaging materials, post-sterilization testing
9. Packaging of Parenterals, Ophthamlics, aerosols and testing
Corrugated fiber board materials, Printing requirements, label and leaflets preparation, Legal requirement as per D &C rules and rules of importing countries, testing of packaging materials and their transit worthiness [08]

Unit-V
Mechanization of packaging operation, use of bar codes and controls on inline packing, testing of finished packs as per ICH guidelines, packaging materials and product mix-up, their investigations and corrective & punitive action (CAPA) [08]

BOOKS RECOMMENDED:
1. Ross, Packaging of Pharmaceuticals.
3. Griffin, Drug and cosmetic Packaging.
7. USP
8. BIS specifications

(E) NOVEL DRUG DELIVERY SYSTEM

Unit-I
1. Theory of controlled release drug delivery systems.

Unit-II
3. Carriers for drug delivery systems, Prodrugs, Physical, chemical and biomedical engineering approach to achieve controlled drug delivery.
4. Microencapsulation: Methods, kinetics of drug release from microcapsules technology and applications. [08]

Unit-III
5. Transdermal drug delivery systems: Theory, formulation and evaluation, iontophoresis.
6. Implants and inserts: Types, design and evaluation methods, Osmotic pumps. [08]

Unit-IV
7. Targeted Drug delivery systems: Concept of drug targeting, importance in therapeutics, methods in drug targeting, drug immobilization techniques, nanoparticles, liposomes, niosomes, pharmacosomes and resealed-erythrocytes. [08]

Unit-V
8. Advances in drug delivery systems. An Introduction to buccal, nose to brain, ocular, pulmonary colonic delivery, transmucosal and stemceuticals [08]

BOOKS RECOMMENDED
2. Robinson and Vincent, Controlled Drug Delivery.
4. Noxon, Microencapsulation.
6. Deasy, Microencapsulation and Related Processes.
8. Lisbeth, Illum & Davis, Polymers in Controlled Drug Delivery.
9. Ghosh, Premamoy “ Polymer Science & Technology”.

(F) GMP, QUALITY ASSURANCE & VALIDATION

Unit-I
No GMP- GMP-cGMP-CGMP with reference to Indian scenario
1. Requirements of GMP, CGMP, GLP, USFDA, WHO guidelines and ISO 9000 series. & ICH [08]

Unit-II
2. Documentation- Protocols, Forms and maintenance of records in Pharmaceutical industry.
3. Preparation of documents for new drug approval and export registration (schedule L1 & Y) [08]

Unit-III
4. Basic concept of quality assurance, Quality assurance systems, Sources and control of quality variation- raw materials, containers, closures, personnel, environment etc [08]

Unit-IV
Facility design- Concepts in validation, validation master plan, validation of product, process, equipment, machinery, systems. Cleaning, Building management systems [08]

Unit-V
6. In process quality control tests, IPQC problems in pharmaceutical industries.
7. Pharmacopoeial standards for dosage form and acceptance criteria, Sampling plan, Sampling and operating characteristics curves -raw materials, IPC, finished products and packaging materials
Internal audits, investigations of market complaints, out of specifications (OOS) [08]

**BOOKS RECOMMENDED:**
2. OPPI, Quality Assurance.
4. Florey, Analytical Profile of Drugs (All volumes).
5. Indian Pharmacopoeia.
10. Sharma P.P. How to practice GMP’s, Vandana Publication, New Delhi
11. Sharma P.P. Validation in pharmaceutical industry , Vandana Publication, New Delhi
12. TRS guidelines
13. Orange guide
14. D&C Act
15. 21CFR part 211
16. ICH guidelines

(G) HOSPITAL PHARMACY

**Unit-I: Organization and Structure:** Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist. Pharmacy and therapeutic committee, Budget preparation and implementation.

**Hospital Formulary:** Contents, preparation and revision of hospital formulary. [08]

**Unit-II: Drug Store Management and Inventory Control:** Organization of drug., Types of materials stocked, storage conditions.

**Purchase and Inventory control:** Principles, various methods of inventory control, purchase procedures, purchase order, procurement and stocking. [08]

**Unit-III: Central Sterile Supply Unit and their Management:** Aseptic techniques and clean area classification, Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.

**Manufacture of Sterile and Non-sterile Products:** Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, Master formula record , Production control, Manufacturing records. [08]

**Unit-IV: Drug information service:** Sources of information on drugs, treatment schedules, procurement of information, computerized services (e.g. MEDLINE), Retrieval of information, Medication error.

**Records and Reports:** Prescription filling drug profile, Patient medication profile, case on drug interaction & adverse reactions, idiosyncratic cases etc. [08]

**Unit-V: Drug distribution systems in Hospitals:** Out-patient dispensing, methods adopted, Dispensing of drugs to in-patients. Types of drug distribution systems Charging Policy, labeling, Dispensing of drugs to ambulatory patients, Dispensing of controlled drugs.

**Nuclear Pharmacy:** Introduction to Radiopharmaceutics- radio-active half life, Units of radioactivity. Production of radio pharmaceuticals, methods of isotonic tagging, preparation of radioisotopes in laboratory using radiation dosimetry, radio-isotope generators, permissible radiation dose level, Radiation hazards and their prevention, specifications for radio-active laboratory. [08]

**BOOKS RECOMMENDED:**
UNIT 1 Molecular Pharmacology
Receptor occupancy and cellular signaling systems including G-proteins, cyclic nucleotides, calcium and calcium binding proteins, phospholipases.

Pharmacology of receptors: Classification, cellular signaling systems, and pharmacology of agonists of the following receptor types:
Excitatory Amino Acid receptors, Purinoreceptors, GABA & Benzodiazepine Receptors, Neurosteroid receptors, Cannabinoid receptors, Melatonin receptors

Ion Channels and Their Modulators: Classification and biology of potassium ionic channels, and pharmacology of their modulators

UNIT 2. Novel Target Sites: Physiological functions, pharmacological implications, and therapeutic potential of the following target sites:: Rho kinase (ROCK)
Phosphoinositide 3-kinase (PI3K), Akt (Protein kinase B), Caspases, Poly (ADPribose) polymerase (PARP), Peroxisome proliferator activator receptors (PPAR)-α and AMP activated protein kinases, Protein kinases, Phosphodiesterases

UNIT 3 Pharmacological Techniques to Evaluate the following Class of Drugs
Antiepileptics
Antianxiety agents and drugs used in mood and sleep disorders
Antipsychotics
Drugs affecting memory
Skeletal muscle relaxants and neuromuscular blockers
Antidiabetic agents
Analgesics and drugs used in arthritis and neuropathic pain.
Anti-inflammatory agents
Antiucler agents
Hepatoprotective agents

UNIT 4 Pharmacotherapeutics
Etiopathogenesis and pharmacotherapy of diseases associated with following systems/diseases:
Cardiovascular System: Hypertension, Congestive cardiac failure, Angina pectoris, Myocardial infarction, hyperlipidemia, Arrhythmias.
Endocrine System: Diabetes, Thyroid diseases, Oral contraception, HRT osteoporosis.
Infection Diseases: Tuberculosis, HIV and related opportunistic infections, malaria, amoebiasis, helminthiasis, leprosy.
Psychiatric Disorder: Anxiety, Alzheimer’s diseases, mood & sleep disorder, schizophrenia.
Neurological disorder: Epilepsy, Parkinson, myasthenia gravis, migraine.

UNIT 5 Stem cell therapeutics
Biology of stem cells.
Potentials of stem cell in various disorders.
Ethical Issues.

BOOKS RECOMMENDED
2. Edinburg University Pharmacology Staff (ed.) Pharmacological Experiments on Isolated Preparations, Livingstone, UK
7. E.T.Herfindal and D.R.Gourley, Text Book of Therapeutics: Drug and Disease Management, Lippincott Williams & Wilkins, USA.
11. Dennis L. Kasper, Eugene Braunwald, Anthony S. Fauci, Stephen L. Hauser, Dan L. Longo,
(I) Pharmaceutical Entrepreneurship

Unit-I
Entrepreneurship- history & concept, importance

Unit-II
Entrepreneurship in the pharmaceutical industry- needs, problems and issues
Importance of communication, decision making and problem solving skills.
Business strategies, competition, marketing opportunities, supply chain management keeping in mind return on investments. Case studies -3 to 5 (8)

Unit-III
Identification of market for product and services, SWOT analysis
Formulation of strategies, market leaders and success stories of their leading brands.
Regulatory aspects- Drugs and Cosmetics Act and rules relevant to licensing requirements for retail, wholesale, (schedules H,G,L1,M,Mii,P,P1,U,V,X,Y); DPCO - price control and price fixation, Factory Act, Central and State Excise Act Including Vat, Environmental Protection Act covering air, water, solid waste disposal record keeping, income tax and sales tax , ( include only relevant to working), quality system and its relevance. (8)

Unit-IV
Technology Transfer considerations
Funding of projects- Financial, Bootstrapping, External Financing
Project Management, Financial Management – understanding of balance sheet and profit and loss accounts, imports and exports. (need based for understanding for practical application). Case studies - 3 (8)

Unit-V
Importance of hr recourses- team building and management
Concept of social entrepreneurship & sustainable entrepreneurship (Growth oriented). Case studies-3 (8)

Suggested Books:
4. Handbook of Entrepreneurship Research: An Interdisciplinary Survey and Introduction
9. The Business of Healthcare Innovation [Hardcover]
Lawton Robert Burns, Publisher: Cambridge University Press; 2 edition
10. Bootstrapping Your Business: Start And Grow a Successful Company With Almost
No Money by Greg Gianforte, Marcus Gibson, Publisher Adams Media 2005

11. Drugs and Cosmetics Act and Rules, and DPCO, Govt. of India.
12 Factory Act.
13 Shop and Establishment Act.
14 Environmental Protection Act.
15. Central Excise Tariff Act and Import Policy.

**PHR-805 P**
**Project on Elective**