

COURSES OF STUDY AND SCHEME OF EXAMINATION OF B. PHARM. W.E.F. 2011-12

Name of the Programme			Bachelor of Pharmacy
Program Core (PC)	Qualifying Elective (QE)	Open Elective (OE)	Total Credits
200	--	--	200

I Year B.Pharm.

Semester I					
S.No.	Course No.	Subjects	Title	Teaching Hours/Week	
				L – T – P	Credits
1	BPL 111	PHARMACEUTICAL CHEMISTRY- I (Pharmaceutical Analysis-I)	PC	3 – 0 – 4	5.0
2	BPL 112	PHARMACEUTICAL CHEMISTRY - II (Pharmaceutical Inorganic Chemistry)	PC	3 – 0 – 4	5.0
3	BPL 113	PHARMACEUTICS – I (Dispensing & Hospital Pharmacy)	PC	4 – 0 – 4	6.0
4	BPL 114	PHARMACEUTICS - II (General Pharmacy)	PC	3 – 0 – 4	5.0
5	BPL 115	REMEDIAL BIOLOGY / REMEDIAL MATHS (For candidates who have not studied Maths/Biology accordingly)	PC	3 – 0 – 2 4 – 0 – 0	4.0
Total Credits:					25
Semester II					
1	BPL 121	PHARMACEUTICAL CHEMISTRY- III (Pharmaceutical Organic Chemistry-I)	PC	4 – 0 – 4	6.0
2	BPL 122	PHARMACEUTICAL CHEMISTRY- IV (Physical Chemistry)	PC	3 – 0 – 4	5.0
3	BPL 123	PHARMACOGNOSY-I	PC	4 – 0 – 4	6.0
4	BPL124	PHARMACOLOGY-I (Anatomy, Physiology & Health Education-1)	PC	3 – 0 – 4	5.0
5	BPL125	PHARMACEUTICAL MATHEMATICS	PC	3 – 0 – 0	3.0
Total Credits:					25

II Year B.Pharm.

Semester III					
1	BPL 231	PHARMACEUTICAL CHEMISTRY – V (Pharmaceutical Organic Chemistry-II)	PC	4 – 0 – 4	6.0
2	BPL 232	PHARMACEUTICS-III (Pharmaceutical Engineering-I)	PC	3– 0 – 0	3.0
3	BPL 233	PHARMACOGNOSY-II	PC	3 – 0 – 4	5.0
4	BPL 234	PHARMACOLOGY-II (Anatomy, Physiology & Health Education-II)	PC	3 – 0 – 4	5.0
5	BPL 235	COMPUTER SCIENCE	PC	4 – 0 – 4	6.0
		Total Credits:			25
Semester IV					
1	BPL 241	PHARMACEUTICAL CHEMISTRY - VI (Pharmaceutical Analysis -II)	PC	4 – 0 – 4	6.0
2	BPL 242	PHARMACEUTICS-IV (Pharmaceutical Microbiology)	PC	4 – 0 – 4	6.0
2	BPL 243	PHARMACOGNOSY-III	PC	4 – 0 – 4	6.0
4	BPL 244	PHARMACEUTICS-V (Forensic Pharmacy)	PC	3 – 0 – 0	3.0
5	BPL 245	PHARMACOLOGY-III (Pathophysiology of common diseases)	PC	4 - 0- 0	4.0
		ENVIORNMENT STUDIES	QE		
		Total Credits:			25

III Year B.Pharm

Semester V					
S.No.	Course No.	Subjects	Title	Teaching Hours/Week	
				L – T – P	Credits
1	BPL 351	PHARMACEUTICAL CHEMISTRY-VII (Pharmaceutical Biochemistry)	PC	3 – 0 – 4	5.0
2	BPL 352	PHARMACEUTICS -VI (Physical Pharmacy)	PC	3 – 0 – 4	5.0
3	BPL 353	PHARMACEUTICS-VII (Pharmaceutical Engineering-II)	PC	3 – 0 – 4	5.0
4	BPL 354	PHARMACOGNOSY-IV	PC	3 – 0 – 4	5.0
5	BPL 355	PHARMACOLOGY-IV	PC	3 – 0 – 4	5.0
		Total Credits:			25
Semester VI					
1	BPL 361	PHARM. CHEMISTRY-VIII (Medicinal Chemistry- I)	PC	4 – 0 – 4	6.0
2	BPL 362	PHARMACEUTICS-VIII (Dosage Form Design)	PC	4 – 2 – 4	7.0
3	BPL 363	PHARMACOGNOSY-V (Chemistry of Natural Products)	PC	4 – 0 – 4	6.0
4	BPL 364	PHARMACOLOGY- V	PC	4 – 0 – 4	6.0
		Total Credits:			25

IV Year B.Pharm.

Semester VII					
1	BPL 471	PHARMACEUTICS-IX (Biopharmaceutics & Pharmacokinetics)	PC	4 – 2 – 4	7.0
2	BPL 472	PHARMACEUTICAL CHEMISTRY-IX (Medicinal Chemistry-II)	PC	4 – 0 – 4	6.0
3	BPL 473	PHARMACEUTICS-X (Packaging Technology)	PC	3 – 0 – 0	3.0
4	BPL 474	PHARMACOLOGY-VI	PC	4 – 0 – 4	6.0
5	BPL 475	PHARMACEUTICS-XI (Pharmaceutical Management)	PC	3 – 0 – 0	3.0
Total Credits:					25
Semester VIII					
1	BPL 481	PHARMACEUTICS-XII (Pharmaceutical Technology)	PC	3 – 0 – 4	5.0
2	BPL 482	PHARMACOLOGY- VII	PC	3 – 0 – 0	3.0
3	BPL 483	PHARMACEUTICAL CHEMISTRY-X (Pharmaceutical Analysis-III)	PC	4 – 0 – 4	6.0
4	BPL 484	PHARMACEUTICAL CHEMISTRY-XI (Medicinal Chemistry-III)	PC	4 – 0 – 4	6.0
5	BPL 485	PHARMACOGNOSY-VI	PC	3 – 0 – 4	5.0
Total credits					25

SEMESTER-I

BPL 111 PHARMACEUTICAL CHEMISTRY – I

(Pharmaceutical Analysis-I)

(3 – 0 – 4)

1. Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Significant figures, Rules for retaining significant digits, Types of errors, Mean deviation, Standard deviation, Statistical treatment of small data sets, Selection of sample, Precision and accuracy. Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.

2. Acid Base Titrations : Acid base concepts, Role of solvent, Relative strengths of acids and bases, Ionization, Law of mass action, Commonion effect, Ionic product of water, pH, Hydrolysis of salts, Henderson-Hassel bach equation, Buffer solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, mixed indicators, Polyprotic system, applications in assay of HIO_4 , NaOH , CaCO_3 etc. .

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, Cell representations, Measurement of electrode potential, Oxidation-reduction curves, Iodimetry and Iodometry, Titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate; titanous chloride and Sodium 2, 6-dichlorophenol indophenol.

4. Precipitation Titrations: Precipitation reactions, Solubility products, Effect of acids, temperature and solvent upon the solubility of a precipitate. Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, Indicators, Gaylussac method; Mohr's method, Volhard's method and Fajan's method.

5. Gravimetric Analysis: Precipitation techniques, Solubility products; The colloidal state, Supersaturation co-precipitation, Postprecipitation, Digestional washing of the precipitate, Filtration, Filter papers and crucibles, Ignition, Thermogravimetric curves, Specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic precipitants.

6. Non-aqueous Titrations; theoretical titrations, scope and limitations, acid base equilibria in non-aqueous media, titrations of weak bases, titrations of weak acids, indicators, pharmaceutical products, should be selected for illustration. Complexometric Titrations: concept of complexation and chelation, Warner's coordination number and electronic structure of complex stability constants, titration curves, masking and demasking agents, types of complexometric titrations, metal ion indicators, factors influencing the stability of complexes, applications. Miscellaneous method of analysis; Diazotization titration, Kjeldahl nitrogen determination, Karl fishcher titration, determination of alcohol in liquid galenicals, oxygen flask combustion,

PRACTICALS

The students should be introduced to the main analytical tools through demonstrations. 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.

1. Standardization of analytical weights and calibration of volumetric apparatus.

2. Acid Base Titrations : Preparation and standardization of acids and bases; some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures e.g. boric acid should also be covered.

3. Oxidation Reduction Titrations : Preparation 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.

4. Precipitation titrations : Preparation and standardization of titrants like silver nitrate and, ammonium thiocyanate, Titrations according to Mohr's, Volhard's and Fajan's methods.

5. Gravimetric Analysis: Preparation of gooch crucible for filtration and use of sintered glass crucible, Determination of water of hydration, Some exercises related to gravimetric analysis should be covered.

6. Nonaqueous Titrations: Preparation and standardization of perchloric acid and sodium/potassium/lithium methoxides solutions; Estimations of some pharmacopoeial products.

7. Complexometric Titrations : Preparations and standardization of EDT A solution, some exercises related to pharmacopoeial assays by complexometric titrations.

BPL 112 PHARMACEUTICAL CHEMISTRY – II **(Pharmaceutical Inorganic Chemistry)**

(3-0-4)

An outline of the methods of preparation, properties, uses, sources of impurities, tests for purity and identity, including the limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any, of the following classes of inorganic Pharmaceuticals included in Indian Pharmacopoeia monograph details. Acids and bases: Buffers, water, Gastrointestinal agents: acidifying agents, antacids, protectives and adsorbent, Cathartics. Major extra and intra-cellular electrolytes: Physiological ions, electrolytes used for replacement therapy, acid base balance and combination therapy. Essential and trace elements: transition elements and their compounds of pharmaceutical importance: Iron and haematinics, mineral supplements. Cationic and anionic compounds of inorganic drugs useful for systemic effects. Topical agents: protectives, astringents and anti-infectives. Gases and vapours: oxygen, anesthetics and respiratory stimulants. Dental products: dentrifices, anti-caries agent. Complexing and chelating agents used in therapy. Miscellaneous agents: sclerosing agents, expectorants, emetics, poisons and antidotes sedatives etc. Pharmaceutical aids used in Pharmaceutical industry Antioxidants, preservatives, filter aids, adsorbents, diluents, excipients, suspending agents, colorants etc. Inorganic Radiopharmaceuticals nuclear Radiopharmaceutical, reactions, nomenclature, methods of obtaining their standards and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions.

PRACTICALS

The background and systemic qualitative analysis of inorganic mixtures up to 4 radicals. Six mixtures to be analyzed, preferably by semi-micro methods. All identification tests for pharmaceutical, inorganic pharmaceutical and qualitative tests for cations and anions as included in the appendix of IP should be carried out.

BPL 113 PHARMACEUTICS – I **(Dispensing and Hospital Pharmacy)**

(4-0-4)

Definitions and General Dispensing Procedures. Sources of information required for Pharmacists. Types of Dispensed products Containers, closures and labeling for dispensed products. Sources of error and care required in dispensing prescriptions. Principles involved and procedures adopted in dispensing of typical preparations like mixtures, solutions, emulsion, creams, ointments, powders, pastes, jellies, suppositories, ophthalmics, pastillers, lozenges, pills, lotions, liniments, inhalations, paints, sprays etc.

Incompatibilities - physical and chemical, occurrence and methods adopted in corrections. Colours flavours, sweeteners and other additives used in prescriptions. Latin terms used in prescriptions and their English equivalents. Pharmaceutical Calculations - calculation of doses, enlarging and reducing receipes, percentage solutions, alligation, alcohol dilutions, proof spirit, isotonic solutions, displacement value etc.

Hospital and its organization. Pharmacy, organization and personnel. Hospital formulary. Purchasing and inventory control, Drug distribution, Dispensing to inpatients, Dispensing to outpatient, Dispensing of controlled drugs, Drug charges, Prepackaging, Central sterile supply, Drug information centre, Maintenance of records, Safe use of medicines, Professional practices

PRACTICAL

Number of practicals based on aforementioned theory portion but including dispensing of preparations like emulsions, suspensions, solutions, creams, ointments, inhalations, liniments, paints, syrups, mixtures, pastes etc

BPL 114 PHARMACEUTICS – II **(General Pharmacy)**

(3-0-4)

Extraction: Various methods of extraction of crude drugs namely percolation (various types including processes for concentrated preparations, constant hot percolation), maceration (various types including processes for organized and unorganized drugs, for concentrated preparations, double and triple maceration processes), Decoction. Liquid Preparations: Formulation, preparation and uses of various liquid products namely syrups, aromatic waters, spirits, solutions, mucilages, elixirs, glycerins, mouthwashes, gargles, nasal drops, ear drops. Immunology : General introduction, infection, factors influencing infection, kinds of immunity, vaccines, (i.e. Tetanus vaccine, Diphtheria vaccine, BCG vaccine, small pox vaccine), virus immunity, toxoids, toxins, diagnostic preparation, sera, antitoxins (i.e. Diphtheria antitoxins, Botulinium antitoxins), brief control of immunological products-identification tests, toxicity tests, sterility tests, potency tests and storage of immunological products. Blood and related products : Whole human blood, concentrated human RBC, dried human plasma, dried human serum, human plasma protein fraction, human fibrinogen, human thrombin, plasma substitute properties, products i.e. PVP, Dextran, absorbable gelatin, sponge, oxidized cellulose calcium gluconate. Surgical dressings: like fibers, fabrics, bandages, surgical ligatures and sutures i.e. catgut and other absorbable and non-absorbable products. Semisolid dosage forms (ointment and suppositories) ointment, ointment bases, factors governing selection of ideal base, preparation of ointments, Suppositories-suppositories bases, selection of ideal base, production and quality control of suppositories.

PRACTICALS: Number of practicals based on aforementioned theory portion and including preparation of the following : Peppermint water, cinnamon water, camphor water, chloroform water, concentrated peppermint water, concentrated cinnamon water, simple syrup, syrup of ginger, syrup of orange, syrup of tolu, compound syrup of ferrous sulphate, spirit of peppermint, spirit of chloroform, spirit of ether, strong solution of ammonium acetate, surgical solution of chlorinated soda, solution of cresol with soap, solution of ferric chloride, strong solution of iodine, solution of hydrogen peroxide tannic acid glycerin, boric acid glycerin mouth washes, nasal drops, ear drops, elixirs mucilage of acacia, mucilage of tragacanth, tincture of orange, capsicum tincture, strong tincture of ginger, tincture of lemon, tincture of tolu, tincture of nuxvomica, liquid extract of liquorice, liquid extract of ipecacuanha, liquid extract of belladonna, liquid extract of senna, concentrated infusion of clove, concentrated infusion of quassia, concentrated infusion of senna, liver extract.

BPL 115 REMEDIAL BIOLOGY

(3-0-2)

1. Methods of classification of plants.
2. **Plant Cell:** It's structure and non-living inclusions; mitosis and meiosis; different types of plant tissues and their functions.
3. Morphology and histology of root, stem, bark, wood, leaf, flower fruit and seed. Modification of root and stem.
4. General Survey of Animal Kingdom; Structure and life history of parasites as illustrated by amoeba, entamoeba, trypanosoma, plasmodium, taenia, ascaris, schistosoma, oxyuris, and ancylostoma.
5. General Structure and life history of insects like mosquito, housefly, mites and silkworm.

PRACTICAL

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

OR

BPL 115 REMEDIAL MATHS

(4-0-0)

Algebra : revision on equation reducible to quadratics and simultaneous equations (linear and quadratic) up to two variable only. Determinants and their six important properties, solutions of simultaneous equations by Cramer's rule. Matrices: Definition of special matrices (like unit, singular, diagonal matrices etc.) arithmetic operation on matrices, transpose, adjoint reciprocal and inverse of a matrix, solution of simultaneous equations using matrices. Partial fractions and resolution of linear and quadratic (non-repeated) partial functions. Evaluation of E_n , E_n^2 and E_n^3 Trigonometry: revision on angle measurement and T-ratios addition, subtraction and transformation formulae. T-ratio of multiple, sub multiple and allied angles, solution of simple trigonometric identities based on above concepts. Pharmaceutical application of logarithms. Analytical plane geometry: Cartesian co-ordinates, distance between two points, area of triangle, locus of a point, straight line, slope and intercept form, general equation of first degree.

SEMESTER – II

BPL 121 :PHARMACEUTICAL CHEMISTRY - III

(Pharmaceutical Organic Chemistry-I)

(4-0-4)

The subject of organic chemistry will be treated in its modern perspective keeping for the sake of convenience, the usual classification of 'organic compounds':

1. Structure and Properties : Atomic structure, Atomic orbitals, Molecular orbital theory, wave equation, Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, structure and physical properties, Intermolecular forces, Acids and bases.
2. Stereochemistry : Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations.
3. Structure; Nomenclature; Preparation and Reactions of: Alkanes, Alkenes, Alkynes; Cycloalkanes, Dienes, Benzene, Polynuclear aromatic compounds, Arenes, Alkyl halides, Alcohols, Ethers, Epoxides, Amines, Phenols, Aldehydes and ketones, Carboxylic acids, Functional derivatives of carboxylic acids, Reactive intermediates - carbocations, carbanions, carbenes, nitrene and nitrenium ions.

PRACTICALS

1. The student should be introduced to the various laboratory techniques through demonstrations involving synthesis of selected organic compounds (e.g. aspirin, p-bromoacetanilide, anthraquinone from anthracene, reduction of nitrobenzene etc)
2. Identification of organic compounds and their derivatisation.
3. Introduction to the use of stereomodels.

BPL 122 :PHARMACEUTICAL CHEMISTRY- IV

(Physical Chemistry)

(3-0-4)

1. **Behaviour of Gases:** Kinetic theory of gases, deviation from behaviours and explanation.
2. **The Liquid State:** Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents).
3. **Solutions:** Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement, Debye Huckel theory.
4. **Thermodynamics:** First, second and third laws, Zeroth law, absolute temperature scale, thermochemical equations, phase equilibria and phase rule.
5. **Adsorption:** Freundlich and Gibbs adsorption, isotherms, Langmuir theory of adsorption.
6. **Photochemistry:** Consequences of light absorption, Jablenski diagram, Lambert-Beer Law, Quantum efficiency.
7. **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.

8. **Quantum Mechanics** : Postulates of quantum mechanics, operators in quantum mechanics, the schrodinger wave equation

PRACTICALS

1. To determine molar mass by Rast method and cryoscopic method.
- 2 To determine refractive index of given liquids and find out the contribution of carbon, hydrogen and oxygen in molar refraction of a compound.
3. To determine molar mass of volatile liquids by Victor-Meyer method.
4. To determine the specific rotation of sucrose at various concentrations and determine the intrinsic rotation.
5. To determine the heat of solution, heat of hydration and heat of neutralization.
6. To determine the cell constant, verify Ostwald dilution law and perform conductometric titration,.
7. To determine rate constant of simple reaction.

BPL 123 : PHARMACOGNOSY – I

(4-0-4)

1. Definition, history, scope and development of Pharmacognosy
2. Sources of drugs : Biological, marine, mineral and plant tissue cultures as sources of drugs
3. Classification of drugs : Alphabetical, morphological, taxonomical, chemical and pharmacological classification of drugs
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, Papaveraceae.
5. Cultivation, Colloction, Processing and storage of crude drugs: Factors influencing cultivation of medicinal plants. Types of soils and fertilizers of common use. Pest management and natural pest control agents. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants.
6. Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods and properties.
7. An introduction to active constituents of drugs: classification and properties.
8. Systematic pharmacognostic study of following
 - a) Carbohydrates and derived products: agar, guar gum acacia, Honey, Isabgol, pectin, Starch, sterculia and Tragacanth.
 - b) Lipids: Bees wax, Castor oil, Cocoa butter, Codliver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice, Bran oil, Shark liver oil and Wool fat.

PRACTICALS

1. Morphological characteristics of plant families mentioned in theory.
2. Microscopic measurements of cells and cell contents: Starch grains, calcium oxalate crystals and phloem fibres.
3. Determination of leaf constants such as stomatal index, stomatal number, vein-islet number, vein-termination number and palisade ratio.
4. Identification of crude drugs belonging to carbohydrates and lipids.
5. Preparation of herbarium sheets.

BPL 124: PHARMACOLOGY I

(Anatomy, Physiology & Health Education -I)

(3-0-4)

1. Scope of anatomy and physiology, basic medical terminology.
2. Structure of cell, its components and their functions.
3. **Elementary tissues** of the human body: epithelial, connective, muscular and nervous tissue, their sub-types and characteristics.
4. **Osseous system:** structure, composition and functions of skeleton, classification of joints, types of movements at joints, disorders of joints.

5. **Skeletal muscles:** Gross anatomy, physiology of muscle contraction, their disorders.
6. **Haemopoetic system:** Composition and function of blood and its elements, their disorders, blood groups, and their significance, mechanism of coagulation, disorders of platelets and coagulation.
7. **Lymph and lymphatic system:** Composition, formulation and circulation of lymph, disorders of lymph and lymphatic system, structure and functions of spleen.
8. **Cardiovascular system:** Basic anatomy of the heart, physiology of the heart, blood vessels and circulation. Cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation, Brief outline of cardiovascular disorders like hypertension, hypotension, arteriosclerosis, angina, myocardial infraction, congestive heart failure and cardiac arrhythmias.
9. **Digestive system:** Gross anatomy of the gastrointestinal tract, function of its different parts including those of liver, pancreas and gallbladder, various gastrointestinal secretions and their role in the absorption and digestion of food. Disorders of digestive system.
10. **Respiratory system:** Anatomy of respiratory organs and their functions, mechanism and regulation of respiration, respiratory volumes and capacities.

PRACTICAL

1. Study of human skeleton.
2. Study of different systems with the help of charts and models.
3. Microscopic study of different tissues with the help of permanent slides.
4. Estimation of hemoglobin in blood. Determination of bleeding time, clotting time, R.B. C. count, Total Leukocyte Count, Differential Leukocyte Count, and E. S. R.
5. Recording of body temperature, pulse rate and blood pressure, basic understanding of electrocardiogram-PQRST waves and their significance.

BPL 125- PHARMACEUTICAL MATHEMATICS

(3 – 0 – 0)

Calculus : Differential : Limits and functions, differential coefficient, differentiation of standard functions, including function of a function (chain rule), differentiation of implicit functions, logarithmic differentiation, parametric differentiation, elements of successive differentiation. Integral : integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, by partial fractions and by substitution, formal evaluation of definite integrals. Differential equations : definition and formation of ordinary differential equations, equations of first order and first degree, variable separable, homogeneous equations, linear equations (Liebnitz form) and differential equations reducible to there types. Linear differential equations of order greater than one with constant coefficients, complementary function and particular integrals of e^x , x^m , $\sin(ax + b)$ or $\cos(ax + b)$ types of functions, solution of simple simultaneous linear differential equations, Pharmaceutical transforms. Laplace transforms : definition, properties of linearity and shifting, transforms of elementary function (without proof) and inverse laplace transforms not involving Euler's theorem, transforms of derivatives, solutions of ordinary and simultaneous differential equations. Pharmaceutical statistics : concept, mathematical computations (wherever applicable) and pharmaceutical applications (wherever possible) on : Significant digits and rounding of numbers, collection of primary and secondary data through experiments of surveys sampling and complete enumeration survey, merits and limitations of various random and non-random sampling methods, data organization including frequency distributions and tabulation, diagrammatic representation of data, simple, multiple, sub-divided and floating bar diagrams, pie diagrams, 2-D and 3-D pictographic representation, graphs of frequency distributions. Measures of central tendency, ideal characteristics, mean, median, mode, GM, HM and weighted arithmetic mean form discrete and continuous frequency distribution, quartiles, deciles and percentiles, measures of dispersion, range, quartile deviation, mean deviation, standard deviation, calculation of standard deviation from discrete and continuous frequency distributions, standard error of means, coefficient of variation. Probability and events, Bayes theorem, probability theorems, probability distributions, elements of

binomial and Poisson distributions, normal distribution, normal distribution curve and properties, calculation of areas under normal curve and standard normal curve (Z statistic), confidence limits, deviations from normality, Kurtosis and skewness, elements of central limit theorem. Linear correlation and regression analysis, scatter plots, method of least squares, Pearsonian coefficients of correlation and determination, definitions, of amount of explained variance, standard error of estimate and significance of regression (F). Statistical inference, type I and II errors, t-test (paired and unpaired).

SEMESTER – III

BPL 231: PHARMACEUTICAL CHEMISTRY - V

(Pharmaceutical Organic Chemistry - II)

(4-0-4)

Nucleophilic aromatic substitutions; α , β - unsaturated carbonyl compounds; Conservation of orbital symmetry and rules., Electrocyclic, Cycloaddition and sigmatropic reactions; Neighbouring group effects; Catalysis by transition metal complexes, Stereoselective and stereospecific reactions; New organic reagents used in drug synthesis.

Heterocyclic Compounds: Chemistry, preparations and properties of some important heterocycles containing 3, 4,5,6 & 7 atoms with one or two heteroatoms like O, N, S. : Furan, Thiophene, Pyrrole, Thiazole, oxazole, imidazole, Pyrazole, Triazole and Tetrazole. Six membered Heterocycles: Pyridine, pyridazine, Pyrimidine, Pyrazine, Pyrones. Benz-fused Heterocycles: Quinoline, Isoquinoline, Indole, Purines, Acridine, and lanthone.

Chemistry of lipids, Carbohydrates, Proteins and Nucleic acids. Vitamins- Classification, chemistry of thiamine, pyridoxine, folic acid, ascorbic acid and vitamin A.

PRACTICALS

At least five exercises in synthesis involving various heterocyclic ring systems. An exercise involving stereoselective synthesis of a compound. Resolution of racemic DL-alanine or any other example. Workshop on molecular modelling of primary, secondary and tertiary structures of proteins, molecular modelling on double helical structure of nucleic acid showing hydrogen bonding.

BPL 232 PHARMACEUTICS-III

(Pharmaceutical Engineering-I)

(3 -0- 0)

Flow of fluids: Introduction, mechanism of fluid flow, Reynolds number and its significance, Bernoulli's theorem, manometers and friction losses in pipes, measurement of flow rate using direct weighing or measuring, hydrodynamic methods, displacement meters and dilution methods. Regulation of flow using plug cocks, globe valves, gate valves, unidirectional valves, automatic regulating valve, butterfly valve and diaphragm valve, and water hammer Heat Transfer: Modes of heat transfer, Fourier's law, overall heat transfer coefficient, Stefan-Boltzman's law, single pass heater, multi-pass heater, liquid-liquid heat interchanger and finned tubes Evaporation: Factors affecting evaporation, natural circulation evaporators e.g. evaporating pan, evaporating still, horizontal and vertical tube evaporators, forced circulation evaporators, film evaporators, multiple effect evaporation, material and energy balance of evaporators. Drying: Theory, behavior of solids during drying, static bed dryers, moving bed dryers, fluidized bed dryer and pneumatic bed dryers. Centrifugation: theory, industrial centrifugal filters and industrial centrifugal sedimenters. Filtration: Theory, filter aids, filter media, industrial filters i.e. sand filter, washing and non-washing type filter presses, rotary drum filter, leaf filters, edge filter. Humidification, dehumidification and air conditioning: Principles of Humidification, dehumidification and air conditioning, psychrometry, humidity measurement, large scale equipment for humidification and dehumidification, cooling towers. Refrigeration: Principle and equipment employed for vapor compression refrigeration,

lithium bromide absorption refrigeration and steam jet refrigeration. Applications of refrigeration in Pharmacy. Size reduction: Mechanism, factors influencing, energy requirements, applications in pharmacy, grinders i.e. fluid energy mill, hammer mill, ball mill and its variants, centrifugal mill, attrition mill, edge runner mill, colloid mill, squirrel cage disintegrator, Buhrstone mill.

BPL 233 : PHARMACOGNOSY - II

(3-0-4)

1. Resins: Study of Drugs Containing Resins and Resin Combination like colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of peru, benzoin, turmeric, ginger.
2. Tannis : Study of tannins and tannin containing drugs like gambir, black catechu, gall and myrobalan.
3. Volatile Oils : General methods of obtaining volatile oils from plants, Study of volatile oils of Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood.
4. Phytochemical Screening:
 - a. Preparation of extracts.
 - b. Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts.
5. Fibres: Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.
6. Pharmaceutical aids: Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors.

PRACTICALS

1. Identification of crude drugs mentioned in theory.
2. Study of fibres and pharmaceutical aids.
3. Microscopic studies of seven-selected crude drugs and their powders mentioned under the category of volatile oils in theory and their chemical tests,
4. General chemical tests for alkaloids, glycosides, steroids, flavonoids and tannins.

BPL 234 PHARMACOLOGY-II

Anatomy, Physiology and Health Education –II)

(3-0-4)

1. **Central nervous system:** Structure and functions of different parts of brain and spinal chord. Neurohumoral transmission in the central nervous system, reflex action, electroencephalogram, cranial nerves and their functions.
2. **Autonomic nervous system:** Physiology of the autonomic nervous system. Mechanism of neurohumoral transmission in the autonomic nervous system.
3. **Urinary system:** various parts, structure and functions of the kidney. Physiology of the urine formation and acid-base balance. Diseases of urinary system.
4. **Reproductive system:** Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis and oogenesis. Pregnancy, its maintenance and parturition.
5. **Endocrine system:** Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenals, pancreas, their hormones and functions.
6. **Sense organs:** Basic anatomy and physiology of the eye, ear, taste buds, smell and skin.

7. Health Education:

- A.) Concepts of health & disease, disease causing agents and prevention of disease.
- B.) Classification of food requirements, balance diet, nutritional deficiency disorders, their treatment and prevention, specification of drinking water.
- C.) Demography and family planning: Demography cycle, family planning and various contraceptive methods. Medical termination of pregnancy.
- D.) Brief out line of communicable diseases, their causative agents, modes of transmission and prevention (chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, hepatitis, cholera, typhoid, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea and AIDS).
- E.) First aid: emergency treatment of shock, snakebites, burns, poisoning, fractures and resuscitation methods.

PRACTICAL

1. Study of different systems with the help of charts and models.
2. Microscopic study of different tissues and organs with the help of permanent slides.
3. Analysis of normal and abnormal constituents of urine, determination of pH of urine.
4. Determinations of vital capacity, experiments on spirometry.

BPL 235 COMPUTER SCIENCE

(4- 0 – 4)

Computer fundamentals: Computer components, characteristics and classification of computers, hardware and software, peripheral devices. Algorithmic development: Techniques of problem solving, flowcharting, decision table, structured programming concepts, modular programming, algorithms for searching, sorting and merging. Programming methodologies: top down and bottom-up programming. Fortran: Data types operator and expression, input output statements, control statements- if, else, select case, do continue, do enddo, do while, exit, cycle, goto. Array processing – implied do, allocate, deallocate. Structures- array structures, nested structures. Function and subroutine: function subprogram, subroutine subprogram, passing arguments. Managing data files. Fortran 90: data types, control surfaces, arrays, pointers, subprograms, recursion. Study and programs for numerical and statistical methods: matrices, solution of linear equations, interpolating a function, numerical integration, solution of ordinary differential equation, measures of central tendency, dispersion, regression analysis, correlation coefficient. Internet: Definition, various activities on internet.

PRACTICALS: Number of experiments based on aforementioned theory.

SEMESTER – IV

BPL 241 PHARMACEUTICAL CHEMISTRY- VI

(Pharmaceutical Analysis -II)

(4-0-4)

Extraction procedure, separation of drug from Excipients, liquid-liquid extraction, separation of mixtures by extraction, distribution law, successive extraction, the Craig method of multiple extraction, continuous counter-current extraction, effect of temperature, pH, inert solute, association, ion-pair formation, the emulsion problem in extraction. Fundamentals of Chromatography Introduction and theory of underlying different types of chromatography techniques like- Column chromatography, thin layer chromatography, paper and circular chromatography, adsorbents and

solvents used in these techniques. Electrochemistry: the electric cell, electrode potential, half cells, types of half cells, sign convention, Nernst equation, the salt bridge, activity series, standard potential, standard hydrogen electrode, measuring the relative voltage of half cells, calculations of standard potential, reference electrodes, indicator electrodes. Potentiometry: theoretical considerations, ion-selective electrodes, measurement of potential, location of end point equipment, analytical application, direct measurement of a metal concentration, differential curve, determination of K_{sp} , pH measurement dead-stop titrations; pH meter, pH definition, relation to pH to potential, equipment and applications. Conductance and high frequency titrations and their applications. Coulometric titrations, its principles and applications, controlled potential coulometry, cell design, instrumentation, advantages and limitations, and electrode selection. Polarography and its applications: theory of mass transport processes, current processes, current potential relationship, polarization, choice of electrodes, effect of oxygen, instrumentation, calculation of concentration, laboratory design and safety. Amperometric titrations and its applications.

Gas chromatography: introduction, principles of gas chromatography, basic GLC apparatus, sample introduction, column, column efficiency, solid support, liquid phases, branches of gas chromatography, detectors, temperature effect, application of GLC in pharmaceutical analysis. HPLC: introduction and nomenclature, instrumentation, liquid solid chromatography, liquid liquid chromatography, exclusion chromatography, HPLC columns, solvent selection in HPLC, data handling in HPLC, application of HPLC. TLC quantitative estimate. Ion exchange and molecular sieve processes. Theory of ion exchange, types of exchangers, ion-exchange equilibria, ion-exchange capacity, ion-exchange separation, applications in pharmaceutical analysis, molecular sieve separation and application.

PRACTICALS

1. Experiments involving separation of drugs from excipients.
2. Chromatographic analysis of some pharmaceutical products.
3. Exercises based on acid base titration in aqueous and non-aqueous media, oxidation-reduction titrations using potentiometric technique, Determination of acid-base dissociation constants and plotting of titration curves using pH meter.
4. Exercises involving polarimetry.
5. Exercises involving conductometric and polarographic techniques.

BPL 242 PHARMACEUTICS-IV

(Pharmaceutical Microbiology)

(4 – 0 – 4)

Introduction to the science of microbiology-ancient theories concerning the origin of life, contribution of great scientists to this science, with particular reference to the contributions of the following scientists: A.V. Leeuwenhoek, Louis Pasteur, Edward Jenner, Robert Koch, Alexander Fleming, Joseph Lister. Microscopy: Microscopes, their magnification, resolution, illumination and filters, working of different types of microscopes, micrometry. Classification of microbes. Nutrition, cultivation isolation and identification of bacteria, fungi and viruses. Disinfection, factors affecting disinfection, dynamics of disinfection, disinfectants and antiseptics and their evaluation. Sterilization, different methods, applications and evaluation of sterilization methods. Aseptic technique. Microbial standardisation of antibiotics (ampicillin, streptomycin), Vitamins (Vitamin B-12, Niacin) and calcium pantothenate. Fermentation: Types of media used; factors affecting, control of various parameters during fermentation. A detailed account of the industrial fermentation process for manufacture of penicillin, streptomycin, glutamic acid; Lysine, citric acid, Vit. B₁₂.

PRACTICALS: Number of experiments based upon afore mentioned theory and including experiments devised to prepare various types of culture media, sub culturing of common aerobic and anaerobic bacteria, fungus and yeast, various staining methods, various methods of isolation and identification of microbes, sterilizing techniques and evaluation of sterilizing techniques, evaluation of aseptics and disinfectants, testing and sterility of pharmaceutical products as per I.P. requirements, evaluation of potency of antibiotics and vitamins etc.

BPL 243 :PHARMACOGNOSY - III

(4-0-4)

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 containing glycosides :

(i) Saponins : Liquorice, ginseng, dioscorea, sarsaparilla, and senega.

(ii) Cardioactive sterols: Digitalis, squill, strophanthus and thevetia.

(iii) Anthraquinone cathartics: Aloe, senna, rhubarb and cascara.

(iv) Others: Psoralea, Ammi majus, Ammi visnaga, gentian, saffron, chirata, quassia. 2. Studies of traditional drugs, common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs:

Amla, Kantkari, Satavari, Tylophora, Bhilawa, Kalijiri, Bach, Rasna, Punamava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi, Adusa, Atjuna, Ashoka, Methi, Lahsun, Palash, Guggal, Gymnema, Shilajit, Nagarmotha and Neem.

3. The holistic concept of drug administration in traditional systems of medicine. Introduction to ayurvedic preparations like Arishtas, Asvas, Gutikas, Tailas, Chumas, Lehyas and Bhasmas.

. PRACTICALS

1. Identification of crude drugs listed in theory.

2. Microscopic study of some important glycoside containing crude drugs as outlined above.

BPL 244 PHARMACEUTICS –V

(Forensic pharmacy)

(3-0 -0)

Introduction Pharmaceutical Professional bodies. - A brief review. Pharmaceutical Education- A brief review. An elaborate (Practical orientation) study of the following: Pharmaceutical Ethics. Pharmacy Act 1948. Drugs and Cosmetics Act 1940 and Rules 1945 Medicinal & Toilet Preparations (Excise Duties) Act 1955. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules A brief study of the following with special reference to the main provisions. Poisons Act 1919 Drugs and Magic Remedies (Objectionable advertisements) Act 1954. Medical Termination of Pregnancy Act 1970 & Rules 1975. Prevention of Cruelty to Animals Act 1960. CPCSEA AICTE Act 1987. Patents Act. 1970.

BPL 245: PHARMACOLOGY-III

(Pathophysiology of common diseases)

(4-0-0)

1. Basic Principles of Cell Injury and Adaptation: Causes of Cellular injury, pathogenesis, morphology of cell injury. Intercellular alterations in lipids, proteins and carbohydrates, Cellular adaptation, atrophy, hypertrophy.

2. Basic Mechanisms involved in the process of inflammation and repair: Alterations in vascular permeability and blood flow, migration of WBCs, acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.

3. Pathophysiology of Common Diseases: Rheumatoid arthritis, gout, epilepsy, psychosis, depression, mania, Alzheimer's disease, hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, diabetes, peptic ulcer, asthma, ulcerative colitis, various types of Hepatitis, liver cirrhosis, acute and chronic renal failure, tuberculosis, urinary tract infections, sexually transmitted diseases, AIDS, anemia, Iatrogenic diseases, and common types of neoplasm. Wherever applicable the molecular basis should be discussed.

ENVIRONMENTAL STUDIES:

Multidisciplinary nature of environmental studies: Definition, scope and importance. Natural resources- Renewable and nonrenewable resources: Natural resources and associated problems- Forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, Changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ecosystems: Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers, energy flow in the ecosystem. Ecological succession, food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its conservation: Introduction- Definition, genetic, species and ecosystem diversity. Biogeological classification of India, value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values. Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Environmental pollution: Definition, causes, effects and control measures of – air, water, soil, marine, noise and thermal pollution and nuclear hazards. Solid waste management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone, and landslides. Social issues and the environment: from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns, case studies. Environmental ethics: issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case-studies. Wasteland reclamation, consumerism and waste products, environment protection act, Air (Prevention and control of pollution) act, Water (Prevention and control of pollution) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public awareness. Human population and the environment: Population growth, variation

among nations, population explosion – Family Welfare programme. Environment and human health, Human rights, value education, HIV/AIDS, women and child welfare, role of information technology in environment and human health, case studies. Field work: Visit to local area to document environmental assets- river/forest/grassland/hill/mountain. Visit to a local pollute site- Urban/rural/industrial/agricultural. Study of common plants, insects, birds, Study of simple ecosystems- pond, river, hill slopes etc. (Filed work equal to 5 lecture hours)

SEMESTER – V.

BPL 351: Pharmaceutical Chemistry –VII

(Pharmaceutical Biochemistry)

(3-0-4)

1. Biochemical organization of the cell and transport processes across cell membrane.
2. The concept of free energy, determination of change in free energy - from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance.
3. Enzymes: Nomenclature, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.
4. Co-enzymes: Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance.
5. Carbohydrate Metabolism: Conversion of polysaccharide to glucose-1-phosphate, Glycolysis and fermentation and their regulation, Gluconeogenesis and glycogenolysis, Metabolism of galactose and galactosemia, Role of sugar nucleotides in biosynthesis, and Pentosephosphate pathway.
6. The Citric Acid Cycle: Significance, reactions and energetic of the cycle, Amphibolic role of the cycle, and Glyoxalic acid cycle.
7. Lipids Metabolism : Oxidation of fatty acids, α -oxidation & energetic, ω -oxidation, β -oxidation, Biosynthesis of ketone bodies and their utilization. Biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids & eicosanoids (prostaglandins, thromboxanes and leukotrienes), phospholipids, and sphingolipids.
8. Biological Oxidation : Redox-potential, enzymes and co-enzymes involved in oxidation reduction & its control, The respiratory chain, its role in energy capture and its control, Energetics of oxidative phosphorylation, Inhibitors of respiratory chain and oxidative phosphorylation. Mechanism of oxidative phosphorylation.
9. Nitrogen & Sulphur Cycle : Nitrogen fixation. ammonia assimilation, nitrification and nitrate assimilation, Sulphate activation. sulphate reduction. Incorporation of sulphur in organic compounds, Release of sulphur from organic compounds.
10. Metabolism of Ammonia and Nitrogen Containing Monomers : Nitrogen balance. Biosynthesis of amino acids. Catabolism of amino acids. Conversion of amino acids to specialized products, Assimilation of ammonia. Urea. cycle, metabolic disorders of urea cycle. Metabolism of sulphur containing amino acids. Porphyrin biosynthesis. formation of bile pigments. hyperbilirubinemia. Purine biosynthesis. Purine nucleotide interconversion. Pyrimidine biosynthesis. and Formation of deoxyribonucleotides.
11. Biosynthesis of Nucleic Acids: Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Biosynthesis of DNA and its replication. Mutation. Physical & chemical mutagenesis / carcinogenesis. DNA repair mechanism. Biosynthesis of RNA.

12. Genetic Code and Protein Synthesis: Genetic code. Components of protein synthesis. and Inhibition of protein synthesis. Brief account of genetic engineering and polymerase chain reactions.

13. Regulation of gene expression.

PRACTICALS

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 two dimensional paper chromatography and gel electrophoresis.

4. The separation of lipids by TLC.

5. Separation of serum proteins by electrophoresis on cellulose acetate.

6. Quantitative estimation of amino acids.

7. Quantitative estimation of proteins.

8. The identification of c-terminal amino acids of a protein.

9 The determination of glucose by means of the enzyme glucose. oxidase.

10. The isolation and assay of glycogen from the liver and skeletal muscle of rats.

11 Enzymatic hydrolysis of glycogen by. alpha- and beta-amylases.

12. The isolation and determination of RNA and DNA.

13. Effect of temperature on the activity of alpha - amylase.

14. Estimation of SGOT, SGPT, ALP and BRN in the serum.

BPL 352: PHARMACEUTICS –VI

(Physical Pharmacy)

(3-0-4)

Micromeretic and Powder Rheology: Particle size and distribution, average particle size, number and weight distribution, particle number, method of determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods of determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness and flow properties. Surface and Interfacial Phenomenon: Liquid interface, surface and interfacial tensions, surface free energy measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, electric properties of interface. Viscosity and Rheology: Newtonian systems, laws of flow, kinematic viscosity, effect of temperature, non Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers. Dispersion system: Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloid in pharmacy. Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, emulsions; types, theories and physical stability. Complexation: Classification of complexes, method of preparation and analysis, application. Kinetics and drug stability: general considerations & concepts, half life determination, influence of temperature, light, solvent, catalytic species and other factors, accelerated stability study, expiration dating. Buffers: Buffer equation and buffer capacity in general, buffer in pharmaceutical systems- buffered isotonic solutions, measurement of tonicity calculations, methods of adjusting isotonicity.

PRACTICALS: Number of experiments based upon aforementioned theory and including the following: Determination of latent heat, vapor pressure and critical point. Studies on polymorphs, their identification and properties. Determination of particle size, particle size distribution and

surface areas using various methods of particle size analysis. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc. Determination of surface/interfacial tension, HLB values and critical micellar concentration of surfactants. Study of rheological properties of various types of systems using different viscometers. Studies of different types of colloid and their properties. Preparation of various types of suspensions and determination of their sedimentation parameters. Preparation and stability studies of emulsions. Studies on different types of complexes and determination of their stability constants. Determinations of half-life rate constant and order of reaction. To study the influence of various factors on the rate of reaction. Accelerated stability testing, shelf life determination and expiration dating of pharmaceuticals. Preparation of pharmaceutical buffers and determination of buffer capacity. Experiments involving tonicity adjustments

BPL 353 PHARMACEUTICS-VII

(Pharmaceutical Engineering)

(3-0-4)

Distillation: Raoult's law, volatility, boiling point diagrams, azeotropic mixtures, equilibrium diagrams, types of distillation, rectification, rectifying columns, downcomers, material and energy balance of a rectifying column, reflux ratio, determination of number of theory plates, H.E.T.P. and steam distillation. Extraction: Factors affecting, equipment for extraction of solids i.e. fixed bed diffusion battery, continuous diffusion battery, basket extractor, Rotocel extractor and Dorr agitator; equipment for liquid-liquid extraction i.e. extraction towers and Podbielniak extractor. Mixing: Definition, objectives, mechanism, uniformity index, factors influencing selection of suitable mixer. Study of equipment employed for solid-solid, liquid-liquid and solid-liquid mixing. Emulsification equipment. Size separation: Screening equipment i.e. trommels, rotex and hummer; air suspension methods i.e. air separator and cyclone separators; hydraulic separation i.e. elutriation and double cone emulsifier. Crystallization: crystal forms, habit, Mier's supersaturation theory, crystallizers based on supersaturation, by cooling (i.e. tank crystallizers, agitated batch crystallizers and Swenson-Walker), adiabatic cooling (i.e. vacuum crystallizers) and evaporation (i.e. Krystal crystallizers). Material and energy balance of crystallizer. Corrosion and its prevention: Types of corrosion causes of corrosion and method for combating corrosion. Materials for pharmaceutical plant construction: factors affecting the selection of a material for pharmaceutical plant, ferrous metals (i.e. cast iron, steel and stainless steels), nonferrous metals (i.e. Copper and its alloys, aluminium, tin sliver, nickel and alloys), nonmetals i.e. glass, slate, asbestos, rubber, plastics and timber. Industrial hazards and safety precautions: Mechanical-chemical-electrical-fire-dust hazards, safety requirements, accident records etc. Transportation of materials: Liquids: Pumps i.e. airlift, ejector, piston plunger, egg, diaphragm, gear, screw, centrifugal and self-priming. Gases: Ejectors, compressors, fans and blowers. Solids: Intermittent and continuous methods in vertical, horizontal and inclined plane. Introduction: Significance of Engineering Drawing in Pharmaceutical Industry, drawing instruments and their uses, lines, lettering and dimensioning. Scales: Construction of plain scales, vernier scale, diagonal scale, comparative scale and isometric scale. Isometric projections: Theory, isometric views and projections, construction of isometric projections/views of two-dimensional and three-dimensional objects. Orthographic projections: Theory, types, and construction of drawing in both first angle and third angle. Various methods of sectioning i.e. full section, half section, removed section, partial section, and offset section. Conversion of orthographic projections into isometric projections/views. Drawing of machine parts and simple pharmaceutical equipment. Methods of depicting layouts of various sections of a pharmaceutical unit.

PRACTICALS: Numbers of practical based on theory portions of Pharmaceutical Engineering-I and Pharmaceutical Engineering-II and including the following: To perform Reynold's experiment. Determination of fanning factor. Comparison of the sensitivity of various manometers. Determination of flow rate using venturimeter. Determination of flow rate using orificemeter. Determination of overall heat transfer coefficient. Effect of number of balls on the grinding rate in a ball mill. Efficiency of a centrifugal pump. Effect of thickness of cake on filtration rate in a filter press. Effect of colour on radiation of heat. Overall efficiency of steam distillation. Use of psychrometric chart. Flow rate using pitot tubes. Determination of equilibrium moisture constant.

BPL 354: PHARMACOGNOSY - IV

(3-0-4)

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid containing drugs:

- a) Pyridine - piperidine: Tobacco, areca and lobelia.
- b) Tropane: Belladonna, hyoscyamus, datura, duboisia, coca and withania
- c) Quinoline and isoquinoline : Cinchona, ipecac, opium.
- d) Indole : Ergot, rauwolfia, catharanthus, nux-vomica and physostigma
- e) Imidazole: Pilocarpus
- f) Steroidal: Veratrum and kurchi
- g) Alkaloidal amine: Ephedra and colchicum.
- h) Glycoalkaloid: Solanum.
- i) Purines: Coffee, tea and cola.

2. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.

3. General techniques of biosynthetic studies and basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance.

4. Plant bitters and sweeteners.

5. Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.

PRACTICALS

i) Identification of crude drugs listed above.

ii) Microscopic study of characters of eight - selected drugs given in theory in entire and powdered form.

iii) Chemical evaluation of powdered drugs.

BPL 355: PHARMACOLOGY- IV

(3-0-4)

1. **General Pharmacology:** Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying Drug action, tolerance and dependence, Pharmacogenetics. Principles of Basic and Clinical pharmacokinetics, Adverse Drug Reactions and treatment of poisoning, ADME drug interactions, Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs.

2. Pharmacology of Peripheral Nervous System:

a. Neurohumoral transmission (autonomic and Somatic)

b. Parasympathomimetics, Parasympatholytics, Sympathomimetics, Adrenergic Receptor and neuron blocking agents, Ganglionic, stimulants and blocking agents.

c. Neuromuscular blocking Agents.

d. Local anesthetic Agents.

3. Pharmacology of Central Nervous System:

a) Neurohumoral transmission in the C.N.S.

- b) General Anesthetics.
- c) Alcohols and disulfiram.
- d) Sedatives and hypnotics, Anti-anxiety agents and centrally acting muscle relaxants.
- e) Psychopharmacological agents (antipsychotics, antidepressants and antimaniacs)
- f) Anti-epileptics drugs.
- g) Anti-Parkinsonian Drugs.
- h) Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs.
- i) Narcotic analgesics and antagonists.
- j) C.N.S. stimulants
- k) Drug Addiction and Drug Abuse.

PRACTICALS

1. Introduction to Experimental Pharmacology:

Preparation of different solutions for experiments. Common laboratory animals and anesthetics used in animal studies. Commonly used instruments in experimental pharmacology.

2. Experiments on Central Nervous system:

Recording of spontaneous motor activity, analgesia, anticonvulsant activity, anti-inflammatory activity, and muscle relaxant activity of drugs using simple experiments.

3. Effect of various agonists and antagonists and their characterization using Isolated preparations like isolated ileum preparations of rat/guinea pig/chick.

SEMESTER – VI.

BPL 361: PHARMACEUTICAL CHEMISTRY - VIII ./

(Medicinal Chemistry - I)

(4-0-4)

1. Basic Principles of Medicinal Chemistry: Physico-chemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action, Drug-receptor interaction including transduction mechanisms.

2. Principles of Drug Design (Theoretic~fil Aspects) : Traditional analog (QSAR) and mechanism based approaches (Introduction 00' graph theory, applications of quantum mechanics, Computer Aided Drug Designing (CADD) androolecular modeling.

3. Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including physicochemical properties of the following classes of drugs:

A. Drugs acting at Synaptic and neuro-effector junction sites:

i. Cholinergics and Anticholinesterases

ii. Adrenergic .drugs

iii. Antispasmodic and anti ulcer drugs iv. Neuromuscular blocking agents.

B. Autocoids

i. Antihistamines ii. Eicosanoids

iii. Analgesic-antipyretics, anti-inflammatory (non-steroidal) agents.

C. Drugs affecting uterine motility

Oxytocics (including oxytocin, ergot alkaloids and prostaglandins) Biochemical approaches in drug designing wherever applicable should be discussed.

D. Synthetic procedures of following selected drugs – Adrenaline, Phenylephrine, Etorphonium Chloride, Dicyclomine, Neostigmine bromide, Cyclopentolate HCl, Propanthaline bromide, Benzhexol, Omeprazole, Pentoprazole, Rabeprazole, Ranitidine, Roxatidine, Diphenhydramine, Chlorpheniramine, Promethazine, Mepyramine, Cyclizine, Sodium chromoglycollate, Aspirin, Ibuprofen, Indomehtacin, Phenazone, Phenylbutazone, Oxyphenbutazone, Diclofenac, Piroxicam, Tenoxicam, Celecoxib, Valdecoxib, Allopurinol, Probenecid,

PRACTICALS

1. Exercises based on QSAR: Hansch & Free-Wilson methods.

2. Synthesis of selected drugs from the course content.

3. Spectral analysis of the drugs synthesized.

4. Establishing the pharmacopoeial standards of the drugs synthesized.
5. Determination of partition coefficient, dissociation constant and molar refractivity of compounds for QSAR analysis.

BPL 362: PHARMACEUTICS-VIII

(Dosage Form Design)

(4-2-4)

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. Study of chemical properties of drug like hydrolysis, oxidation, reduction, recombination, polymerization etc., and their influence on formulation and stability of products. Study of prodrugs in solving problems related to stability, bioavailability and elegance of formulation. Radiopharmaceuticals: fundamentals of radio pharmacy, therapeutic applications of isotopes, diagnostic applications of isotopes, use of radioisotopes in basic research, product development, product production, process control and quality control. Liquid formulations, formulation and industrial production of liquid and semi-solid formulation like suspension, syrup, emulsions and ointments. Skin: structure and physiology, physiology of sweating, physiology of skin secretions formulations, preparations for skin of face and hands, formulation, preparation and evaluation of cleansing creams, cold creams, cleansing lotions, foundation creams, moisturizing creams, skin tonics, hand and body lotion. Hairs, structure and functions, formulation, preparation and evaluation of shampoos, dandruff preparation, hair creams, and fixers, hair colorants, hair remover (depilatories), shaving sticks and after shave lotion. Formulation, preparation and evaluation of lipsticks. Formulation, preparation and evaluation of other cosmetics like nail lacquers, anti-perspirants and deodorants, tooth powders and tooth paste.

PRACTICALS:

Experiments illustrative of the portion covered in the theory portion of the syllabi and including the following: Formulation, preparation, packing and presentation of the following class of dosage forms using laboratory scale equipment's syrups, dry syrups drops, suspensions, solubilized systems, emulsions and topical applications. Preparation and quality control of (a) cold cream (b) vanishing cream (c) Cleansing lotion and creams (d) moisturizing creams (e) skin tonics, (f) hair creams and hair conditioners (g) shampoos (h) hair colorant (i) depilatory (j) shaving creams and sticks (k) tooth powder (l) tooth pastes (m) after shave lotions and other cosmetics. Experiments to illustrate comparative study of suspending agents, emulsifying agent and antioxidant preservatives. Preformulation studies including drug-excipient, compatibility studies, effect of stabilizers, preservatives etc. in dosage form design. Stability evaluation of various dosage forms and their expiring

BPL 365:PHARMACOGNOSY - V

(Chemistry of Natural Products)

(4-0-4)

1. Chemical and spectral approaches to simple molecules of natural origin
2. Concept of stereoisomerism taking examples of natural products.
3. Chemistry, biogenesis and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes, and triterpenoids.
4. **Carotenoids:** α -carotenoids, β -carotenes, vitamin A, Xanthophylls of medicinal importance.
5. **Glycosides** : Chemistry and biosynthesis of digitoxin, digoxin, hecogenin, sennosides, diosgenin and sarasapogenin.
6. **Alkaloids:** Chemistry, biogenesis and pharmacological activity of atropine and related compounds; quinine, reserpine, morphine, papaverine, ephedrine, ergotand vinca alkaloids.
7. Chemistry and biogenesis of medicinally important lignans and quassanoids, flavonoids.
8. Chemistry and therapeutic activity of penicillin, streptomycin and tetracyclines.

PRACTICALS

- i) Laboratory experiments on isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.
- ii) Exercises on paper and thin layer chromatographic evaluations of herbal drug constituents.

BPL 364: PHARMACOLOGY – V

(4-0-4)

1. Pharmacology of Cardiovascular System:

- a) Digitalis and cardiac glycosides.
- b) Antihypertensive drugs.
- c) Antianginal and Vasodilator drugs.
- d) Antiarrhythmic drugs
- e) Antihyperlipidemic drugs
- f) Drugs used in the therapy of shock.

2. Drugs Acting on the Hemopoietic System:

- a) Hematinics
- b) Anticoagulants, Vitamin K and hemostatic agents.
- c) Fibrinolytic and anti-platelet drugs.
- d) Blood and plasma volume expanders.

3. Drugs acting on urinary system:

- a) Fluid and electrolyte balance
- b) Diuretics

4. Autocoids:

- a) Histamine, 5- HT and their antagonists.
- b) Prostaglandins, thromboxanes and leukotrienes.
- c) Pentagastrin, Cholecystokinin, Angiotensin, Bradykinin and Substance P.

5. Drugs Acting on the Respiratory System:

- a) Anti-asthmatic drugs.

- b) Anti-tussives and expectorants.
- c) Respiratory stimulants.

PRACTICALS

1. Experiments on Isolated Preparations:

- a) To record the concentration response curve (CRC) of acetylcholine using rat/chick ileum preparation.
- b) To study the effects of physostigmine and d-tubocurarine on the CRC of acetylcholine using rat/chick ileum preparation.
- c) To record the CRC of histamine on guinea pig ileum preparation.

UCC 551 PRESENTATION AND COMMUNICATION SKILLS

Communication skills: Essentials of communication skills, small group communication techniques, group discussion etc. Public speaking techniques, body language – verbal and non-verbal cues, Interview – Kinds of interview-as interviewee, as interviewer. Workshops: Mock interviews, group discussions, JAM sessions [just a minute], dress codes. Presentation Skills: Pre-presentation preparation, presentation skills, post-presentation follow-up, Presentation aids- audio, visual, audio-visual and printed aids, computer aides presentations- use of power point. Meetings – Convening – Managing – Post meeting follow up : organizing, meeting manners, presiding over a meeting-participating in a meeting. Written presentation, Language of writing, preparation of C.V./Resume, official correspondence, report writing.

SEMESTER VII

BPL 471 PHARMACEUTICS-XII

(Biopharmaceutics and Pharmacokinetics)

(4-2-4)

Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting. Biopharmaceutics: Passage of drug across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis). Factors influencing absorption-physiochemical, physiological and pharmaceutical. Drug distribution in the body, plasma protein binding. Pharmacokinetics. Significance of plasma drug concentration measurement. Compartmental model: definition and scope. Pharmacokinetics of drug absorption-zero order and first order absorption rate constant using wagner-Nelson and Loo-Riegelman method. Volume of distribution and distribution coefficient. Compartment kinetics-one compartment and two compartment models. Determination of pharmacokinetics parameters from plasma and urine data after drug administration by intravascular and oral route. Curve fitting (method of residuals), regression procedures. Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance. Hepatic elimination of drugs, first pass effect, extraction ratio, hepatic clearance, biliary excretion, enterohepatic circulation. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menten equation, determination of non-linearity (saturation mechanism).

Clinical pharmacokinetics; Definition and scope. Dosage adjustment in patients with and without renal and hepatic failure. Dosage regimen adjustment for repeated therapy. Introduction to Pharmacokinetics drug interactions and its significance in

combination therapy. Bioavailability and bioequivalence: Measures of bioavailability, C_{max} , t_{max} and Area under Curve(AUC). Design of single dose bio-equivalence study and relevant statistics. Overview of regulatory requirements for conduction of bio-equivalence study.

PRACTICALS: Number of experiments based on aforementioned theory topics, should be conducted.

BPL 472: PHARMACEUTICAL CHEMISTRY - X

(Medicinal Chemistry - II)

(4-0-4)

Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs.

1. **Steroids and related drugs** : Steroidal nomenclature and stereochemistry, androgens and anabolic agents, estrogens, and progestational agents, adrenocorticoids.
2. **Drugs acting on the Central Nervous System:** General Anesthetics, Local Anesthetics, Hypnotics and Sedatives, Opioid analgesics, antitussives, anti convulsants, Antiparkinsonism drugs, CNS stimulants, Psychopharmacological agents (neuroleptics, antidepressants, anxiolytics).
3. Diuretics, Cardiovascular drugs, Anticoagulant and Antiplatelet drugs.

Biochemical approaches in drug designing wherever applicable should be discussed.

Synthetic procedures of following selected drugs: Procaine, Benzocaine, Lignocaine, Cinchocaine, Thiopentone, Phenobarbitone, Hexobarbitone, Diazepam, Mehtaqualone, Phenytoin, Troxidone, Pethidine, N-methylmorphine, Chlorpromazine, Trifluoperazine, Amitryptiline, Nikethamide, Cholesterol, Dihydroepiandrosterone, Oestradiol, Diethylstilbosterol, Progesterone, Cortisone acetate, Stigmasterol, Norethisterone, Testosterone, Triamcinolone, Furosemide, Acetazolamide, Chlorthiazide, Hydrochlorthiazie, Spironolactone, Triametrene, Nifedipine, Procainamide, Verapamil, Propranolol, Methyldopa, Clonidine, Guanethidine, Hydrallazine, Phentolamine, Clofibrate, Warfarin, Phenindione,

PRACTICALS

1. Workshop on stereomodel use of some selected drugs.
2. Synthesis of selected drugs from the course content involving two or more steps and their spectral analysis.
3. Establishing the Pharmacopoeial standards of the drugs synthesized.

BPL 473: PHARMACEUTICS-X

(Packaging Technology)

(3-0-0)

Introduction: Definition, life history of a package, qualities of the package, purpose of packaging, hazards encountered by the package, various types of inner and outer packages, selection of a suitable package and child resistant package. Packaging materials: Detailed study with regard to composition packaging characteristics, advantages, economics and limitations of paper, glass, plastics, metals and rubber as packaging materials. Strip Packing: Significance of Strip Packing, advantages, economics and limitation of Strip Packing, Strip Packing machinery, films employed

in Strip Packing (including composites and laminates) and evaluation of films and strips packs. Blister Packaging: Blister packing materials, significance of Blister packing, advantages, economics and limitation of blister packing, blister packing machinery, various types of blister packages, evaluation of blister package.

Pouch packaging: Materials used, advantages, economics and limitation of pouch packing, pouch packing machinery, spectrum of applications, evaluation of pouch packing. Liquid Formulation Packaging: Various containers/closures employed for liquid formulations. Machinery employed for liquid filling – constant level, volumetric, gravimetric etc. Evaluation of liquid formulation packages. Semi-Solid Packaging: Various types of containers/packages used for semi-solid products, filling and sealing machinery (including collapsible tube filling and sealing machine) merits and limitations of various packages, evaluation of semi-solid product package. Sterile Product Packaging: General principles of packaging of sterile products. Various types of containers used for sterile products including small volume and large volume parenterals. Types of closures used for the sterile products. Sterile product filling and sealing machinery i.e. ampoule filling and sealing machine. Limitations and merits of various packages. Evaluation of the sterile product packages. Labeling: Types of label, Labeling requirements as per Drugs and Cosmetics act, packaging inserts and machinery employed for labeling.

BPL 474: PHARMACOLOGY- VI

(4-0-4)

1. Drugs Acting on the Gastrointestinal Tract:

- a) Anti- ulcer drugs.
- b) Laxatives and antidiarrhoeal drugs.
- c) Appetite Stimulants and Suppressants
- d) Emetics and anti- emetics.
- e) Miscellaneous- Carminatives, demulcents, protectives, adsorbents, astrigents, digestants, enzymes and mucolytics.

2. Pharmacology of Endocrine System:

- a) Hypothalamic and pituitary hormones.
- b) Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and Vitamin D.
- c) Insulin, oral hypoglycaemic agents and Glucagon.
- d) ACTH and corticosteroids
- e) Androgens and anabolic steroids
- f) Estrogens, progesterone and oral contraceptives
- g) Drugs acting on the uterus.

3. Chemotherapy

- a) General Principles of Chemotherapy
- b) Sulfonamides and cotrimoxazole
- c) Antibiotics- penicillins, cephalosporins, chloramphenicol, erythromycin, Quinolones.
- d) Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.
- e) Chemotherapy of malignancy and immunosuppressive agents.

4. Principles of Toxicology

- a) Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning.
- b) Heavy metals (arsenic, lead and mercury) and heavy metal antagonists.

PRACTICALS

1. Experiments on Isolated Preparations:

- a) To calculate the pA₂ value of atropine using acetylcholine as an agonist on rat/chick ileum preparation.
- c) To estimate the strength of the test sample of a drug (e.g. acetylcholine, histamine, serotonin) using a suitable isolated muscle preparation employing matching, interpolation and three point bioassays.

BPL 475: PHARMACEUTICS-XI **(Pharmaceutical Management)**

(3-0-0)

Principles of Management (CO-ordination, Communication, Motivation, decision making, Leadership, innovation, Creativity, Delegation of Authority, Responsibility, Managerial qualities.

Accountancy: Principles of Accountancy, Ledger posting and book entries. Economics: Principles of economics with special reference to the laws of demand and supply, Pharmaceutical Marketing: Functions; buying, selling, transportation, storage, finance, feedback information, channels of distribution, wholesale, retail, departmental store, multiple shop Salesmanship: Principles of sale promotion, advertising, ethics of sales, 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.

Management: The concept, scope, functions and principles of management, Management and administration, Evolution of management. Human Resource Management: A brief exposure of human resource management - HR planning, recruitment, selection, training, performance appraisal, positive attitude.

SEMESTER –VIII

BPL 481 PHARMACEUTICS-XII **(Pharmaceutical Technology)**

(3-0-4)

Tablets: types of tablets, formulation of tablets, various granulation techniques including slugging, chilsonator, extruder and granulator. Tableting machinery for production of single layer, multilayer and compression. coated tablets. Physics of tablet compression, strain gauge, Tablet coating: sugar coating, film coating and compression coating, coating processes i.e. air suspension coating and pan coating (using conventional, rear vented and perforated pans). Quality control of tablets. Process validation. Capsules: advantages, applications, formulation, large scale production and quality control of hard and soft capsules. Microencapsulation:

terminology, advantages and applications. Study of various processes employed for microencapsulation i.e. coacervation phase separation, multiorifice centrifuge, electrostatic deposition, vacuum deposition, spray drying, spray congealing, polymerization, complex emulsion, air suspension technique and pan coating. Aerosols: definitions, advantages and applications, liquified-gas system, compressed gas system, propellants, containers, valves, cold-filling process, pressure filling process and quality control of aerosols. Parenterals: types of parenteral products, formulation, production facilities, production procedures for small volume and large volume Parenterals, large scale production of injectable grade water and quality control of parenterals. Design, development, production and evaluation of oral controlled release preparations.

PRACTICALS: Number of experiments based on aforementioned theory and including the following; Microencapsulation by coacervation phase separation brought about by change of temperature. Microencapsulation by coacervation phase separation brought about by addition of nonsolvent. Formulation, preparation and evaluation of pediatric tablets. Preparation and evaluation of aspirin tablets. Coating of tablets. Evaluation of coatings. Granulation by slugging. Determination of BA and M/G factor. Formulation of hard capsules. Quality control of soft and hard capsules. Preparation of small volume parenterals. Test for pyrogen. Preparation and evaluation of large volume parenteral. Formulation, preparation and evaluation of aerosol. Microencapsulation by complex emulsion method.

BPL 482: PHARMACOLOGY-VII
(Clinical Pharmacy and Drug Interactions)

(4-0-0)

1. Introduction to Clinical Pharmacy
2. **Basic Concepts of Pharmacotherapy.**
 - a) Clinical Pharmacokinetics and individualization of Drug Therapy.
 - b) Drug use during Infancy and in the Elderly (Pediatrics and Geriatrics).
 - c) Drug use during pregnancy.
 - d) Drug-induced Diseases.
 - e) The Basics of Drug Interactions.
 - f) General Principles of Clinical Toxicology.
 - g) Interpretation of Clinical Laboratory Tests.
3. Therapeutic Drug Monitoring.
4. Concept of Essential Drugs and Rational Drug use.

BPL 483: PHARMACEUTICAL CHEMISTRY - X
(Pharmaceutical Analysis – III)

(4-0-4)

A. Quality assurance:

1. GLP, ISO 9000, TQM, Quality Review and Quality Documentation.
2. Regulatory control, regulatory drug analysis, interpretation of analytical data.
3. Validation, quality audit: quality of equipment, validation of equipment, validation of analytical procedures.

B. The theoretical aspects, basic instrumentation, elements of interpretation of spectra, and applications of the following analytical techniques should be discussed :

1. Ultraviolet and visible spectrophotometry
2. Fluorimetry.
3. Infrared spectrophotometry including FTIR.
4. Nuclear Magnetic Resonance spectroscopy including ¹³C NMR.
5. Mass Spectrometry.
6. Flame Photometry.
7. Emission Spectroscopy.
8. Atomic Absorption Spectroscopy.
9. X-ray Diffraction. 10. Radio immunoassay.

PRACTICALS

1. Quantitative estimation of at least ten formulations containing single drug or more than one drug, using instrumental techniques.
2. Estimation of Na⁺, K⁺, Ca⁺⁺ ions using flame photometry.
3. IR of samples with different functional groups (-COOH, -COOR, -CONHR; -NH₂, -NHR, -OH, etc.).
4. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS.

BPL 484:PHARMACEUTICAL CHEMISTRY - XI

(Medicinal Chemistry III)

(4-0-4)

1. Drug metabolism and Concepts of Prodrugs.
- 2 Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs. (Biochemical approaches in drug designing wherever applicable should be discussed).
 - i) Antimetabolites (including sulfonamides).
 - ii) Chemotherapeutic agents used in Protozoal, Parasitic and other infection
 - iii) Antineoplastic agents
 - iv Anti-viral including anti - HIVagents.
 - v) Immunosuppressives and immunostimulants.
3. Amino acids, peptide, nucleotides and related drugs
 - a. Thyroid and Anti thyroid drugs
 - b. Insulin and oral hypoglycaemic agents.
 - c. Peptidomimetics and nucleotidomimetics.
4. Diagnostic agents.
5. Pharmaceutical Aids.

Synthetic procedures of following selected drugs: Diethyl carbamazine, Thiabendazole, Sulphadiazine, Sulphamethoxazole, Trimethoprim, Cycloserine, Chloramphenicol, Nalidixic acid, Norfloxacin, Nitrofurantoin, Isoniazid, Ethambutol, Ethonamide, Clofazimine, Ketoconazole, Clotrimazole, Chlorambucil, Melphalan, Thio-TEPA, 5-Fluorouracil, Cisplatin, Tolbutamide, Rosiglitazone, Pioglitazone, L-Thyroxine, Methylthiouracil, Methimazole, Azathioprine, Primaquine, Amodiaquine, Pyrimethamine, Metronidazole, Thioacetazole, Pyrazinamide

PRACTICALS

1. **Experiments designed on drug metabolism:**
 - a. Preparation of S9 and microsomes from tissue homogenates and standardization of protein.

- b. Effect of phenobarbital pretreatment on microsomal cytochrome p-450, cytochrome b5, and NADPH-Cytochrome C-reductase and comparison of micro somes from control.
 - c. Determination of microsomal aminopyrine demethylase and p_ nitroanisoie o-demethylase activities.
 - d. Determination of microsomal azo- and nitroreductase activities.
2. Synthesis of selected drugs.
 3. Establishing the pharmacopoeal standards and spectral studies.

BPL 485: PHARMACOGNOSY – VI

(3-0-4)

1. World-wide trade in medicinal plants and derived products with special reference to diosgenin (disocorea), taxol (Taxus sps) digitalis, tropane alkaloid containing plants, Papain, cinchona, I pecac, Liquorice, Ginseng, Aloe, Valerian, Rauwolfia and plants containing laxatives.
2. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Utilization and production of phytoconstituents such as quinine, calcium sennosides, podophyllotoxin, diosgenin, solasodine, and tropane alkaloids.
3. Utilization of aromatic plants and derived products with special reference to sandalwood oil, mentha oil, lemon grass oil, vetiver oil, geranium oil and eucalyptus oil.
4. Historical development of plant tissue culture, types of cultures,. nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy.
5. Chemotaxonomy of medicinal plants.
6. Marine pharmacognosy, novel medicinal agents from marine sources.
7. Natural allergens and photosensitizing agents and fungal toxins.
8. Herbs as health foods.

PRACTICALS

- i Isolation of some selected phytoconstituents studied in theory.
- ii Extraction of volatile oils and their chromatographic profiles.
- iii Demonstration of some experiments in plant tissue culture.

BOOK RECOMMENDED

LATEST EDITION OF THE BOOK, HAS TO BE FOLLOWED, HENCE THE SPECIFIC EDITION AND YEARS OF PUBLICATION ARE OMITTED.

1. PHARMACEUTICS

(Pharmaceutical Technology" Dispensing Pharmacy, Forensic Pharmacy and Pharmaceutical Microbiology)

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