

UTTARAKHAND TECHNICAL UNIVERSITY DEHRADUN
Ordinances for
Bachelor of Pharmacy Programme

B.PHARM. I YEAR

SEMESTER-I

PHR-101

PHARMACEUTICAL ANALYSIS – I

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.
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.
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, iodimetry and iodometry, titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate.
4. PRECIPITATION TITRATIONS: Precipitation reactions, solubility products; effect of acids, temperature and solvent upon the solubility of precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate indicators, Gaylussac methods, Mohr's method, Volhard's method and Fajan's methods.
5. GRAVIMETRIC ANALYSIS: Precipitation techniques, Solubility products; the colloidal state, Supersaturation co-precipitation, Post-precipitation, Digestional washing of the precipitate, filtration, Filter papers and crucibles, Ignition, Thermogravimetric curves, Specific examples like barium as barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic precipitants.
6. Adsorption: Freundlich and Gibb's adsorption, isotherms, Langmuir theory of adsorption.
7. Photochemistry: Consequences of light adsorption, Jablenski diagram, Lambert-Beer's Law, Quantum efficiency.

PHR-151

PHARMACEUTICAL ANALYSIS-I LAB

1. The students should be introduced to the main analytical tools through demonstration,. They should have a clear understanding of a typical analytical balance, the requirements of a good balance, weights, care and use of balance, methods of weighing and errors in weighing. The students should also be acquainted with the general apparatus required in various analytical procedures.
2. Standardization of analytical weights and calibration of volumetric apparatus.
3. Acid base Titrations: Preparation and standardization of acids and bases; some exercises related with determination of acids and bases separately or in mixture form some official assay procedures e.g. boric acid should also be covered.
4. Oxidation Reduction Titrations: Preparation and standardization of some redox titrants e.g. potassium permanganate, Potassium dichromate, iodine, sodium thiosulphate, etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2,6-dichlorophenol indophenol and ceric ammonium sulphate.
5. Precipitation titrations: Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, Titrations according to Mohr's Volhard's and Fajan's methods.
6. Gravimetric Analysis: Preparation of gooch crucible for filtration and use of sintered glass crucible, determination of water of hydration, some exercises related to gravimetric analysis should be covered.

BOOKS RECOMMENDED:

1. Beckett. AII. And Stanlake, J.B. Practical Pharmaceutical Chemistry, Athilone Press, London.
2. Jeffery, G.II. Bessett, J., Mendham J. and Denney, R.C., Vogel's Textbook of Quantitative
3. Inorganic Analysis including Elementary Instrumental Analysis 4th Ed. The ELBS and Longman London, 1978.
4. Atherden, I.M. Bentley and Driver's Textbook of Pharmaceutical Chemistry. 8th ed. Oxford University Press, Delhi. 1969
5. Gary, D.C. Analytical Chemistry 4th ed. John Wiley and Sons, New York, 1986.

SEMESTER-I

PHR-102

REMEDIAL MATHEMATICS

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.
Measures of Central value: objectives and pre-requisites of an ideal measure, mean, mode and median.
2. TRIGONOMETRY: Measurement of angle, Trigonometric addition, subtraction and transformation formulae, Trigonometric ratios of multiple, submultiples, allied and certain angles, application of logarithms in pharmaceutical computations.
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.
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.

SEMESTER-I

PHR-107

REMEDICAL BIOLOGY

1. Methods of classification of plants.

Plant cell: It's detailed structure, mitosis, meiosis different types of plant tissues and their functions.

2. 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.

3. General survey of animal kingdom; structure and life history of parasites illustrated by amoeba, Entamoeba, Trypanosoma, Plasmodium, Taenia, Ascaris, Schistosoma, Oxyuris and Ancylostoma.

4. General structure of life history of insects including their relation to medicinal crops as illustrated by cockroach, mosquito, housefly, mite and silkworm.

REMEDICAL BIOLOGY LAB

(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.

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 help of specimens.

SEMESTER-I

PHR-103

*PHARMACEUTICAL CHEMISTRY- I
(PHARM. INORGANIC CHEMISTRY)*

1. An outline of important physical and chemical properties, medicinal and pharmaceutical uses, storage conditions of the following classes of drugs included in the Indian Pharmacopoeia (The discussion of assays should be excluded).
2. PHARMACEUTICAL AIDS & NECESSITIES :
Acids & Bases – Hydrochloric acid, Sulphuric acid, Nitric acid, Phosphoric acid, Sodium hydroxide, Strong ammonia solution, Soda lime.
Buffers – Standard buffer solutions.
Anti-oxidants – Hypophosphorous acid, Sulphur dioxide, Sodium-bisulphite, Sodium metabisulphite, Sodium thiosulphate, Sodium nitrite, Nitrogen.
Water – Purified water, Water for injection, sterile water for injection.
3. GASTRO-INTESTINAL AGENTS: Acidifying agents – Dilute hydrochloric acid.
Antacids – Sodium bicarbonate, Aluminium hydroxide gel, Calcium carbonate, Milk of magnesia, Magnesium oxide, Magnesium trisilicate, Combination antacid preparations.
4. PROTECTIVES & ADSORBANTS: Bismuth subcarbonate, Bismuth subgallate, Kaolin, Activated charcoal.
Saline Cathartics – Sodium hydrogen phosphate, Sodium phosphate, Sodium potassium tartrate, Milk of magnesia, Magnesium sulphate.
5. MAJOR INTRA- AND EXTRA-CELLULAR ELECTROLYTES: Electrolytes used for replacement therapy – Sodium chloride and its preparations, Potassium chloride and its preparations, Calcium Gluconate, Calcium Lactate, Dibasic calcium phosphate, Tribasic calcium phosphate, Magnesium Sulphate.
Physiological acid-base balance and electrolytes used in sodium and potassium bicarbonate, sodium dihydrogen phosphate, sodium citrate, ammonium Chloride. Electrolyte combination therapy.
6. ESSENTIAL AND TRACE IONS: Iron and haematinics – Ferrous fumarate, Ferrous gluconate, Ferrous Sulphate, Iron-dextran injection, Ferric ammonium citrate.
Mineral replacements – Iodine, Potassium iodide.
7. Topical agents: Protectives – Talc, Zinc oxide, Calamine, Titanium dioxide.

Anti-microbials and astringents – Hydrogen peroxide solution, Potassium permanganate, Iodine, Silver nitrate, Mild & strong silver protein, Yellow mercuric oxide, Ammoniated mercury, Sublimed sulphur, Precipitated sulphur, Boric acid, Antimony potassium tartrate.

Astringents – Aluminium hydrochloride, Alum, Zinc sulphate.

8. SOURCES OF IMPURITIES IN PHARMACEUTICAL SUBSTANCES: Impurities and their sources, Limit tests for chloride, sulphate, iron, lead, heavy metals and arsenic included in Indian pharmacopeia.
9. COMPLEXING AND CHELATING AGENTS – Disodium edetate, Dimercaprol.
10. DENTAL PRODUCTS – Sodium fluoride, Calcium carbonate, Dibasic calcium phosphate.
11. GASES AND VAPOURS: Inhalant – Oxygen, Anaesthetic gas – Nitrous oxide, Respiratory stimulants Aromatic spirit of ammonia, Ammonium carbonate, Carbon dioxide.
12. RADIOPHARMACEUTICALS: Biological applications of radioactive drugs – Cobalt compounds, Gold compounds, Iodine preparations, phosphorous preparations. Radio-opaque contrast media Barium sulphate.
13. MISCELLANEOUS AGENTS- Expectorants – Ammonium chloride, Potassium iodide.
14. ANTIDOTES – Sodium nitrite, Sodium thiosulphate, activated charcoal, light Kaolin.

PHR-153

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

Qualitative analysis of inorganic mixture of up to four radicals preferably by semi-micro method.

Limit tests for chloride, sulphate, iron and arsenic in the inorganic pharmaceutical compounds.

Identification and purification tests of selected inorganic pharmaceutical compounds.

SEMESTER - I

PHR-104

PHARMACEUTICS- I
(GENERAL PHARMACY)

1. HISTORY OF PHARMACY: Origin & developments of pharmacy, scope of pharmacy, introduction to pharmacopoeias with special references to I.P., B.P., U.S.P. & International Pharmacopoeia.
2. PHARMACEUTICAL CALCULATIONS: Posology, Latin terms, calculation of doses for infants, adults and elderly patients; Enlarging and reducing recipes percentage solution, allegation, alcohol dilution, proof spirit.
3. PHARMACEUTICAL ADDITIVES: Colouring, flavouring and sweetening agents, co-solvents, preservatives, surfactant and their applications, antioxidants.
4. EXTRACTION & GALENICALS: Extraction processes, study of infusion, decoction, digestion, percolation, maceration and their modifications, applications in the preparation of tinctures and extracts. Factors affecting selection of extraction process.
5. MIXING: Theory of mixing, mechanism of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments.
6. INTRODUCTION OF PHARMACEUTICAL DOSAGE FORMS – A brief theory of solutions, mixtures, spirits, aromatic waters, glycerin, paints, syrups, elixirs, mouth washes, mucilage, lotions, liniments, pastes, inhalations, emulsions, suspensions and powders.

PHR-154

PHARMACEUTICS-I
(GENERAL PHARMACY)

Practical based on calculations involving percentage solution, allegation & alcohol dilution.

Practical based on above mentioned dosage forms.

SEMESTER-I

PHR-105

HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-I

[HAPHE-I]

1. SCOPE OF ANATOMY AND PHYSIOLOGY: Basic terminology used in these subjects. Structure of cell, its components and their function. Elementary tissues of the human body: Epithelial, connective, muscular and nervous tissues, their sub-type and characteristics.
2. SKELETAL SYSTEM: Structure, composition and function of skeleton. Classification of joints, types of movements at joints, disorders of joints. Skeletal muscles: Their gross anatomy, physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.
3. BLOOD: Composition and function of blood and its elements, their disorders, blood group and their significance, mechanism of coagulation, disorders of platelets and coagulation.
4. CARDIOVASCULAR SYSTEM AND CIRCULATION: Basic anatomy of the heart, Physiology of heart, blood vessels and circulation. Blood pressure and factor affecting B.P. Basic understanding of Cardiac cycle, heart sounds and electrocardiogram. Heart disorders.
5. LYMPHATIC SYSTEM: Composition, formation and circulation of lymph node and spleen.
6. HEALTH EDUCATION: Concepts of health and disease.
Classification of food requirements, balance diet, nutritional deficiency disorders, their treatment and prevention. Specification of drinking water
7. DEMOGRAPHY AND FAMILY PLANNING: Demography cycle, family planning, various contraceptive methods.
8. FIRST AID: Emergency treatment of shock, snake bite, burns, poisoning, fractures and resuscitation methods.

PHR-155

HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-I
[HAPHE -I] LAB

Study of Human Skeleton.

Study of different systems of Human body with the help of charts & models.

Microscope study of different tissues.

Estimation of Hemoglobin, and determination of clotting time & Bleeding time, RBC, WBC (Total)
DLC & ESR.

BOOKS RECOMMENDED:

1. Chatterjee, C.C, Human Physiology, Medical allied agency, Calcutta
2. Shalya, Subhas, Human Physiology CBS publisher Delhi
3. Ross and Wilson, Human anatomy and Physiology
4. Chaurasia, B.D, Human anatomy, Regional and applied. Part-1, CBS publisher New Delhi
5. Parmar N.S. Health education and community pharmacy, CBS publisher New Delhi.

PHR-106

COMMUNICATION SKILLS

1. Grammar: Sequences of tenses, voice, articles, direct and indirect speech; degrees of comparison and preposition.
2. 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.
3. Scientific/technical report writing; drafting and delivering a speech, resume writing and interview techniques.
4. Types and methods of learning and listening; learning and listening of knowledge, attitudes, skills, decision making, thinking, motivation and practices.
5. Agreement and disagreements; how to use a dictionary; how to use a thesaurus; vocabulary development; synonyms; one word substitutes; comprehension.

B.PHARM. I YEAR

SEMESTER -II

PHR-201

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

1. Structure and Properties: Atomic Structure, atomic orbital, molecular orbital, hybridization, sigma and Pi bond, covalent, electrovalent and co-ordinate bond, inductive effect, resonance, Classification and Nomenclature of organic compounds.
2. Isomerism, geometrical isomerism, Stereochemistry including optical activity, stereoisomerism, specification of configuration and conformational analysis.
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.
4. Aromatic Compounds, aromatic character, structure of benzene, resonance, orientation of aromatic substitution, arenes, amines (aliphatic and aromatic), phenols, aryl halides, Aldehydes and ketones (aliphatic and aromatic).

PHR-251

*ORGANIC CHEMISTRY-I
(PHARMACEUTICAL CHEMISTRY- II)LAB*

1. Identification of elements and functional groups in given organic compounds.
2. Purification of solvents like Benzene, Chloroform, Acetone and preparation of absolute Alcohol.
3. Synthesis of compounds involving benzylation and acetylation.
4. Synthesis of Picric acid, Aniline, Acetanilide, Aspirin, Hippuric acid, p- Bromo acetanilide, Iodoform and Oxalic acid.

SEMESTER -II

PHR-202

PHYSICAL PHARMACY-I
(PHARMACEUTICS-II)

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

PHR-252

PHYSICAL PHARMACY-I
(PHARMACEUTICS-II)LAB

Experiments based on above mentioned theory topics.

SEMESTER-II

PHR-203

HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-II
[HAPHE-II]

1. DIGESTIVE SYSTEM: Gross anatomy of the gastro-intestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food.
2. RESPIRATORY SYSTEM: Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiratory volumes and vital capacity.
3. 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.
4. AUTONOMIC NERVOUS SYSTEM: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.
5. URINARY SYSTEM: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base balance.
6. REPRODUCTIVE SYSTEM: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization, Sex differentiation, spermatogenesis and oogenesis.
7. ENDOCRINE SYSTEM: Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones and functions.
8. SENSE ORGANS: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

PHR-253

HUMAN ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-II
[HAPHE-II] LAB

1. Study of different systems with the help of charts and models.
2. Microscopic studies of different tissues.
3. Simple experiments involved in the analysis of normal and abnormal urine: Collection of specimen, appearance, determination of pH, Sugars, proteins, urea and Creatinine.
4. Physiology experiments on nerve-muscle preparations.
5. Determination of vital capacity, experiments on spirometry.

1. Definition and information of different equations, equation of first order and first degree. Variable separation homogenous and linear differential equation and equation reducible to such types.
2. Linear differential equation of order greater than one with constant coefficients, complimentary function and particular integral, simultaneous, pharmaceuticals applications.
3. STATISTICAL INFERENCE: Chi Square test as test of independence of Attributes, test of goodness of fit in testing of significance in biological/pharmaceutical experiments and elements of ANOVA in one variable.
4. BIOMETRICS: Significant digits and rounding off numbers, data collection, random and non-random sampling methods, sample size, data organization diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams measures of central tendency, measures of dispersion, standard deviation and standard error of means, coefficient of variation, confidences (fiducial) limits, correlation, regression analysis.
5. PROBABILITY AND DISTRIBUTION: Bayer's theorem, probability theorem, probability distribution, elements of binominal and poison distribution curve and properties, kurtosis and skewness.

SEMESTER-II

PHR-204

COMPUTER SCIENCES

1. CONCEPT: History of computers, simple model of computer and its working parts of the computer, CPU, memory input/output devices, computer languages and their hierarchal machine language, assembly language, high level language comparison of high level and low level languages especially C, C⁺⁺, PASCAL etc.

Introduction to microcomputers and concepts of operating systems: Elements of DOS, UNIX, etc, introduction of computer networks.

2. DATABASE MANAGEMENT: Spread sheets (like MS-EXCEL, ACCESS), concept and objectives of database and database management system, advantages and disadvantages of the database management system and examples of DBMS packages (like DBASEAIII).

Flow chart and algorithm development: Definition and properties of the algorithm, Flow chart symbols and their uses, Examples of efficient algorithm and flow-char, conversion of algorithm/flow chart to high level languages.

3. INTRODUCTION TO COMPUTER PROGRAMMING: C Language: Constant and string variables, expressions, functions, structures, repetition statements (loops), nested loop, definite and indefinite loop and arrays. Concepts of files, Sequential files and random access files, Simple program writing for bio statistical methods.

4. Computer applications in pharmaceutical and clinical studies.

Computer validation-Introduction.

PHR-254

COMPUTER APPLICATION AND PROGRAMMING LAB

Exercise based on the following are to be dealt:

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

B.PHARM. II YEAR

SEMESTER-III

PHR-301

*PHYSICAL PHARMACY-II
(PHARMACEUTICS-III)*

1. MICROMERETIC AND POWDER RHEOLOGY: Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness and flow properties.
2. SURFACE AND INTERFACIAL PHENOMENON: 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.
3. VISCOSITY AND RHEOLOGY: Newtonian systems, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudo plastic, dilatant plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers, application of rheology in pharmacy.
4. DISPERSION SYSTEMS:
 - (a) COLLOIDAL DISPERSIONS: Definition, types, properties of colloids, 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.
 - (c) EMULSIONS: Types, theories, physical stability, small scale preparation, pharmaceutical applications of emulsions.
5. COMPLEXATION: Classification of complexes, methods of preparation and analysis, applications.
6. KINETICS AND DRUG STABILITY: Influence of temperature, light, solvent, catalytic species and other factors, decomposition and stabilization of medicinal agents, accelerated stability study.

PHR-351

*PHYSICAL PHARMACY-II
(PHARMACEUTICS-III) LAB.*

Practicals based on the above mentioned theory topics.

BOOKS RECOMMENDED:

1. Alfred Martin, Physical Pharmacy, 5th ed. B.I. Waverly Pvt. Ltd., New Delhi.
2. S.P. Aggarwal, Rajesh Khanna, Physical Pharmacy, 1st ed., 2000, CBS Publishers, New Delhi.
3. E.A. Rawlins, Bentley's textbook of Pharmaceutics 8th ed. Bailliere Thindann, London.
4. C.V.S Subramaniyan, 2006, 2nd ed., Vallabh Prakashan, New Delhi.
5. A.R. Gennaro, Remington Pharmaceutical Sciences and practice of Pharmacy, vol. I & II, 20th ed. Lippincott, William and Wilkens, Philadelphia.

SEMESTER-III

PHR- 302

*UNIT OPERATION - I
(PHARMACEUTICS- IV)*

1. UNIT OPERATIONS: - Introduction, basic laws.
2. FLUID FLOW :- Types of flow , Reynolds number, viscosity , concept of boundry layers , basic equation of fluid flow, valves, flow meters, manometers & measurement of flow & pressure .
3. FILTRATION & CENTRIFUGATION:- Theory of filtration , filter aids , filter media , filter press, rotary filter, edge filter, factors affecting filtration , principle of centrifugation, industrial centrifugal filters & sedimentation centrifuges.
4. DEHUMIDIFICATION & HUMIDITY CONTROL:- Basic concepts & definations, wet bulb & adiabatic saturation temperature,Psychometric charts & measurement of humidity, application of humidity, measurement in pharmacy, equipment for dehumidifation operations.
5. DRYING: - Moisture content & mechanism of drying, rate of drying & time of drying calculations, classifications & types of dryers, special drying methods.
6. SIZE REDUCTION & SIZE SEPARATION: - Defination, objectives of size reduction, factors affecting size separation, laws governing energy & power requirement of mill including ball mill, hammer mill, fluid energy mill and colloid mill.
7. CRYSTALLIZATION: - Characteristics of Crystals like purity, size, shapes, geometry habit, forms and factors affecting them in brief . Classification of crystallizers, Swenson walkers, agitated batch crystallizers etc, miers super saturation theory & caking of crystals and prevention.

PHR-352

*UNIT OPERATION-I
(PHARMACEUTICS- IV) LAB*

Experiments based on drying, size reduction & size separation, crystalliza tion, filtration and humidity charts, fluid flow are to be performed.

BOOKS RECOMMENDED:-

1. W.L.McCabe, J.C. Smith & peter harriot. Unit operations of chemical engineering. 5th
2. Ed. international student addition, McGraw hills international book co. New Delhi. 1993.
3. J.W. Cooper, & G. Gunn, Tutorial Pharmacy, Petman Books Ltd., London
4. R.H. Perry & Don Green, Chemical engineering's hand book, McGraw hill book company, New Delhi.
5. Water. I. Badger & Julius. T. Banchemo, introduction to chemical engineering, McGraw hill book company, New Delhi.
6. C.V.S Subramanian, pharmaceutical engineering, vallabh prakashan, Delhi.
7. Remington's Pharmaceutical Sciences, Vol. I & Vol. – II, Mack Publishing Co., U.S.A

SEMESTER -III

PHR-303

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

1. STEREOCHEMISTRY: - Chirality, Isomerism, nomenclature, optical activity, Racemic modification, stereoisomerism, specification, Configuration, conformational analysis of cyclohexane and butane
2. REACTION MECHANISM: - Nucleophilic aromatic substitution Elimination reactions, Addition reaction.
3. METHODS OF PREPARATION WITH MECHANISM, PROPERTIES AND MECHANISM OF NAME REACTION ASSOCIATED WITH: -
 - (i) Carboxylic acid (aromatic and aliphatic) and their derivatives
 - (ii) Hydroxy acids
 - (iii) Active methylene compounds (acetoacetic ester and malonic ester) and their synthetic importance.
 - (iv) α , β -unsaturated carbonyl compounds
4. 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)
 - 6-membered heterocycles with one hetero atom (Pyridine, Pyran)
 - 6-membered heterocycles with two hetero atoms (Pyrimidine, Piperazine)
 - Benz fused heterocycles (Quinoline, Isoquinoline, Indole)
5. NAME REACTIONS: - Wolf-Kishner reduction, Clemensen reduction, Birch reduction, Meervien-Pondroff Varley reduction, Oppenaur oxidation, Bayer-Villiger oxidation, Backman, Hoffman, Curtius, Schimdt & Pinacol-pinacolone rearrangement.

PHR-353

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

Identification of organic compound with derivatisation. Synthesize the organic compounds involving Oxidation, Reduction, Rearrangement, Substitution, Condensation, Diazotization reactions.

BOOKS RECOMMENDED:-

1. E.L. Eliel Stereochemistry of carbon compounds, Tata McGra Hill Publishing Company New Delhi 1975.
2. Jerry March, Advance organic Chemistry 4th ed.. A Wiley-Interscience Publication, 1999.
3. I.L. Finar's Organic chemistry,
4. Bansal, R.K; Organic reaction Mechanism,
5. Kalsi, P.S; Organic reaction mechanism,
6. O.P. Aggarwal Organic reaction mechanism,
7. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
8. Furniss B A, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.

SEMESTER-III

PHR-304

PHARMACOGNOSY-I

1. INTRODUCTION: - Definition, Historical back ground, present status and future scope of Pharmacognosy.
2. SOURCES OF DRUGS: - Biological, Marine, Mineral, and Plant tissue culture as a source of drugs.
3. CLASSIFICATION OF DRUGS: - Alphabetical, Morphological, Taxonomical, Chemical, and Pharmacological.
4. 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.
5. COMMERCE IN CRUDE DRUGS: Collection, preparation, drying, and storage of drugs with special emphasis on factors influencing the quality of drugs. Cultivation of medicinal plants. Types of soil and fertilizers of common use.
6. ADULTERATION AND EVALUATION OF DRUGS: Causes and types of Adulteration, Organoleptic, Microscopic, Biological, Chemical and Physical method of evaluation. WHO guidelines for the standardization of medicinal plants.
7. AN INTRODUCTION TO ACTIVE CONSTITUENTS OF DRUGS: Their classification, properties and general methods of isolation.
8. SYSTEMATIC PHARMACOGNOSTIC STUDY OF THE FOLLOWING:
 - a) Carbohydrates and derived products: Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia, Tragacanth, Alginates, and Katir.
 - b) Fixed oil, Fats and Waxes: Castor oil, Sesame oil, Olive oil, Arachis oil, Cotton seed oil, Chaulmoogra oil, Neem oil, Fish liver oil, Lard, Lanolin, Bees wax, Cocoa butter, Kokum butter and wool fat.

PHR-354

PHARMACOGNOSY-I LAB.

1. Macroscopic evaluation of crude drugs.
2. Microscopical measurement of cell and cell contents, starch grains, calcium oxalate crystal, trichomes and fibres.
3. Determination of leaf constant such as Stomatal index, Stomatal numbers, Veinlet numbers, Vein termination numbers and Palisade ratio
4. Identification of crude drugs belonging to carbohydrates and lipids.
5. Preparation of herbarium sheets.

BOOKS RECOMMENDED:

1. Trease. GE & Evans WC, Pharmacognosy, Bailliere tindall East bourne. UK.
2. Wallis. TE, Text book of Pharmacognosy, JA Churchill Ltd.
3. Kokate. CK, Practical Pharmacognosy, Vallabh Prakashan, Delhi.
4. Wallis. T.E, Analytical Microscopy, J & A Churchill Limited London.
5. Brain, KR and Turner, TD, The practical evaluation of phyto pharmaceutical, Wright, Scientifica-Bristol.
6. Kokate, CK, Pharmacognosy, Nirali Prakashan. Pune.
7. Schewar, PJ, Marine Natural Products, Academic press, London.

PHR-305

HOSPITAL & COMMUNITY PHARMACY
(*PHARMACEUTICS – V*)

1. ORGANIZATION & STRUCTURE: Organization of a hospital & hospital pharmacy, responsibilities of hospital pharmacist, Pharmacy & therapeutic committee, its composition & various roles.
2. HOSPITAL FORMULARY: Contents, preparation and revision of hospital formulary.
3. Drug store Management and Inventory Control:
 - a) Organization of drug store, types of material stocked, storage conditions.
 - b) Sources of supply, purchase procedure, techniques of inventory control.
4. DRUG DISTRIBUTION SYSTEMS IN HOSPITALS:
 - a) Out patient dispensing, dispensing of drugs to ambulatory patients.
 - b) Dispensing of drugs to inpatients, systems for in patient drug distribution.
 - c) Dispensing of controlled drugs.
5. CENTRAL STERILE SUPPLY UNIT AND STERILIZATION: CSSR: organization and function, types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, applications of sterilization methods, supply of sterile material.
6. PRESCRIPTION: Parts of prescription, handling of prescription, pricing of prescription, therapeutic incompatibility in prescription.
7. RETAIL AND WHOLE SALE DRUG STORE: Organization and structure of retail and wholesale drug store, types of drug store and design, legal requirements for establishment, maintenance of drug store, maintenance of records of wholesale and retail.
8. COMMUNICABLE DISEASES: Causative agent, mode of transmission and prevention in brief of the following diseases: chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, hepatitis, cholera, typhoid, malaria, filariasis, rabies, tetanus, leprosy, syphilis, gonorrhoea and AIDS.

BOOKS RECOMMENDED:

1. P. Nand and R.K. Khar, A text book of Hospital and Clinical Pharmacy, 1st ed. Birla publications, Delhi 2003-04.
2. S.J. Carter, Cooper and Gunn's Dispensing for Pharmaceutical Students, 12th ed. CBS publishers and distributors, Delhi 1987.
3. W.E. Hassan, Hospital Pharmacy, 5th ed, Lea and Febiger, Philadelphia, 1986.
4. S.H. Merchant, J.S. Qadry; A text book of Hospital Pharmacy, 2nd ed, Shah Prakashan, Ahmedabad 1988.
5. P.C. Dandiya, Z.Y.K. Zafer, Afefa Zafer, Health Education and Community Pharmacy, 2nd ed, Vallabh Prakashan, Delhi 1997.
6. A.R. Gennaro, Remington, The Science and practice of Pharmacy, Vol 1 & II, 20th ed. Lippincot Williams and Wilkens Philadelphia, 2000.
7. Jyoti Gupta and Mohamad Ali – Drug store and Business Management, 1st et, 1996, CBS Publishers, New Delhi.

PHR-306

ENVIRONMENTAL SCIENCES

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.

UNIT – II

Ecosystems

- A. Introduction, types, features & functions of different ecosystems- Forest Grassland, Desert and Aquatic.
- B. Biodiversity & its conservation with special reference to India.

UNIT – III

Environmental pollution – Air, Water, Soil, Marine, Noise, Thermal, Nuclear-Introduction, causes and control measures.

UNIT – IV

Law related to Environmental Protection
Air (Prevention and Control of Pollution) Act 1987.
Water (prevention & control of Pollution) Act 1974.

UNIT – V

Environmental Protection Act – 1986

Noise Pollution
Hazardous Wastes
Hazardous Chemicals
Hazardous Microorganisms
Biomedical Waste
Provisions applicable to drugs and cosmetic.

Reference

1. Principles of environmental Studies, C. Manoharachary, P. Jyaranama Reddy, Pharma Book Syndicate, Hyderabad.
2. Handbook of Environmental Laws, Acts, Guidelines, Compliances & Standards Vol. I & II. R.K. Trivedy, Pharma Book Syndicate, Hyderabad.
3. Relevant Acts & Rules published by Govt. of India with latest amendments.

B.PHARM. II YEAR

SEMESTER-IV

PHR-401

*PHARMACEUTICAL MICROBIOLOGY
(PHARMACEUTICS-VI)*

4. Introduction to scope of microbiology, structure of bacterial cell, classification of microbes and their taxonomy (bacteria, actinomycetes, rickettsiae, spirochetes and viruses)
Nutrition, cultivation and isolation of bacteria and viruses
2. Identification of microbes; stains and types of staining techniques, electron microscopy
3. Control of microbes by physical and chemical methods
 - (a) Disinfection, factors influencing disinfectants, Dynamics of disinfection, Disinfectants and antiseptics and their evaluation
 - (b) Sterilisation, different methods, validation of sterilization methods and equipments
 - (c) Sterility testing as per I.P, Preservative efficacy.
4. Immunity (Primary, secondary), defensive mechanism of body, microbial resistance, interferon. Vaccines, their preparation, standardization and storage. Sera, their preparation, standardization and storage.

PHR-451

*PHARMACEUTICAL MICROBIOLOGY
(PHARMACEUTICS-VI) LAB*

1. Study of sterilization methods and equipments (dry heat, moist heat)
2. Preparation of Various type of culture media
3. Subculturing of common bacteria, fungi and yeast
4. Isolation of Bacteria
5. Identification and staining of bacteria (simple staining, Gram staining, Acid fast staining, negative staining, hanging drop preparation)
6. Evaluation of disinfectants and antiseptics (phenol coefficient test, minimum inhibitory concentration)
7. Test for sterility of pharmaceutical products as per IP
8. Microbial assay of antibiotics as per IP

BOOKS RECOMMENDED:

- 1) Pelczar and Reid, Microbiology, Tata Mc Grow Hill, Delhi
- 2) Ananthnarayan R and Panikar CKJ, Textbook of Microbiology, orient Longman
- 3) Gunasekaram p, lab Manual of Microbiology, New age Publisher
- 4) Remington Pharmaceutical Sciences
- 5) Indian pharmacopoeia
- 6) S.J. Carter's Tutorial Pharmacy, CBS publisher New Delhi

SEMESTER-IV

PHR-402

*CHEMISTRY OF NATURAL PRODUCTS
(PHARMACEUTICAL CHEMISTRY-IV)*

1. Chemical and spectral approaches to simple molecule of natural origin.
2. Phytochemical identification test of steroids, carbohydrates, terpenoids, aminoacids and proteins, alkaloids, flavonoids and saponins
3. Different techniques of extraction and isolation of natural compounds

INTRODUCTION, CLASSIFICATION AND CHEMISTRY INCLUDING STEREOCHEMISTRY OF :

1. Carbohydrate: Monosaccharide:- Glucose (mutarotation, ring structure of glucose,) configuration of monosaccharides), Disaccharides (Sucrose and maltose), Polysaccharides (Starch and cellulose)
2. Aminoacids and proteins: Preparation, properties and end group analysis. Protein structure (Primary, secondary, tertiary and quaternary)
3. Glycosides: Salicin, amygdalin, cardiac glycosides
4. Alkaloids: Atropine, Nicotine. Structural features of morphine, reserpine and quinine.
5. Terpenoids : Citral, menthol and camphor,
6. Steroids : Structural features of cholesterol and ergosterol and saponin (excluding chemistry)
7. 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.

PHR-452

*CHEMISTRY OF NATURAL PRODUCTS
(PHARMACEUTICAL CHEMISTRY-IV) LAB*

Isolation of natural organic compounds from medicinal plants

Extraction of essential oils

Analysis of fixed oils (acid value, saponification value, ester value, and iodine value)

BOOKS RECOMMENDED:

1. I.L. Finar, Organic chemistry, Vol. II, 1st Indian ed., Pearson Education Pte Ltd Indian Branch, Delhi, 2002.
2. O.P. Agarwal, Chemistry of Natural Products, Vol. I & II, 7th ed., Goel Publishing House, Meerut, 1983.
3. Indian pharmacopoeia

PHR-403

PHARMACOGNOSY-II

1. SYSTEMATIC PHARMACOGNOSTIC STUDY OF THE FOLLOWING DRUGS:

Resins: Colophony, Podophyllum, Jalap, Cannabis, Capsicum, Myrrh, Asafoetida, Balsam of tolu, Balsam of peru, Benzoin, Turmeric, Ginger.

Tannins: Gambir, Black catechu, Gall, Myrobalam.

Volatile oil: Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandalwood.

2. STUDY OF THE SOURCES, PHYSICAL AND CHEMICAL TEST OF IDENTITY, SALIENT MICROSCOPIC FEATURES AND USES OF THE FOLLOWING:

Cellulose and Cellulose derivative.

Fibres: Wool, Cotton wool, Jute, Silk, Nylon, Terylene and Polyesters.

Pharmaceutical aid: Talc, Asbestos, Bentonite, Kaolin and Prepared Chalk'

3. PHYTOCHEMICAL SCREENING:

(a) Preparation of extract

(b) Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and poly phenols, anthraquinones, cyanogenic glycoside, amino acid in plant extracts.

PHR-453

PHARMACOGNOSY-II LAB

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

BOOKS RECOMMENDED:

1. Trease. GE & Evans WC, Pharmacognosy, Bailliere Tindall Eastbourne. UK
2. Wallis. TE, Text book of Pharmacognosy, J & A Churchill Ltd.
3. Kokate. CK, Practical Pharmacognosy, Vallabh Prakashan, Delhi.
4. Wallis. TE, Analytical Microscopy, J & A Churchill Limited London.
5. Brain, KR and Turner, TD, The practical evaluation of phyto pharmaceutical, Wright, Scientifica-Bristol.
6. Kokate, CK, Pharmacognosy, Nirali Prakashan. Pune.
7. Harborne. JB, Phytochemical method, Chapman & Hall international edition, London.
8. Atal. CK, & Kapoor. BM, Cultivation & Utilization of medicinal plants, RRL, Jammu.
9. Tyler. VE, Pharmacognosy, Le & Febiger, Philadelphia.

SEMESTER-IV

PHR-404

PHARMACEUTICAL ANALYSIS-II

1. Theoretical considerations and application in drug analysis and quality control by the following analytical techniques-
 - A. Non-aqueous titration
 - B. Complexometric titration
2. Miscellaneous methods of analysis:
Diazotisation titrations, Karl-Fischer titration, Oxygen flask combustion, Kjeldahl method of nitrogen estimation.
3. Principle, Instrumentation and Applications of:
Potentiometry, Conductometry, Polarography, Amperometry, Electrophoresis.
4. Theory, Instrumentation and Applications of:
Atomic absorption spectroscopy, Flame Photometry.

PHR-454

PHARMACEUTICAL ANALYSIS-II LAB

1. Non-aqueous titrations: Preparation and standardization of perchloric acid. Estimation of some pharmacopoeial products.
2. Complexometric titrations: Preparation and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titration.
3. Exercises involving diazotization, Karl-Fischer methods.
4. Determination of Sodium, Potassium and Calcium ion by Flame Photometry.

BOOKS RECOMMENDED:

1. Beckett, A H and Stenlake, J.B, Practical Pharmaceutical Chemistry, Vol I and II, The Athlone Press of the University of London.
2. Pharmacopoeia of India, published by The Controller of Publications, Delhi.
3. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.
4. Mendham J. Denny RC Barnes, J.D. Thomas M.J.K. "Vogel's Text Book of Quantitative Chemical Analysis" Pearson Education Asia.
5. Connors KA, A text book of Pharmaceutical Analysis, Wiley Intescience, New York.

PHR 405

*UNIT OPERATION-II
(PHARMACEUTICS-VII)*

1. STOICHIOMETRY:- unit process material & energy balances , molecular units , mole fractions , gas laws , mole volume , primary & secondary quantities, rate process, steady and unsteady states, dimensionless equations, dimensionless formulae.
2. HEAT TRANSFER:- source of heat, heat transfer, steam & electricity as heating media, radiations, black body, tubular heaters.
3. EVAPORATION:- basic concepts of phase equilibrium, factors affecting evaporation, evaporators, film evaporators, single effect & multiple effect evaporators.
4. DISTILLATION:- Raoult's law , phase diagrams, simple , steam, & flash distillations , principle of McCabe Thiele method of calculation of number of theoretical plates equipment for rectifications, azeotropic & extractive distillations , molecular distillations .
5. MATERIAL HANDLING SYSTEMS:- (a) Liquid handling:- different types of pumps (b) Gas handling: various types of fans & blowers (c) Solid handling:- conveyors & air transport.
6. MATERIAL OF CONSTRUCTION:- general study of composition, corrosion resistance, properties & application of material of construction with special reference to stainless steel and glass.
7. INDUSTRIAL HAZARDS & SAFETY PRECAUTIONS:- mechanical, chemical, electrical, fire & dust hazards, accidents records etc.
8. REFRIGERATION AND AIR CONDITIONING - principles & applications of refrigeration and air conditions.

BOOKS RECOMMENDED:-

1. W.L.McCabe, J.C. Smith & Peter Harriot. Unit operations of chemical engineering. 5th
2. Ed. international student addition, McGraw hills international book co. New Delhi. 1993.
3. J.W. Cooper, & G. Gunn, Tutorial Pharmacy, Petman Books Ltd., London
4. R.H. Perry & Don Green, Chemical engineering's hand book, McGraw hill book company, New Delhi.
5. Water. I. Badger & Julius. T. Banchemo, introduction to chemical engineering, McGraw hill book company, New Delhi.
6. C.V.S Subramanian, pharmaceutical engineering, Vallabh Prakashan , Delhi.
7. Remington's Pharmaceutical Sciences, Vol. I & Vol. – II, Mack Publishing Co., U.S.A

B.PHARM. III YEAR

SEMESTER -V

PHR-501

BIOCHEMISTRY
(PHARMACEUTICAL CHEMISTRY-V)

1. ENZYMES :Nomenclature, enzymes-kinetics and mechanism of action, mechanism of inhibition of enzymes and isoenzymes.
2. CO-ENZYMES:Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance.
3. CARBOHYDRATE METABOLISM: Glycolysis, Gluconeogenesis and Glycogenolysis. Metabolism of galactose and galactosemia. Role of sugar nucleotides in biosynthesis and pentose phosphate pathway.
4. The citric acid cycle, significance, reactions and energetics of the cycle.
5. LIPID METABOLISM: Oxidation of fatty acids-oxidation & energetics, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids., regulation of lipid metabolism, essential fatty acids.
6. BIOLOGICAL OXIDATION: The respiratory chain, its role in energy capture & control, Energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation
7. Introduction of amino acids, catabolism of amino acids,assimilation of ammonia and urea cycle, biosynthesis of purine and pyrimidine., formation of deoxyribonucleotides.
8. Introduction of RNA, DNA replication and DNA repair mechanism.
9. Genetic Code and Protein synthesis, components of protein synthesis, inhibition of protein synthesis.

PHR-551

BIOCHEMISTRY
(PHARMACEUTICAL CHEMISTRY-V)LAB

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
3. Separation of amino acids by chromatography.
4. The separation of lipids by TLC.
5. Quantitative estimation of amino acids.
6. The determination of glucose by means of the enzyme glucose oxidase.
7. Enzymatic hydrolysis of glycogen by α & β amylase.
8. Effects of temperature on the activity of alpha amylase.
9. Estimation of cholesterol in Blood.
10. Estimation of Glucose in blood & urine.
11. Estimation of Urea in blood.
12. Estimation of ketone bodies in blood.
13. Qualitative analysis of inorganic as well as organic constituents of Urine.

BOOKS RECOMMENDED :

1. Jayaraman J., Laboratory Manual in Biochemistry, Wiley Eastern Limited.
2. Plummer, David J., An Introduction to Practical Biochemistry, Mc Graw Hill, New Delhi.
3. Singh S.P., Practical Manual to Biochemistry, CBS Publisher, New Delhi.
4. "Harpers Review of Biochemistry" Lange Medical Publication.

PHR-502

PHARMACOLOGY-I

1. GENERAL PHARMACOLOGY

Definition, scope and branches of Pharmacology. History of development of pharmacology, sources of drugs, Routes of administration.

Pharmacokinetics-ADME

Basic pharmacokinetic parameters employed in the use of drugs, their bioavailability and biotransformation, enzyme induction and enzyme inhibition

Mechanism of drug action, principles of drug action, drug receptors and cellular signaling systems. Drug antagonism and combined effects of drugs.

ADR and their monitoring, Drug tolerance, Iatrogenic diseases

2. AUTONOMIC NERVOUS SYSTEM

Study of general pharmacology, classification, mechanism of action, pharmacology, uses, side effects, drug interaction and contra indication of the following category of drugs.

Parasympathomimetics and parasympatholytics, Sympathomimetics and sympatholytics
Drugs acting on autonomic ganglia

Neuromuscular blocking agents and centrally acting muscle relaxant, local anaesthetics.

3. AUTOCOIDS

Histamine and antihistaminics

Serotonin, its agonists and antagonists

Prostaglandins (arachidonic acid metabolites)

Angiotensin, plasmakinins, neurotensin substance P, PAF and leukotrienes

PHR-552

PHARMACOLOGY-I LAB.

Study of instruments used in experimental Pharmacology, P.S.S.

Handling of laboratory animals. Techniques of drug administration in animals.

Experiments on isolated tissue preparations.

1. To record the concentration response curve of acetylcholine using guinea pig ileum.
2. To record the concentration response curve of acetylcholine using rat ileum.
3. To record the concentration response curve of histamine using guinea pig ileum.
4. Study of competitive antagonism using acetylcholine and histamine as agonist.
5. Determination of dose ratio.
6. Potentiation of actions of acetylcholine responses with anticholinesterases.
7. Determination of PD₂ value.
8. Identification of unknown drug using isolated tissues (rat and guinea pig ileum).

BOOKS RECOMMENDED:

1. "K.D Tripathi, "Essentials of medical pharmacology".
2. D.R.Laurence and P.N.Bennett, "Clinical pharmacology".
3. R.S. Satoskar and S.D. Bhandarker, "Pharmacology and pharmacotherapeutics"
4. A. Goodman, R.W.T. Gilman, A.S.Nies and T.Palmer, "Goodman and Gilman's pharmacological basis of Therapeutics".
5. F.S.K. BararEssentials of pharmacotherapeutics"

PHR-503

PHARMACOGNOSY-III

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes adulterants, uses, diagnostic macroscopic & microscopic features & specific chemical tests of following alkaloid containing drugs.
 - (a) Pyridine-piperidine: Tobacco, Areca & Lobelia.
 - (b) Tropane: Belladonna, Hyoscyamus, Datura, Coca & Withania.
 - (c) Quinoline & Isoquinoline: Cinchona, Ipecac & Opium..
 - (d) Indole: Ergot, Rauwolfia, Catharanthus & Nux-vomica.
 - (e) Imidazole: Pilocarpus.
 - (f) Steroidal: Veratrum & Kurchi.
 - (g) Alkaloidal amine: Ephedra & Colchicum.
 - (h) Glycoalkaloid: Solanum.
 - (i) Purines: Coffee & Tea
 - (j) Quinazoline: Vasaka.
2. Role of Medicinal & aromatic plants in National Economy.
3. Enzymes: Sources, Preparation, Identification test, Chemical nature, and uses of the papain, pepsin, pancreatin, urokinase, diastase, trypsin, penicillinase, hyaluronidase.
4. General principles of formation of primary and secondary plant metabolites. Biogenesis of medicinally important glycosides, alkaloids, carbohydrates, lipids, volatile oils and steroids.
5. Plant bitters and sweeteners
6. Introduction, classification, and study of different chromatography methods and their methods and their applications in evaluation of herbal drugs.

PHR-553

PHARMACOGNOSY-III LAB.

1. Identification of crude drugs listed above.
2. Macroscopic and Microscopic study of some drugs mentioned in theory.
3. Chemical evaluation of powdered drugs & Enzymes.
4. Chromatographic studies of some herbal constituents.

BOOKS RECOMMENDED:

1. Kokate, C.K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.
2. Wallis T.E. Analytical Microscopy, J&A Churchill Ltd, London.
3. Clarke ECG, Isolation & Identification of drugs. The Pharmaceutical Press, London.
4. Trease, G.E. & Evans, W.C. "Pharmacognosy" Bailliere Tindall East Bourne, U.K.
5. Tyler V.E. et al, Pharmacognosy, Lea & Febiger Philadelphia.
6. Wallis T.E. Text book of Pharmacognosy" J&A Churchill Ltd. London.
7. Kokate, C.K. et al, Pharmacognosy" Nirali Prakashan, Pune.
8. Atal & Kapur, Cultivation & Utilization of Medicinal Plants, RRL, Jammu.
9. Stahl. E, Thin Layer Chromatography. A laboratory handbook, Springer Verlag, Berlin.
10. Henry TA. The Plant Alkaloids, McGraw Hill, New York.
11. Dixit, V.K., Vyas. S.P. Pharmaceutical Biotechnology, CBS Publication, ND.
12. Kokate, C.K. Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan.

PHR-504

PHARMACEUTICAL TECHNOLOGY-I
(PHARMACEUTICS-VIII)

1. PREFORMULATION STUDIES: Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, Solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability
2. TABLETS: Formulation of different types of tablets, granulation technology on large-scale by various techniques, physics of tablets making, different types of tablet compression machinery and the equipments employed, evaluation of tablets.
COATING OF TABLETS: Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablet. Stability kinetics and quality assurance
3. CAPSULES: Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsule, size of capsules, methods of capsule filling, soft gelatin capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsule, quality control, stability testing and storage of capsule dosage forms.
4. LIQUID DOSAGE FORMS: Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavours and others, Manufacturing packaging & evaluation of clear liquids, suspensions and emulsions.
5. SEMISOLID DOSAGE FORMS : Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection, General formulation of semisolids, clear gels & manufacturing procedure, evaluation and packaging.

PHR 554

PHARMACEUTICAL TECHNOLOGY-I
(PHARMACEUTICS-VIII)LAB

Experiments based on above prescribed syllabi.

BOOKS RECOMMENDED:-

1. Remington's Pharmaceutical Sciences, Vol. I & Vol. – II, Mack Publishing Co., U.S.A.
2. J.W. Cooper, & G. Gunn, Tutorial Pharmacy, Petman Books Ltd., London.
3. Lachman L., Lieberman H.A, Kanig J.L, Theory and Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.
4. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.
5. R.L. Juliano, Drug Delivery Systems, Oxford University Press, Oxford.
6. Harrys Cosmetology
7. Balsam and Sagarin, Cosmetics: Science and Technology.
8. Thomssen E.G. Modern Cosmetics, Universal Publishing Corporation.
9. Mittal B.M. & Saha R.N.-a handbook of cosmetics, Vallabh Prakashan.

PHR-505

FORENSIC PHARMACY
(PHARMACEUTICS-IX)

1. 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.

2. AN ELABORATE STUDY OF THE FOLLOWING:

- a) Pharmacy Act 1948.
- b) Drugs and Cosmetics Act 1940 and rules 1945.
- c) Medicinal & Toilet preparations (Excise duties Act 1955).
- d) Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
- e) Drugs Price Control Order 1995.

3. A BRIEF STUDY OF THE FOLLOWING WITH SPECIAL REFERENCE TO THE MAIN PROVISIONS.

- a) Poisons Act 1919.
- b) Drugs and Magic remedies (Objectionable Advertisements) Act 1954.
- c) Medical termination of Pregnancy Act 1970 & Rules 1975.
- d) Prevention of Cruelty to Animals Act 1961.
- e) A.I.C.T.E. Act 1987.
- f) Introduction to Intellectual Property Rights and Indian Patent Act 1970.
- g) Weight and Measures Act.
- h) Package and Commodity Act.

BOOKS RECOMMENDED:

1. B.M. Mittal, Textbook of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta.
2. Relevant Acts & Rules Published by the Govt. of India.
3. N.K. Jain, A Textbook of Forensic Pharmacy, Vallabh Prakashan, New Delhi.
4. Singh, Harkishan “History of Pharmacy in India – Vol. I, II & III” allabh Prakashan.
5. Kuchekar, B.S.; Khadatare, A.M.; Forensic Pharmacy, Nirali Prakashan, Pune.

PHR-601

MEDICINAL CHEMISTRY-I
(*PHARMACEUTICAL CHEMISTRY-VI*)

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

1. AUTONOMOUS NERVOUS SYSTEM.

Cholinergic, Anticholinergic & Anticholinesterases-Neostigmine, Physostigmine, Methacholine, Pilocarpine, Atropine.

Adrenergic Drugs-Ephedrine, Isoproterenol, Amphetamine, Salbutamol, Terbutaline, Adrenaline.

Antiadrenergic Drugs

Neuromuscular Blocking Agents – Gallamine Triethiodide, Mephensin, Pancuronium.

Drugs used in the treatment of Alzheimer's disease

Local Anaesthetics-Lignocaine, Benzocaine.

2. CENTRAL NERVOUS SYSTEM-I

General Anaesthetics-Thiopental, Ketamine, Methohexital.

Hypnotics and Sedatives-Phenobarbitone, Pentobarbitone.

Opioid Analgesics-Pethidine, Methadone, Pentazocine.

Nonsteroidal anti-inflammatory agents – Aspirin, Mefenamic Acid, Ibuprofen, Diclofenac

3. CENTRAL NERVOUS SYSTEM-II

Neuroleptics – Imipramine, Amitriptyline.

Antidepressants – Meproamate, Chlordiazepoxide, Diazepam.

Antispasmodic and Antiulcer drugs-Dicyclomine, Ranitidine, Omeprazole.[8]

4. Antitussives-Cramiphen, Dextromethorphen.

Anticonvulsants-Phenytoin, Carbamazepine, Ethosuximide, Valproic Acid.

Antiparkinsonism drugs-Carbidopa, Levodopa.

CNS Stimulants-Caffeine, Nikethamide.

5. AUTOCOIDS:

Antihistaminics: (i) H₁ antagonists – Diphenhydramine, Promethazine, Cyproheptadine, Cetirizine.

(ii) H₂ antagonists – Ranitidine, Famotidine.

(iii) 5-HT, 5HT-antagonist, Angiotensin antagonist, Prostaglandin-Mesoprostol, Carboprost.

PHR-651

MEDICINAL CHEMISTRY-I
(*PHARMACEUTICAL CHEMISTRY-VI*)LAB

Synthesis of selected drugs from the course content involving two steps.

Characterization of the synthesized medicinal compounds by TLC & melting point.

SUGGESTED PRACTICALS:

1. Synthesis and characterize the Methyl salicylate.
2. Synthesis and characterize the Paracetamol.
3. Synthesis and characterize the Benzocaine.
4. Synthesis and characterize the Phenytoin.

5. Synthesis and characterize the Hydantoin.
6. Synthesis and characterize the Barbituric acid.

BOOKS RECOMMENDED:

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/Longman, London.
2. Furniss B A, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Pharmacopoeia of India, Minsitry of Health, Govt. of India.
4. Wolff ME. Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
5. Degado J.N. and Remers W A R, 10th eds., Wilson and Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott, William & Wilkins.
6. Foye W C. Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh Harkrishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.
8. Nogrady T, Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York, Oxford.
9. Finar I L. Organic Chemistry, Vol I & II, ELBS/ Longman, London.

PHR 602

PHARMACUTICAL TECHNOLOGY- II
(PHARMACEUTICS-X)

1. MICRO-ENCAPSULATION: Types of microcapsule, importance of micro encapsulation in pharmacy, micro encapsulation by phase separation, co-acervation, multi orifice, spray drying, spray congealing, polymerisation, complex, formulation, emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.
2. PARENTERAL PRODUCTS & OPHTHALMIC PREPARATIONS: Preformulation factors, routes of administration, water for injection, pyrogenicity, nonaqueous vehicles. Formulation details, containers and closures and their selection. Prefilling treatment, washing of containers and closures, preparation of solution and suspensions, filling and sealing of ampoules, vial, infusion fluids, lyophilization & preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products.
3. PHARMACEUTICAL AEROSOLS: Definition, Propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications
4. COSMETOLOGY AND COSMETIC PREPARATIONS: Structure of skin, formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, protective cream, antiperspirants, deodorant, face powder. Hair structure, Shampoos, Conditioner, Shaving and after shaving products, Dentrifice & Mouthwash, Lipstick, Nail lacquer.
5. BLOOD PRODUCTS AND PLASMA SUBSTITUTES : collection , processing & storage of whole blood plasma , concerated human RBCs, dried blood plasma , human fibrinogen , human thrombin, human normal immunoglobulin, human fibrin , foam plasma substitutes, ideal requirements , PVP, dextran etc for con troll of blood pressures.

PHR 652

PHARMACUTICAL TECHNOLOGY- II
(PHARMACEUTICS-X) LAB

Experiments baseds on above prescribed syllabi.

BOOKS RECOMMENDED:

1. Remington: The Science and Practice of Pharmacy Pharmaceutical Sciences Vol. I & III, Mack Publishing Company, U.S.A.
2. R.E. Avis, Pharmaceutical Dosage Forms: Parenteral Medication, Vo-I, Marcel Dekker-Inc, New York & Basel.
3. H.C. Ansel, Introduction to Pharmaceutical Dosage Forms, Lea & Febiger, Philadelphia, U.S.A.
4. R.C. Juliano, Drug Delivery Systems, Oxford University Press, Oxford.
5. Herbert A. Liebermann & Leon Lachman, Theory & Practice of Industrial Pharmacy, Lea & Febiger, Philadelphia, U.S.A.

SEMESTER -VI

PHR-603

PHARMACOLOGY-II

1. DRUGS ACTING ON CENTRAL NERVOUS SYSTEM: General anesthetics, alcohol, sedatives and hypnotics, central analgesics, antipyretics, NSAIDs and antigout, anticonvulsants, antipsychotics, antianxiety, antidepressant drugs, antiparkinsonism drugs, CNS stimulants
2. DRUGS USED IN OCULAR PHARMACOLOGY: mydriatics, miotic agents and drugs used in glaucoma.
3. DRUGS ACTING ON CVS: Cardiac glycosides and positive inotropic agents, antiarrhythmic drugs, antihypertensives, coronary vasodilators and antianginals, hypolipidemics and fibrinolytics.
4. DRUGS ACTING ON RESPIRATORY SYSTEM: Expectorants, Antitussive, Anti asthmatics, Drugs used in common cold
- 5 HAEMOPOITIC SYSTEM: Drugs acting on blood and blood forming agents, Coagulants, anticoagulants, Haematinics and plasma expanders.

PHR-653

PHARMACOLOGY-II LAB.

1. Stages of ether and chloroform anesthesia with and without premedication (demonstration)
2. The study of pentobarbitone induced hypnosis (demonstration)
3. Determination of analgesic activity.
4. Determination of anticonvulsant activity of drugs.
5. Determination of muscle relaxant activity of drugs.
6. Determination of anti-inflammatory activity of drugs.
7. Determination of CNS stimulant and depressant activity of drugs.
8. Study of local anesthetic activity.
9. Effect of drugs on ciliary movement.
10. Determination of Intra Ocular Pressure (IOP) in rabbits.

BOOKS RECOMMENDED:

1. K.D Tripathi, "Essentials of medical pharmacology".
2. D.R.Laurence and P.N.Bennett, "Clinical pharmacology".
3. R.S. Satoskar and S.D. Bhandarker, "Pharmacology and pharmacotherapeutics"
4. A. Goodman, R.W.T. Gilman, A.S.Nies and T.Palmer, "Goodman and Gilman's pharmacological basis of Therapeutics".
5. F.S.K. Barar, "Essentials of pharmacotherapeutics"
6. H.P. rang, M.M. Dale, J.M. Ritter, P.K. Mouse 5th ed. Pharmacology.

SEMESTER -VI

PHR-604

PHARMACOGNOSY-IV

1. Study of the biological sources, cultivation, collection, Commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containin glycoside:
Saponins: Liquorice, Ginseng, Dioscorea, Senega and Sarsaparilla.
Cardioactive sterols: Digitals, Squill, Stropanthus & Thevetia.
Anthraquinone glycosides: Aloe, Senna, Rhubarb & Cascara.
Others: Psoralea, Ammi majus, Ammi visnaga, Gentian, Saffron, Chirata, and Quassia.
2. Study of 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, Tylophora, Bhilwa, Kalijiri, Vach, Rasna
Punarnava, Chitrak, Apamarg, Gokhru, Shankhpushpi, Brahmi, Methi, Lehsun, Palash, Guggul, Gymnema, Shilajit, Tulsi, Nagarmotha, Majith, Malkanguni and Neem.
3. Introduction and principals of Ayurvedic, Unani, Sidha and Homeopathic system of medicine.
4. Introduction to Ayurvedic dosages form: preparations and standardization of Ayurvedic preparations such as Aristas, Asvas, Gutika, Tailas, Churnas, Lehyas and Bhasnas.

PHR-654

PHARMACOGNOSY-IV LAB.

1. Identification of crude drugs listed in theory.
2. Microscopic study of some important glycoside containing drugs as outlined above, Study of powdered drugs.
3. Standardization of some traditional drug formulations.
4. Project: Tour and submission of tour report.

BOOKS RECOMMENDED:

1. Kokate C.K. "Practical Pharmacognosy" Vallabh Prakashan, New Delhi.
2. Wallis T.E. "Analytical Microscopy" J&A Churchill Ltd., London.
3. Trease, G.E., & Evans, W.C., Evans, W.C., "Pharmacognosy" Bailliere Tindall east Baorne, U.K.
4. Tyler V.E. et al : "Pharmacognosy" Lea & Febiger, Philadelphia.
5. Wallis. T.E. "Text Book of Pharmacognosy" J&A Churchill Ltd. London.
6. Kokate C.K. et al "Pharmacognosy" Nirali Prakashan, Pune.
7. Medicinal plants of India I&II, Indian council of Medical Reasearch, New Delhi.
8. Nadkarni A.K. Indian Materia Medica 1-2, Popular Prakashan (P) Ltd. Bombay.
9. Atal C.K. & Kapur BM. "Cultivation & utilization of Medicinal plants, RRL, Jammu.
10. Indian Herbal Pharmacopoeia, vol. I&II, ICMR & RRL, Jammu.
11. The wealth of India, Raw Materials (All volumes) Council of Scientific & Industrial Research, New Delhi.
12. Compendium of Indian Medicinal Plants I-IV, Rastogi & Malhotra.
13. Indian Ayurvedic Pharmacopoeia, Govt. of India.
14. Kokate CK, Gokhale AS, Gokhale SB, Cultivation of Medicinal Plants, Nirali Prakashan.

PHR-605

*CLINICAL PHARMACY
(PHARMACEUTICS-XI)*

1. Development and scope of clinical pharmacy, concept of health care team, role of clinical pharmacist as a member of health care team, functions of clinical pharmacist.
2. Medication History: Interviewing the patients, recording medication history, patient medication profile, self medication and non prescription drug usage, factors associated with it.
3. Patient compliance: type of compliance, non compliance and factors associated with it, methods to improve compliance including compliance aids.
4. Patient counseling and education: techniques and methods used.
5. Drugs used in infancy, elderly (pediatrics and geriatrics) and pregnancy.
6. Drug interactions; mechanism of drug interaction, types, methods of minimizing clinically relevant drug interactions.
7. Adverse drug reaction, types, monitoring and prevention of A.D.R.
8. General principles of clinical toxicology.
9. Therapeutic drug monitoring.
10. Interpretation of clinical laboratory tests.
11. Drug information services: source of information, computerized services, retrieval of information, setting up a drug information centre.

BOOKS RECOMMENDED:

1. R. Walker, Clinical Pharmacy and therapeutics, 2nd ed, Churchill Livingstone, N.Y. 1999.
2. D.H. Lawson, Clinical Pharmacy and Hospital Management, 1st ed. Chapman Hall, N.Y. 1980.
3. A.J. Winfield & R.M.E. Richards. Pharmaceutical practice; 2nd ed. Churchill Livingstone, N.Y. 1999.
4. W.E. Hassan, Hospital Pharmacy, 3rd ed, Lea and Fiebiger, Philadelphia, USA 1974.
5. A.R. Gennaro, Remington's the science and practice of Pharmacy vol. I & II, 20th ed. Lippincott William and Wilkins, Philadelphia, N.Y. 2000.
6. R.K. Goyal, P.A. Bhatt, M.D. Burande, 1st ed. 2003-04, B.S. Shah Prakashan, Ahemdabad.

B.PHARM. IV YEAR

SEMESTER-VII

PHR-701

**BIOPHARMACEUTICS & PHARMACOKINETICS
(PHARMACEUTICS –XIV)**

UNIT-1

1. Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation, development and clinical setting.
Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
Factors influencing absorption – Physicochemical, physiological and pharmaceutical.
Drug distribution in the body, plasma protein binding.

UNIT-2

2. Pharmacokinetics:
Significance of plasma drug concentration measurement.
Compartment model and Non-compartment model. Definition and Scope.
Pharmacokinetics of drug absorption – zero order and first order absorption rate constant using Wagner – Nelson, Loo-Reigelman method.

UNIT-3

3. 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

UNIT-4

4. Dosage adjustment in patients with and without renal and hepatic failure.
Pharmacokinetic drug interactions and their significance in combination therapy.

UNIT-5

5. Bioavailability and Bioequivalence :
Review of Measures of bioavailability, C-max, and area under the curve (AUC).
regulatory requirements for conduction of bioequivalent studies.

PHR 751

**BIOPHARMACEUTICS & PHARMACOKINETICS
(PHARMACEUTICS-XIV)LAB.**

Experiments designed for the estimation of various pharmacokinetic parameters with given data.
In vitro evaluation of different dosage forms for drug release.
Absorption studies – in vitro.
Statistical treatment of pharmaceutical data.

SUGGESTED PRACTICALS:

1. In-vitro drug release study of the given powder dosage form using various dissolution media.
2. In-vitro drug release study of the given uncoated tablet dosage form using different dissolution media.

3. In-vitro drug release study of the given capsule dosage form using various dissolution media.
4. In-vitro drug release study of the given film coated dosage form using various dissolution media.
5. In-vitro dissolution study of the given sustained release dosage form.
6. In-vitro dissolution study of the given fast release (M.D, Dispersible etc.) dosage form.
7. To study the effect of hardness of tablet on dissolution rate.
8. To study the effect of various diluents on dissolution rate of dosage form (Tablets, Capsules, Ointment etc.).
9. To study the effect of formulation on drug release (powder, suspension etc.).
10. To determine the % protein binding of the given drugs.
11. To determine the effect of protein binding on drug bioavailability.
12. To calculate various Pharmacokinetic parameters from the given zero order drug release data.
13. To calculate various Pharmacokinetic parameters from the given first order drug release data.
14. To calculate the various Pharmacokinetic parameters from the given blood data of I.V bolus injection (one compartment model).
15. To calculate various Pharmacokinetic parameters from the given urinary excretion data of I.V bolus.injection using both methods (Rate of elimination & sigma minus method one compartment model).
16. To study the in- vitro drug- drug interaction.
17. To study the passive diffusion of the given drug using cellophane membrane.
18. To study the passive diffusion of the given drug using egg or goat membrane.
19. To determine the various Pharmacokinetic parameters from the given blood data of oral administration of dosge form.

20. DEMONSTRATION EXPERIMENTS

- a) Dissolution Apparatus.
- b) Preparation of Buffers & membranes.
- c) Use of semilog paper.
- d) Operation of colorimeter & U.V spectrophotometer.

BOOKS RECOMMENDED:

1. Notari, R.E, Biopharmaceutics and Pharmacokinetics – An introduction Marcel Dekker Inc. N.Y.
2. Rowland M, and Tozer T.N. Clinical Pharmacokinetics, Lea and Febriger, N.Y.
3. Wagner J.G. Fundamentals of Clinical Pharmacokinetics, Drugs Intelligence Publishers, Hamilton.
4. Wagner J.G. Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A.G. Basel, Switzerland.

PHR-702

MEDICINAL CHEMISTRY-II
(PHARMACEUTICAL CHEMISTRY-VII)

Classification, Synthesis, Structure activity relationships, mechanism of action and Medicinal uses of the following classes of drugs (Synthetic procedures of individually mentioned drugs only)

UNIT-1

1. **CARDIOVASCULAR AGENTS:** Antianginal & vasodilators, antiarrhythmics, antihypertensives, anticoagulants, antihyperlipidemics & cardiotonics – Nifedipine, Procainamide, Propranolol, Methyldopa, Captopril, Clofibrate, Warfarin, Phenidione.

UNIT-2

2. **DIURETICS:** Acetazolamide, Chlorthiazide; Frusemide, Spironolactone.

UNIT-3

3. **HORMONES RELATED DRUGS:** Thyroid and Antithyroids – Carbimazole, Levothyroxine, Propylthiouracil, Methimazole. Insulin & Oral Hypoglycaemics – Chlorpropamide, Phenformin, Tolbutamide, Glybenclamide.

UNIT-4

4. **STEROIDS AND RELATED DRUGS:**
Introduction, Classification, Nomenclature & Stereochemistry.
 - a) Androgens and Anabolic steroids – Testosterone, Stanozolol.
 - b) Estrogens and Progestational agents – Progesterone, Estradiol.
 - c) Adrenocorticoids – Prednisolone, Dexamethasone, Betamethasone.

UNIT-5

5. **ANTINEOPLASTIC AGENTS:** Alkylating agents, folic acid antagonist, natural anticancer agents, Cisplatin, Chlorambucil, 5- Fluorouracil, methotrexate, cytophosphamide, busulphan

PHR-752 MEDICINAL CHEMISTRY-II
(PHARMACEUTICAL CHEMISTRY-VII) LAB.

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

BOOKS RECOMMENDED:

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.

2. Furniss B S, Hannaford A J, Smith P W G and Tathell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Pharmacopoeia of India, Ministry of Health, Govt. of India.
4. Wolff ME, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
5. Delgado J N and Remers W A R, Eds., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
6. Foye W C, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh Harkishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.

SEMESTER-VII

PHR-703

PHARMACOLOGY-III

UNIT-1

1. DRUGS ACTING ON GIT: Carminatives, Antacids and treatment of peptic ulcer, Purgatives and laxatives, Antidiarrhoal drugs, Emetics and antiemetics, Digestants

UNIT-2

2. DIURETICS:
Classification, mechanism of action, adverse effect and therapeutic uses of diuretics

UNIT-3

3. PHARMACOLOGY OF ENDOCRINE SYSTEM: Pituitary hormones, Thyroid- anti thyroid drugs
Insulin, ant diabetic drugs, Adrenocortical steroids and their antagonists, Sex hormones, contraceptives and drugs used in infertility, Drugs regulating calcium homeostasis, Oxytocic.

UNIT-4

4. AUTOIMMUNE DISEASES: Pharmacological immunosuppressant, immuno-enhancers and immuno-modulators.

UNIT-5

5. BIOASSAYS: General principles and methods of bioassays. Official methods and bioassay of Insulin, Oxytocin, d-tubocurarine, Heparin, Digitalis, Histamine, Adrenaline & Acetyl Choline.

PHR-753

PHARMACOLOGY-III LAB.

Bioassay of followings by different methods using appropriate isolated tissue preparation:
Acetylcholine, Histamine, Adrenaline, Oxytocin, LD50 determination in mice, Bioassay of Antagonists Determination of PA_2 value.

BOOKS RECOMMENDED:

1. K.D Tripathi, "Essentials of medical pharmacology".
2. D.R.Laurence and P.N.Bennett, "Clinical pharmacology".
3. R.S. Satoskar and S.D. Bhandarker, "Pharmacology and pharmacotherapeutics"

4. A. Goodman, R.W.T. Gilman, A.S.Nies and T.Palmer, "Goodman and Gilman's pharmacological basis of Therapeutics".
5. F.S.K. Barar, "Essentials of pharmacotherapeutics"
6. H.P. rang, M.M. Dale, J.M. Ritter, P.K. Mouse 5th ed. Pharmacology.

SEMESTER-VII

PHR-704

PHARMACOGNOSY-V

UNIT-I.

1. World wide trade in medicinal plants and derived products with special reference to diosgenin, taxol, digitalis, tropane alkaloids containing plants, papain, cinchona, ipecac, liquorice, ginseng, aloe, valerian, Rauwolfia and plants containing laxatives.
2. Utilization and production of phytoconstituents such as quinine, morphine, Reserpine, Sennosides, Digitalis glycosides, Diosgenin and Atropine.

UNIT-2

3. Utilization and production of aromatic plants and derived products with special reference to sandalwood oil, menthe oil, lemongrass oil, vetiver oil, geranium oil, and eucalyptis oil.
4. An introduction to tissue culture and its scope in production of phytopharmaceuticals, application, types of tissue culture, nutritional requirements, growth and maintenance.

UNIT-3

5. Chemotaxonomy of medicinal plants.
6. Marine Pharmacognosy, novel medicinal agents from marine sources.

UNIT-4

7. Mushroom: Introduction, classification, morphology and cultivation of mushroom. Mushroom medicinals.
8. An overview of plants as Photosensitizing agents and anti-tumor.

UNIT-5

9. Plants against free radicals and as antioxidants. Herbs as Health foods and concept of nutraceuticals.
10. Herbal cosmetics.

PHR-754

PHARMACOGNOSY-V LAB

1. Extraction and Isolation of some important phyto constituent mentioned in the theory.
2. Extractions of volatile oil and their chromatographic profile.
3. Chromatographic studies of some important phytoconstituent.

BOOKS RECOMMENDED:

1. Scheuer, P.J., Marine Natural Products. Academic Press, London.
2. Swain, T. Chemical Plant Taxonomy Academic Press, London.
3. Reinert, J & Bajaj, Y.P.S. Applied and Fundamental aspects of plants cell, tissue and organ culture Berlin.
4. Atal C.K. and Kapoor, B.M. cultivation and utilization of medicinal plants. R.R.L. Jammu.
5. Barz, W., Reinhard, E. and Zerk, M.H. plant tissue culture and its Biotechnological application. Springer, Berlin.
6. Chadha, K.L. and Gupta, R. advance in horticulture vol. II medicinal and aromatic plants. Malhotra publishing house, New Delhi.
7. Export potential of selected medicinal plants; prepared by basic chemicals, pharmaceuticals and cosmetic export promotion council, Mumbai and other reports.
8. Trease, G.E. and Evasn W.C. Pharmacognosy. Baillier, Tindall, Eastbourne, U.K.
9. Kokate, C.K., Purohit, A.P. and Gokhale, Pharmacognosy, Nirali Prakashan, Pune.
10. Tyler, V.C., Brady, L.R., and Robers, Pharmacognosy, Lea and Febiger, Philadelphia.

11. Kalia, A.N. Textbook of Industrial Pharmacognosy, CBS Publishers and Distributors, New Delhi.
12. Vyas and Dixit, Biotechnology, CBS Publishers New Delhi
13. Dewick, P.M, (2002) Medicinal Natural Products (II edition), John Wiley and Sons, Chichester.

PHR-705

*PHARMACEUTICAL MANAGEMENT
(PHARMACEUTICS-XIII)*

UNIT-1

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

UNIT-2

2. DRUG REGULATORY AFFAIRS : Definitions, procedure of export & import of drug.

UNIT-3

3. PHARMACEUTICAL MARKETING : Functions, buying, selling, transportation, storage financed feedback information, channels of distribution, wholesale, retail, department store, multiple shop and mail order business.

UNIT-4

4. SALESMANSHIP: Principle of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, Recruitment, training, evaluation , compensation to the pharmacist.
5. MARKET RESEARCH: Measuring & Forecasting Market Demand - Major concept in demand measurement, Estimating current demand Geo-demo-graphic analysis. Estimating industry sales, Market share and future demand. Market segmentation & Market targeting.

UNIT-5

6. MATERIALS MANAGEMENT: A brief exposure of basic principles of management major areas, scope, purchase, stores, inventory control and evaluation of materials management.
7. PRODUCTION MANAGEMENT : A brief exposure of the different aspects of Production Management – Visible and Invisible inputs, Methodology of Activities Performance Evaluation Technique Process – Flow, Process Know-how, Maintenance Management.

BOOKS RECOMMENDED:

1. Beri, Market Research – Tata Mc Graw Hill
2. Chary S.N, Production and Operative Management / Tata Mc Graw Hill.
3. Datta A.K., Material Management / PHI.
4. Chadwick Leslie, The essence of management accounting / PHI.
5. Massie L. Joseph Essentials of Management / PHI.
6. Barthwal R.R, Industrial Economics – / New Age International.
7. Shreenivasan K.R., An Introduction to Industrial Management –/ Vikas.
8. Daver Rustam S. Salesmanship and Publicity –/ Vikas.
9. Mukopadhyay Sekhar, Pharmaceutical Selling, Sterling Publishers.
10. Koontz H, Weihrich H, Essentials of Management, Tata Mc Graw Hill.
11. Vidya sagar Pharmaceutical Industrial Management, Pharma Book Syndicate

SEMESTER-VIII

PHR-801

**MEDICINAL CHEMISTRY-III
(PHARMACEUTICAL CHEMISTRY-VIII)**

Classification, Synthesis, Structure activity relationships, mechanism of action and Medicinal uses of the following classes of drugs (Synthetic procedures of individually mentioned drugs only)

UNIT-1

1. **PHYSICOCHEMICAL PROPERTIES & BIOLOGICAL ACTIVITY:** Complex of events between drug administration and drug action-influence of route of administration, Meyer-Overton Concept, Structure of membrane, Absorption from stomach, intestine and eyes, Protein binding, Neutral fat, Penetration of drugs into tissue cells, solubility & Partition coefficients, Drug receptors and Stereochemical aspects of drug receptor interactions-steric features of drugs, Structural rigidity, Geometric isomers, Conformational isomers, Conformational flexibility and multiple modes of action, Optical isomerism and biological activity. Isosterism and bioisosterism. Selected physico-chemical properties: ionization, H-bonding, redox reactions and complex formation in relation to the biological activity. Introduction to QSAR and Computer aided Drug design

UNIT-2

2. **ANTIBACTERIALS:** Sulphonamides-Sulphamethoxazole, Sulphadiazine, Sulphacetamide, Nalidixic acid.

UNIT-3

3. **ANTIBIOTICS:** Penicillins, Semi-synthetic penicillins, cephalosporins aminoglycosides, macrolides, tetracyclines, chloramphenicol, Fluroquinolones.

UNIT-4

- 4a. **ANTIMYCOBACTERIAL:** PAS, Ethambutol, Isoniazid, Dapsone
- 4b. **ANTIVIRAL AGENTS:** Antivirals – Amantadine, Acyclovir.
Anti – HIV agents .

UNIT-5

5. **ANTISEPTICS & DISINFECTANTS, ANTIFUNGALS (Ketoconazole) AND ANTIPROTOZOALS**
Antimalarials Choloquine, Primaquine, Pyrimethamine

Antiamoebics: Metronidazole, Tinidazole, Diloxanide Antilishmanic drugs, Antitrypanosomal drugs.
Anthelmintics- Mebendazole

BOOKS RECOMMENDED:

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.
2. Furniss B S, Hannaford A J, Smith P W G and Tathell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Pharmacopoeia of India, Ministry of Health, Govt. of India.
4. Wolff ME, Ed. Burger's Medicinal Chemistry, John Wiley & Sons, New York.
5. Delgado J N and Remers W A R, Eds., Wilson And Gisworld's Text book of Organic Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
6. Foye W C, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.
7. Singh Harkishan and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.

PHR-802

PHARMACEUTICAL BIOTECHNOLOGY

Unit-I : Immunology and Immunological preparations :

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

Unit-II : Genetic Recombination

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

Unit-III : Antibiotics :

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

Unit-IV : Microbial 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-V : Enzyme immobilization :

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

BOOKS RECOMMENDED :

1. S.P. Vyas and V.K. Dixit, Pharmaceutical Biotechnology, CBS Publication, New Delhi.
2. Prescott and Dunn's Industrial Microbiology, 4th Ed, 1987, CBS Publishers and Distributors, Delhi.
3. P.F. Stanbury & A. Ahhtar Principles of Fermentation Technology.
3. K. Kieslich Ed. Biotechnology Vol. 69 Verlag Chemie Switzerland 1984.
4. P.F. Standury & A. Whitaker & Hall S.J. Principles of Fermentation, Aditya Book Private Limited, New Delhi.
5. Crueger W. & Crueger A, Biotechnology-A Textbook of Industrial Microbiology, Panima Publishing Corporation, Delhi.

SEMESTER-VIII

PHR-803

PHARMACOLOGY-IV

UNIT-1

1. CHEMOTHERAPY

General principles of chemotherapy

Sulphonamides, quinolones, penicillins, cephalosporins, aminoglycosides, tetracyclines, chloramphenicol and macrolides. Anti-malarial, Antiamoebics, Antileishmaniasis, Antitrypanosoma,

UNIT-2

2. Anthelmintics, Antifungal and Antiviral & Drugs used for the treatment of AIDS.

UNIT-3

3. Chemotherapy of tuberculosis and leprosy, Urinary antiseptics,

UNIT-4

4. POISONING

General methods for the treatment of poisoning

Symptoms and management of heavy metal poisoning (lead, mercury, copper, arsenic and iron) and drugs (morphine and their derivatives, salicylates, barbiturates, benzodiazepines, organophosphates and alcohols)

UNIT-5

5. EVALUATION OF NEW DRUGS

Preclinical and clinical study (acute, sub acute and chronic toxicity tests)

Teratogenicity, Carcinogenicity, Clinical trials

BOOKS RECOMMENDED:

1. K.D Tripathi, "Essentials of medical pharmacology".
2. D.R.Laurence and P.N.Bennett, "Clinical pharmacology".
3. R.S. Satoskar and S.D. Bhandarker, "Pharmacology and pharmacotherapeutics"
4. A. Goodman, R.W.T. Gilman, A.S.Nies and T.Palmer, "Goodman and Gilman's pharmacological basis of Therapeutics".
5. F.S.K. Barar, "Essentials of pharmacotherapeutics"
6. H.P. Rang, M.M. Dale, J.M. Ritter, P.K. Mouse 5th ed. Pharmacology.

PHR-804

PHARMACEUTICAL ANALYSIS-III

UNIT-1

1. Theory, Instrumentation and Applications of Ultraviolet and Visible Spectrophotometry, Fluorimetry, Infrared Absorption Spectroscopy.

UNIT-2

2. NUCLEAR MAGNETIC SPECTROSCOPY:
An introduction to the theory of $^1\text{H-NMR}$, chemical shift & spin-spin coupling, shielding & deshielding, applications.

UNIT-3

3. Mass Spectrometry:
Introduction to mass spectra, instrumentation, applications, fragmentation pattern of some simple compounds e.g. Cyclohexane, Toluene, Phenol.

UNIT-4

4. Chromatographic Techniques involving adsorption and partition principles:
 - a) Paper Chromatography
 - b) Thin Layer Chromatography (TLC)
 - c) Column Chromatography

UNIT-5

5. Basic principles, Instrumentation and Applications of Gas Liquid Chromatography (GLC) and High Performance Liquid Chromatography (HPLC).

PHR-851

PHARMACEUTICAL ANALYSIS-III LAB.

1. Assay of Official formulation containing single and more active ingredients using instrumental techniques.
2. Exercises involving Paper and Thin Layer Chromatographic Technique.

BOOKS RECOMMENDED:

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Beckett, A H and Stenlake, J.B, Practical Pharmaceutical Chemistry, Vol I and II, The Athlone Press of the University of London.
3. Chatten L.G. A text book of Pharmaceutical Chemistry Vol I and II Marcel, Dekker, New York.
4. Willard H.H. and Merrit L. Jr and Dean J.A., Instrumental methods of analysis Van Nostrand Renhold, New York.
5. Obonson J.W.R. Undergraduate Instrumental Analysis, Marcel Dekker Inc, New York, 1970.
6. Parikh V.H. Absorption Spectroscopy of Organic Molecules Addison-Wesley Publishing Co., London 1974.
7. Silver stein RM & Webster FX, Spectrometric Identification of Organic Compounds, John Wiley & Sons.
8. Skoog V, Principles of Instrumental Analysis, Holler-Neimen.

SEMESTER-VIII

PHR-805(a-e)

ELECTIVE

PHR-852(a-e)

PROJECT REPORT ON ELECTIVE PHR-805 (a-e)

PHR-805 a

NOVEL DRUG DELIVERY SYSTEM

Unit-I

1. Theory of controlled release drug delivery systems.
2. Release and diffusion of drugs from C.D.D.S., General methods of design and evaluation of C.D.D.S. [08]

Unit-II

3. Transdermal drug delivery systems: Theory, formulation and evaluation, lonotophoresis, sonophoresis and magnetophoresis [08]

Unit-III

4. Targeted Drug delivery systems: Concept of drug targeting, importance in therapeutics, methods in drug targeting, liposomes, nanoparticles, , and Solid lipid nanoparticles [08]

Unit-IV

5. Novel drug delivery systems. Introduction, concept, design, evaluation and application to osmotic pumps, nasal, ocular delivery and Parenteral controlled drug delivery system. [08]

Unit-V

6. Novel drug delivery systems. Introduction, concept, design, evaluation and application to trans-mucosal, buccal and trans-ungual drug delivery system.

BOOKS RECOMMENDED

1. Julian, Drug Delivery Systems.
2. Robinson and Vincent, Controlled Drug Delivery.
3. Robinson, Sustained and Controlled Drug Delivery Systems.
4. Noxon, Microencapsulation.
5. Chien, Novel Drug Delivery Systems.
6. Lisbeth, Illum & Davis, Polymers in Controlled Drug Delivery.
7. Targeted drug delivery by N.K. Jain and Roop.K. Khar

PHR-805b

STANDARDISATION OF HERBAL DRUGS

Unit I Quality Control and Standardization

Extractive values, ash values, chromatographic techniques (TLC, HPTLC and HPLC) for determination of chromatographic markers, spectroscopic techniques and assay methods. Determination of heavy metals in herbal preparations and alcohol content in Aristas and Bhasamas.

Quality control and rational use of herbal drugs as per WHO guidelines. (8 Hours)

Unit II Herbal formulation

Principle involved in Ayurveda, Sidha, Unani, Chinese and Homeopathic systems of medicines, preparation of Ayurvedic formulations like Aristas, Asava, Ghutika, Tailia, Churna, Avaleha, Gritha and Bhasams; Unani formulations like Majooms and Safoofs. (8 Hours)

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. (8 Hours)

Unit IV Traditional herbal drugs

Common names, sources, active constituents and uses of:

Punarnava (*Boerhavia diffusa*), Shankpushpi (*Convolvulus microphylla*), Lehsun (*Allium sativum*), Guggul (*Commiphora mukul*), Kalmegh (*Andrographis paniculata*), Tulsi (*Ocimum sanctum*), Valerian (*Valerian officinalis*), Artemisia (*Artemisia annua*), Chirata (*Swertia chirata*), Asoka (*Saraca indica*), Saffron (*Corcus sativa*), Shilajit, Bhrami (*Bacopa monnieri* and *Centalla asiatica*), Salai (*Boswellia serrata*), Giloe (*Tinospora cordifolia*) (8 Hours)

Unit-V -General methods of screening of natural products for following biological activity:

- a) Anti-inflammatory b) Hypoglycaemic c) Antibacterial
- d) Antifertility e) Psychopharmacological (8 Hours)

BOOK RECOMMENDED

1. Trease, G.E. Evans W.C.,. Pharmacognosy ELBS.
2. Tyler Varro. E., Brady Lynn. R. Robbers J.E. Pharmacognosy
3. Wallis T.E..Text book of Pharmacognosy
4. Harborne Phytochemical methods of chemical analysis.
5. Pharmacoepl standards for Ayurvedic formulations CCRAS, Delhi.

PHR-805c

ADVANCED PHARMACOLOGY AND PHARMACOTHERAPEUTICS**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

1.2 **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 (ADP-ribose) polymerase (PARP), Peroxisome proliferator activator receptors (PPAR)- α and γ , AMP activated protein kinases, Protein kinases, Phosphodiesterases

UNIT 3 Pharmacological Techniques to Evaluate the following Class of Drugs

- 3.1 Antiepileptics
- 3.2 Antianxiety agents and drugs used in mood and sleep disorders
- 3.3 Antipsychotics
- 3.4 Drugs affecting memory
- 3.5 Skeletal muscle relaxants and neuromuscular blockers
- 3.6 Antidiabetic agents
- 3.7 Analgesics and drugs used in arthritis and neuropathic pain.
- 3.8 Anti-inflammatory agents
- 3.9 Antiulcer agents
- 3.10 Hepatoprotective agents

UNIT 4 Pharmacotherapeutics

Etiopathogenesis and pharmacotherapy of diseases associated with following systems/diseases:

- 4.1 Cardiovascular System: Hypertension, Congestive cardiac failure, Angina pectoris, Myocardial infarction, hyperlipidemia, Arrhythmias.
- 4.2 Endocrine System: Diabetes, Thyroid diseases, Oral contraception, HRT osteoporosis.
- 4.3 Infection Diseases: Tuberculosis, HIV and related opportunistic infections, malaria, amoebiasis, helminthiasis, leprosy.

- 4.4 Psychiatric Disorder: Anxiety, Alzheimer's diseases, mood & sleep disorder, schizophrenia.
- 4.5 Neurological disorder: Epilepsy, Parkinson, myasthenia gravis, migraine.

UNIT 5 Stem cell therapeutics

- 5.1 Biology of stem cells.
- 5.2 Potentials of stem cell in various disorders.
- 5.3 Ethical Issues.

BOOKS RECOMMENDED

1. M.N.Ghosh, Fundamentals of Experimental Pharmacology, 2nd & 3rd edition, Scientific Book Agency, Calcutta, India, 1984, 2005.
2. Edinburg University Pharmacology Staff (ed.) Pharmacological Experiments on Isolated Preparations, Livingstone, UK
3. H.G.Vogel (ed), Drug Discovery and Evaluation-Pharmacological Assays, Springer Verlag, Berlin, Germany, 2002.
4. H.G.Vogel (ed), Drug Discovery and Evaluation-Pharmacological Assays, 2nd edition, Springer Verlag, Berlin, Germany, 2002.
5. D.R.Laurence and A.L.Bacharach (eds), Evaluation of Drug Activities: Pharmacometrics, Vol. 1 and 2, Academic Press, London, U.K., 1964.
6. David R. Gross, Animal Models in Cardiovascular Research, 2nd edition, Kluwer Academic Publishers, London, U.K., 1994.
7. J.T. Dipiro, R.L. Talbert, G.C.Yee, G.R.Matzke, B.G.Wells, L.Michael Posey (eds.), Pharmacotherapy: A Pathophysiologic Approach, 6th ed., The McGraw Hill Companies, Inc., 2005.
8. E.T.Herfindal and D.R.Gourley, Text Book of Therapeutics: Drug and Disease Management, 7th ed., Lippincott Williams & Wilkins, USA, 2000.
9. T.M Speight and NHG Holford (ed.), Avery's Drug Treatment: Principals and Practice of Clinical Pharmacology and Therapeutics, 4th ed., ADIS Press, Sydney, Australia, 1997.
10. Dennis L. Kasper, Eugene Braunwald, Anthony S. Fauci, Stephen L. Hauser, Dan L. Longo, J. Larry Jameson, and Kurt J. Isselbacher, (eds.), Harrison's Principles of Internal Medicine, 16th ed., The McGraw Hill Companies, Inc., 2004.

PHR-805d

QUALITY ASSURANCE & VALIDATION

Unit-I

1. Requirements of GMP, CGMP1, GLP, USFDA, WHO guidelines and ISO 9000 series. [08]

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Unit-II

2. Documentation- Protocols, Forms and maintenance of records in Pharmaceutical industry.

3. Preparation of documents for new drug approval and export registration. [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

5. Concepts in validation, validation of manufacturing and analytical equipment, Process validation in manufacturing dosage formulations, applications of process validation.

Unit-V

6. In process quality control tests, IPQC problems in pharmaceutical industries.

7. Sampling plans, Sampling and operating characteristics curves. [08]

BOOKS RECOMMENDED:

1. Willing, Tuckerman and Hitchings, Good Manufacturing Practices for Pharmaceuticals.

2. OPPI, Quality Assurance.

3. Loftus and Nash, Pharmaceutical Process Validation.

4. Florey, Analytical Profile of Drugs (All volumes).

5. Indian Pharmacopoeia.

6. United States Pharmacopoeia.

7. British Pharmacopoeia.

8. Garfield, Quality Assurance Principles for Analytical Laboratories.

PHR-805e

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

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

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

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

BOOKS RECOMMENDED

1. Smith, Mickey C, “Principles of pharmaceutical marketing”, CBS Publishers & Distributors.
2. Kotler, Philip “Marketing Management”. Pearson Education Asia.