Pt. Ravishankar Shukla University,
RAIPUR (C.G.) 492 010

B. Pharm.

(A Four Year Degree Programme)
Semester System

ORDINANCE
&
SYLLABUS

UNIVERSITY INSTITUTE OF PHARMACY
FACULTY OF TECHNOLOGY
PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)

Approved in meeting of Board of Studies in Faculty of Technology, Subject: Pharmacy Dt. October 03, 2013

First Semester Examination for the Degree of Bachelor of Pharmacy
SCHEME OF PAPERS

Sr. No.	Subject	Teaching Hrs./Week	Maximum Marks			Minimum Marks for Passing	Time Allowed for Examination Hrs.
			Sessional	Paper	Total		
1-T-1	Introduction to Pharmaceutics	3	30	70	100	40	3
1-P-1	Introduction to Pharmaceutics	3	30	70	100	40	4
1-T-2	Pharmaceutical Chemistry Physical	3	30	70	100	40	3
1-P-2	Pharmaceutical Chemistry Physical	3	30	70	100	40	4
1-T-3	Pharmaceutical Chemistry Inorganic	3	30	70	100	40	3
1-P-3	Pharmaceutical Chemistry Inorganic	3	30	70	100	40	4
1-T-4	Pharmaceutical Biology	3	30	70	100	40	3
1-P-4	Pharmaceutical Biology	3	30	70	100	40	4
1-T-5	Computer Application	3	30	70	100	40	3
1-P-5	Computer Application	3	30	70	100	40	4

Second Semester Examination for the Degree of Bachelor of Pharmacy
SCHEME OF PAPERS

Sr. No.	Subject	Teaching Hrs./Week	Maximum Marks			Minimum Marks for Passing	Time Allowed for Examination Hrs.
			Sessional	Paper	Total		
2-T-1	Physical Pharmacy	3	30	70	100	40	3
2-P-1	Physical Pharmacy	3	30	70	100	40	4
2-T-2	Pharmaceutical Engineering- I	3	30	70	100	40	3
2-T-3	Pharmaceutical Engineering- II	3	30	70	100	40	3
2-P-3	Pharmaceutical Engineering- II	3	30	70	100	40	4
2-T-4	Pharmaceutical Jurisprudence	3	30	70	100	40	3
2-T-5	Human Anatomy and Physiology-I	3	30	70	100	40	3
2-P-5	Human Anatomy and Physiology-I	3	30	70	100	40	4

Third Semester Examination for the Degree of Bachelor of Pharmacy
SCHEME OF PAPERS

Sr. No.	Subject	Teaching Hrs./Week	Maximum Marks			Minimum Marks for Passing	Time Allowed for Examination Hrs.
			Sessional	Paper	Total		
3-T-1	Modern Dispensing Pharmacy	3	30	70	100	40	3
3-P-1	Modern Dispensing Pharmacy	3	30	70	100	40	4
3-T-2	Pharmaceutical Chemistry Organic-I	3	30	70	100	40	3
3-T-3	Pharmaceutical Chemistry Organic-II	3	30	70	100	40	3
3-P-3	Pharmaceutical Chemistry Organic-II	3	30	70	100	40	4
3-T-4	Pharmaceutical Analysis- I	3	30	70	100	40	3
3-P-4	Pharmaceutical Analysis- I	3	30	70	100	40	4
3-T-5	Human Anatomy and Physiology-II	3	30	70	100	40	3
3-P-5	Human Anatomy and Physiology-II	3	30	70	100	40	4

Fourth Semester Examination for the Degree of Bachelor of Pharmacy
SCHEME OF PAPERS

Sr. No.	Subject	Teaching Hrs./Week	Maximum Marks			Minimum Marks for Passing	Time Allowed for Examination Hrs.
			Sessional	Paper	Total		
4-T-1	Pharmaceutical Technology- I	3	30	70	100	40	3
4-P-1	Pharmaceutical Technology- I	3	30	70	100	40	4
4-T-2	Pharmaceutical Analysis- II	3	30	70	100	40	3
4-P-2	Pharmaceutical Analysis- II	3	30	70	100	40	4
4-T-3	Pharmaceutical Bio- Chemistry	3	30	70	100	40	3
4-P-3	Pharmaceutical Bio- Chemistry	3	30	70	100	40	4
4-T-4	Pharmacognosy –I	3	30	70	100	40	3
4-P-4	Pharmacognosy –I	3	30	70	100	40	4
4-T-5	Applied Mathematics	3	30	70	100	40	3

Fifth Semester Examination for the Degree of Bachelor of Pharmacy
SCHEME OF PAPERS

Sr. No.	Subject	Teaching Hrs./Week	Maximum Marks			Minimum Marks for Passing	Time Allowed for Examination Hrs.
			Sessional	Paper	Total		
5-T-1	Pharmaceutical Technology- II	3	30	70	100	40	3
5-P-1	Pharmaceutical Technology- II	3	30	70	100	40	4
5-T-2	Pharmaceutical Microbiology	3	30	70	100	40	3
5-P-2	Pharmaceutical Microbiology	3	30	70	100	40	4
5-T-3	Pharmaceutical Analysis- III	3	30	70	100	40	3
5-P-3	Pharmaceutical Analysis- III	3	30	70	100	40	4
5-T-4	Medicinal Chemistry -I	3	30	70	100	40	3
5-P-4	Medicinal Chemistry -I	3	30	70	100	40	4
5-T-5	Pharmacology – I	3	30	70	100	40	3
5-P-5	Pharmacology – I	3	30	70	100	40	4

Sixth Semester Examination for the Degree of Bachelor of Pharmacy
SCHEME OF PAPERS

Sr. No.	Subject	Teaching Hrs./Week	Maximum Marks			Minimum Marks for Passing	Time Allowed for Examination Hrs.
			Sessional	Paper	Total		
6-T-1	Pharmaceutical Technology- III	3	30	70	100	40	3
6-P-1	Pharmaceutical Technology- III	3	30	70	100	40	4
6-T-2	Medicinal Chemistry -II	3	30	70	100	40	3
6-P-2	Medicinal Chemistry -II	3	30	70	100	40	4
6-T-3	Pharmacology – II	3	30	70	100	40	3
6-P-3	Pharmacology – II	3	30	70	100	40	4
6-T-4	Pharmacognosy –II	3	30	70	100	40	3
6-P-4	Pharmacognosy –II	3	30	70	100	40	4
6-T-5	Hospital And Community Pharmacy	3	30	70	100	40	3
6-P-5	Project Work	--	100	--	100	40	--

Seventh Semester Examination for the Degree of Bachelor of Pharmacy
SCHEME OF PAPERS

Sr. No.	Subject	Teaching Hrs./Week	Maximum Marks			Minimum Marks for Passing	Time Allowed for Examination Hrs.
			Sessional	Paper	Total		
7-T-1	Bio-Pharmaceutics	3	30	70	100	40	3
7-T-2	Medicinal Chemistry -III	3	30	70	100	40	3
7-P-2	Medicinal Chemistry -III	3	30	70	100	40	4
7-T-3	Pharmacology – III	3	30	70	100	40	3
7-P-3	Pharmacology – III	3	30	70	100	40	4
7-T-4	Pharmacognosy –III	3	30	70	100	40	3
7-P-4	Pharmacognosy –III	3	30	70	100	40	4
7-T-5	Chemistry of Natural Products	3	30	70	100	40	3

Eighth Semester Examination for the Degree of Bachelor of Pharmacy
SCHEME OF PAPERS

Sr. No.	Subject	Teaching Hrs./Week	Maximum Marks			Minimum Marks for Passing	Time Allowed for Examination Hrs.
			Sessional	Paper	Total		
8-T-1	Cosmetic Technology	3	30	70	100	40	3
8-P-1	Cosmetic Technology	3	30	70	100	40	4
8-T-2	Pharmaceutical Biotechnology	3	30	70	100	40	3
8-P-2	Pharmaceutical Biotechnology	3	30	70	100	40	4
8-T-3	Medicinal Chemistry -IV	3	30	70	100	40	3
8-T-4	Pharmacognosy –IV	3	30	70	100	40	3
8-P-4	Pharmacognosy –IV	3	30	70	100	40	4
8-T-5	Industrial Management and Accountancy	3	30	70	100	40	3

B. Pharm. First Semester

1-T-1 Introduction to Pharmaceutics

1. Pharmacy profession: History, code of pharmaceutical ethics. Pharmacy as a career, pharmacy in relation to allied health professions. Introduction to pharmacopoeias.
2. Routes of drug administration, Classification of pharmaceutical dosage forms. Definition of solid, liquid, semisolid, gaseous dosage forms and introduction to novel drug delivery systems.
3. Definitions, general formulations, manufacturing procedures and official products of-
   Aromatic waters, syrups, spirit, elixirs, glycerites, lotion, liniments, Jellies, mucilages, emulsions,suspensions, milks.
4. Extraction and Galenical Products: Principle and method of extraction, preparation of infusion, tinctures, dry and soft liquid extracts.
6. Pharmaceutical arithmetic: Dilution and concentration of solutions, calculation by allegation, proof spirits, isotonic solutions.
7. Study of following pharmaceutical aids with their application: Colouring agent, flavouring agents, sweetening agents.

1-P-1 Introduction to Pharmaceutics (Practical)

Experiments based on Theory topics.

1-T-2 Pharmaceutical Chemistry Physical

1. Introduction
2. Behaviour of Gases: Kinetic theory of gases, deviation from ideal behaviour and explanation.
3. The liquid state: Physical properties- surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents.
4. Solutions: Ideal and real solutions, solution of gases in liquid, colligative properties, partition coefficient, conductance and its measurements, Debye Huckel theory. Expression of concentration, ebulisocope and cryoscopic methods for determination of molecular weight. Osmosis, Liquid-liquid system, critical solution temperature.
5. Thermodynamics: First, second and third laws of thermodynamics. Zeroth law, absolute temperature scale, thermochemical equations, free energy functions and applications.
6. Chemical equilibrium: Homogeneous and Heterogeneous Law of mass action, Le Chatelier's principle. Hydrolysis of salts. Henderson Hasselbalch's equation.
7. Phase rule: - One and two component system of pharmaceutical interest.
8. Chemical kinetics: Order of reaction, first and second order of reaction, determination of order of reaction. Theories of reaction kinetics, characteristics of homogeneous and heterogeneous catalysis, acid base and enzyme catalysis.
9. Quantum Mechanics: Postulate of quantum mechanics, operators in quantum mechanics, the Schrödinger wave equation.
10. Nuclear and Radiation Chemistry: Nuclear radiopharmaceutical, Clinical Application and dosage, hazards & precautions.

1-P-2 Pharmaceutical Chemistry Physical (Practical)

Experiments based on Theory topics.

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1-T-3 Pharmaceutical Chemistry Inorganic

An outline of methods of preparation, uses and assays of the following classes of pharmaceuticals included in pharmacopoeia:

1. Acid & Bases,Buffers, water
2. Gastrointestinal Agents: Acidifying agents, antacids, protective & adsorbents, cathartics.
3. Major Intra- & Extracellular electrolytes: Physiological ions, Electrolytes used in replacement Theory of acid base balance and combination therapy.
4. Essential & trace elements: Transition elements & their compounds of pharmaceutical importance; Ion & haematinics, mineral supplements
5. Cationic & Anionic components of Inorganic drugs useful for systemic effects.
6. Topical Agents: Protective, Astringents, Ant infective
7. Inhalants, Expectorant and Respiratory stimulants
8. Complexing & Chelating agents use in Therapy
9. Antidotes in poisoning
10. Miscellaneous Agents - Antioxidant

1-P-3 Pharmaceutical Chemistry Inorganic (Practical)

Experiments based on Theory topics.

1-T-4 Pharmaceutical Biology

1. Modern concepts of Biology viz. molecular, Physiological and biochemical aspects.
2. Biological classification, species and population, Biotic community, Biosphere
3. Method of classification of plants
4. Plant cell: It's structure and non-living inclusion, mitosis and meiosis, different types of plant tissues and their functions.
5. Morphology of root, stem, bark, wood, leaf, flower, fruit and seed, modification of root and stem.
6. General structure and life history of parasites as illustrated by amoeba. Entamoeba, trypanosome, plasmodium, taenia, and ascaris.
7. General structure and life history of insects like mosquito, housefly, silkworm and mites.
8. Plant Taxonomy: Study of the following families with special reference to medicinal important plants: Papaveraceae, Ranunculaceae, Cruciferaceae, Apocyaneceae, Rutaeceae, Umbelliferae, Rubiaceae, Solanaceae, Convolvulaceae, Scrophylariaceae, Labiaceae, Euphorbiaceae, Liliaceae, Amarylidaceae, Zingiberaceae, Dioscoraceae..
9. Introduction to microscopy (optical, electron, phase contrast, etc.)
10. Micro-chemical tests for cell wall and cell inclusions.
11. General structure, physiological life history and medico economic importance of: Bacteria, Penicillium, Claviceps, Yeast, Mushrooms and Lycopodium.
12. Preparation and preservation of herbarium sheets.

1-P-4 Pharmaceutical Biology

Experiments based on Theory topics

1-T-5 Computer Applications

1. Digital Electronics: Number system, Review of logic gates, Boolean algebra, Combinational circuits, Decoders and Multiplexers, Flip-Flops, Binary Counters, Shift registers, Data representation, fixed point and floating point representation and other binary codes, half adder, full adder, substracter.

2. Introduction to Computers: Computer System Characteristics and Capabilities: Speed, Accuracy, Reliability, Memory capability, Repeatability. Computer Hardware: Block Diagram of a Computer. Types of Computers: Analog, Digital, Hybrid General and Special Purpose Computers. Computer Generations: Characteristics of Computer Generations Computer Systems – Micros, Minis & Main-frames. Introduction to a PC: The IBM Personal Computer Types of PC systems PC, XT & AT Pentium PC's Limitations of Micro Computer.

3. Computer Software: System software, Application Software, Types of System Software, Introduction and Types of Operating Systems programs, Booting Loader, Diagnostic Tests, Operating Systems Executive, BIOS, Utility Programs, File Maintenance, Language Processors, Assembler, Compiler & Interpreter. Application Software: Types of Application Software- Special emphasis on application of MS-Office software. Difference between Program and Packages. Disk Operating System**:** Internal & External Commands, Unix Commands.

4. Networking Concepts**:** Types of networks design structures; LAN/MAN/WAN; Advantages and limitations. Internet and its Basic Concepts; The Mechanism of the Internet. HTML Basics & Web Site Design.

1-P-5 Computer Applications (Practical)

Experiments based on Theory topics.

B. Pharm. Second Semester

2-T-1 Physical Pharmacy

1. States of Matter:- Gases & Liquids- Introduction, Real gases, Liquefaction of gases, Solids- Crystallisation, Polymorphism: Definition, different shapes of polymorphs, examples and its applications to Pharmacy,
2. Physical Properties of Drug Molecule - Additive, constitutive and colligative properties; Dielectric constant, its significance to pharmacy.
3. Solutions of non electrolytes- Properties and types of solutions, boiling point and boiling point diagrams, Lowering of vapour pressure, osmotic pressure-Semi permeable membrane and osmotic pressure, measurement of osmotic pressure,
4. Solutions of electrolytes - Electrolysis; Conductance : Equivalent and specific conductance.
5. Solubility and Distribution Phenomenon - General principles, types of solvents; solubility of salts ; solubility of slightly soluble electrolyte, solubility of weak electrolyte-influence of pH, influence of surfactants; distribution coefficient (Nernst coefficient) ,co-solvency.
6. Application of Chemical Kinetics: Arrhenius equation and shelf life determination, Theories of reaction rate, Accelerated stability studies: Introduction, conditions used in studying and purpose of studying.
7. Interfacial Phenomenon- Surface tension and surface free Energy ; measurement of surface and interfacial tension, spreading of liquids; adsorption at liquid interfaces, HLB-determination and importance with respect to suspension and emulsion, adsorption on solid surfaces, measurement of surface free area, its significance and importance, electrical double layer, Nernst and Zeta potential , effects of electrolytes, importance with respect to suspension emulsions.
8. Colloids- Introduction, definition, types size and methods of preparation, differences between true , colloidal and coarse suspensions; optical and Kinetic properties : Electro kinetic phenomenon-electrophoresis, electro-osmosis, Donnan membrane equilibrium and its applications; stability of colloidal systems, sensitisation and protective colloids; solubilisation of colloids
9. Rheology- Introduction – Newtonian and Non Newtonian system, viscosity measurements, thixotropy and its pharmaceutical significance; applications of rheology to pharmacy.
10. Micromeritics : Introduction to fundamental and derived properties, methods to determine particle size, shape and surface area, density and bulkiness, flow properties, compaction.

2-P-1 Physical Pharmacy (Practical)

Experiments based on Theory topics.

2-T-2 Pharmaceutical Engineering- I

1. Introduction to industrial Processing: Unit Operations and Processes, fundamental concept of material and energy balance Dimensional analysis.
2. Materials of pharmaceutical Plant construction: - Factors affecting the material selection for Pharmaceutical plants. Physical, Chemical and mechanical properties and uses of important materials and their alloys employed in the construction of pharmaceutical plants, heat and corrosion resistant alloys.
3. Corrosion and its prevention: - General considerations, types of corrosion, methods of reducing corrosion.
4. Industrial hazards and safety measures: - Mechanical chemical, electrical, fire and explosive hazards in pharmaceutical process, industries including inflammable gases and dusts. Safety measures in pharmaceutical plants and works.
5. Flow of fluids: Fluid static, manometers, Reynolds number and its significance, distribution of velocities across a pipe, Bernoulli's theorem and its applications. Fluid heads, friction losses, Enlargement and contraction losses, measurement of flow of fluids.
6. Transportation of material: - Solids: Types of conveyors. Belt conveyers, Chain conveyers screw conveyors, pneumatic conveyors and conveying of manufactured materials. Liquid: - pipes, pipe fittings, pumps and valves. Gases: - Fans, blowers, compressors and ejectors.
7. Process variables and elements of automatic process control, principles and instruments used in measurement of variables like temperature, pressure, flow level, moisture etc. Introduction to process control.
8. Filtration:- Mechanism of filtration, factors affecting filtration, selection of filters, study of filter media, and filter aids, classification of filters, filter press, leaf filters, continuous rotary filters, media filter, membrane filters, sterile filtration of liquids.
9. Size Reduction: - Mechanism of size reduction, factors affecting size reduction, pharmaceutical application, theory of size reduction. energy requirement, classification of equipment. Study of cutting rolls. Hammer mill, ball mill roller mill fluid energy mill colloid mill, selection of equipment's. Wet grinding, closed circuit grinding.

2-T-3 Pharmaceutical Engineering -II

1. Heat transfer- Heat transfer mechanisms. Heat transfer by conduction. Fourier's law compound resistance in series, heat flow through a cylinder, conduction, convection through fluids, Natural and forced convection. Surface coefficients, overall heat transfer coefficients. Radiation. Concepts of black and gray body, Heaters, heat exchangers, Inductive heating. Introduction to various types of heating media and fuels, steam as heating medium, properties and uses of steam. Steam traps, heating by electricity. Insulations types and selection of insulators.
2. Evaporation: - Factors affecting evaporation, types of evaporators, study of evaporating pan, evaporating still, short tube evaporators, forced circulation evaporators, film evaporators, Evaporator accessories, Evaporators capacity, heat and material balances, multiple effect evaporation, capacity of multiple effect evaporators under reduced pressure.
3. Distillation: - General theory applied to binary mixtures boiling point and equilibrium diagrams, Raoult's law and Henry's law, constant boiling mixtures. Equilibrium distillations, differential distillations, rectification, construction of rectifying columns. Enthalpy composition diagram, reflux ratio, McCabe-Thiele method for calculation of theoretical plates efficiency, steam distillation, molecular distillation and its applications.
4. Humidity and air conditioning:- Definition of various terms, psychometric charts, wet bulb theory, determination of humidity, methods of increasing and decreasing humidity, air conditioning, cooling towers, importance of humidity and its control.
5. Refrigeration:- General considerations, coefficient of performance, capacity of a refrigerating unit, compression and absorption types of refrigeration cycle, choice of refrigerate, application in pharmacy.
6. Drying: Introduction, theory of drying rate of drying, classification of dryers, vacuum spray, tray, fluidised bed dryers, Principle of freeze drying and freeze dryers..
7. Crystallisation: - Crystal forms and crystal habit solubility curves theory of crystallisation, nucleation and crystal growth material and energy balances, classification, principle under- lying the design and operation of tank. Swenson Walker, Crystal and vacuum type crystallizers.
8. Gas absorption: - Tower packing properties and types of packing materials for tower, tower construction, pressure drop through packed towers, mass transfer coefficients, HETP.

2-P-3 Pharmaceutical Engineering –II (Practical)

Experiments based on Theory topics of Pharmaceutical Engineering- I and II.

2-T-4 Pharmaceutical Jurisprudence

1. **I**ntroduction
   a. Pharmaceutical Legislations – A brief review
   b. Drugs & Pharmaceutical Industry – A brief review
   c. Pharmaceutical Education – A brief review
2. An elaborate (practical oriented) study of the following
   a. Pharmaceutical Ethics
   b. Pharmacy Act 1948
   c. Drugs and Cosmetics Act 1940 and Rules 1945
   d. Medicinal & Toilet Preparations (Excise Duties)Act 1955
   e. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules.
   f. Drugs Price Control Order.
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 1960
   e. Factories Act 1948
   f. Patents Act 1970.
4. A brief study of the various prescription/Non-prescription Products, Medical/Surgical accessories, Diagnostic aids, appliances available in the market.

Note: - The teaching of all the above acts should cover the latest amendments.

2-T-5 Human Anatomy and Physiology-I

1. Scope of anatomy and physiology and basic terminology used.
2. Structure of cell, its components and their functions.
3. Elementary tissue of the human body: Epithelial, connective, muscular and nervous tissues, their sub-type and their characteristics.
4. Osseous system: Structure, composition and functions of skeleton, classification of joints, type of movement of joints, disorders of joints.
5. Skeletal system: Gross anatomy and physiology of muscle contraction, physiological properties of skeletal muscle and their disorder.
6. Haemopoietic system: Composition and functions of blood and its elements, their disorder, blood groups and their significance, mechanism of coagulation.
7. The lymphatic system: Composition, formulation and circulation of lymph, disorder of lymph and lymphatic system. Basic Physiology and function of spleen.
8. The cardiovascular system: Basic anatomy of the heart. Physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sound and electrocardiogram, blood pressure and its regulation. Outline of cardiovascular disorder like hypertension, hypotension, atherosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

2-P-5 Human Anatomy and Physiology-I (Practical)

Experiments based on Theory topics

B. Pharm. Third Semester

3-T-1 Modern Dispensing Pharmacy

1. **History, definition and scope.**

2. **Prescription:** Types and parts of prescription, handling of prescription, source of errors in prescription, compounding of prescription, care required in dispensing procedures, including labelling of dispensed products, precautions while dispensing various dosage forms, prescription refills, prescription pricing.

3. Good compounding and dispensing practices: Personnel, house keeping, building, documentations, prescription filling, drug profile PMR, ADR, purchase records, stock records, idiosyncratic cases.

4. **Latin terms:** knowledge of commonly used Latin terms in prescription and their translation into English.

5. **Principles involved and procedures adopted in dispensing of:** Typical prescriptions like mixtures, solutions, emulsions, creams ointments, powders, capsules, pastes, gels, jellies, suppositories , ophthalmic, pastilles, lozenges, pills, lotions, liniments, inhalation, paints, sprays, tablet triturates.

6. **Incompatibilities in prescription:** Definition, types, physical, chemical and therapeutic. Intentional and unintentional, toleration and adjusted incompatibility. Inorganic incompatibilities including those of metals and their salts, non-metals, acids, alkalis. Organic incompatibilities including purine bases, alkaloids, barbiturates, tannins, pyrazolone derivatives, amino acids, quaternary ammonium compounds, carbohydrates, glycosides, anaesthetics, dyes, surface active agents. Correction of incompatibilities.

7. **Dispensing calculations**. Basis of posology, calculation of doses for infants, children, adults, elderly and renally impaired patients. Detection of overdoses in prescription, knowledge of prophylactic and therapeutic doses with route of administration. Different systems of weight and measurements and their interconversions.

8. **Surgical products:** Definition, primary wound dressing, absorbents, surgical cotton, surgical gauze's etc., bandages, adhesive tape, protective cellulose haemostatics, official dressings, absorbable and non absorbable sutures, ligatures and catgut. Medical prosthetics and organ replacement materials.

3-P-1 Modern Dispensing Pharmacy

Experiment based on theory topics

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3-T-2 Pharmaceutical Chemistry Organic-I

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.

3-P-2 Pharmaceutical Chemistry Organic-I

Experiment based on theory topics

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3-T-3 Pharmaceutical Chemistry Organic-II

1. Nucleophilic and Electrophilic Aromatic Substitution Reactions: Reactivity and orientation; Electrophilic and Nucleophilic Addition Reactions; Rearrangements (Beckman, Hoffman, Benzilic acid, pinacole-pinacolone and Beyer-Villiger);

2. Elimination reactions 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.

3. Heterocyclic Compounds: Chemistry, preparations and properties of some important heterocyclis containing 3, 4, 5, 6 & 7 atoms with one or two heteroatoms like O, N, S.

4. Chemistry of lipids, Carbohydrates, Proteins and Nucleic acids.

3-P-3 Pharmaceutical Chemistry Organic-II

Experiment based on theory topics

3-T-4 Pharmaceutical Analysis: I

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, Common ion effect, Ionic product of water, pH, Hydrolysis of salts, Henderson-Hasselbalch equation, Buffer solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, mixed indicators, Polyprotic system, Polyamine and amino acid systems, Amino acid titration, 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, Mohrs 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.

3-P-4 Pharmaceutical Analysis: I

Experiment based on theory topics

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3-T-5 Human Anatomy and Physiology-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. Disorders of digestive system.

2. Respiratory System: Anatomy of respiratory organs & its functions, respiration, mechanism and regulation of respiration, 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 ANS.

5. Urinary System: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base balance. Diseases of the urinary system.

6. Reproductive System: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis & oogenesis. Pregnancy its maintenance and parturition.

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).

9. a. Concepts of health and disease: Disease causing agents and prevention of disease.
b. Classification of food requirements: Balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water.
c. Demography and family planning: Medical termination of pregnancy.
d. Communicable diseases: Brief outline, their causative agents, modes of transmission and prevention (Chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea, and AIDS).
e. First Aid: Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

3-P-5 Human Anatomy and Physiology-II

Experiment based on theory topics

B. Pharm. Fourth Semester

4-T-1 Pharmaceutical Technology- I

1. **Centrifugation:** - Theoretical consideration, principle of centrifugation, study of laboratory and large scale equipments and their applications. Size Reduction: - Mechanism of size reduction, factors affecting size reduction, pharmaceutical application, theory of size reduction, energy requirement, classification of equipment. Study of cutting rolls. Hammer mill, ball mill, roller mill, fluid energy mill, colloid mill, selection of equipments. Wet grinding, closed circuit grinding.
2. **Size separation:** - Standards for powders, sieves and sieving equipment fluid classification methods sedimentation, Ceylon separator elutriation particle size distribution and its measurement representation of data.
3. **Extraction:** - Principles of solid-liquid and liquid-liquid extraction. Theories of extraction of drugs, study of diffusion batteries, Door agitator, continuous counter current extraction system, extraction towers, Podbielniak extractor.
4. **Mixing :-** Fundamentals, mechanism of mixing, Factors influencing the selection of mixers, study of solid- solid, solid-liquid and liquid- liquid mixers used in pharmaceutical industry, ultrasonic mixers.
5. **Compaction and compression:-** Measurement of punch forces, transmission of forces through powders distribution of forces, acting within the powder mass, effect of pressure on relative volume, Lubrication of the die wall, adhesion and cohesion of particles, strength of granules, factors affecting the strength of tablets.
6. Study of principle underlying the design and operation of various machines employed in the small scale and large scale production of tablets, capsules, ointments, liquid orals and parenterals.
7. **Packaging of Pharmaceutical Products:** Packaging components, types, specification and methods of evaluation stability aspects of packaging. Packaging equipment's, factors influencing choice of containers, legal and other official requirements for containers, package testing.
8. **Pilot plant scale up Techniques**: - Concept of pilot plant. Pilot plant-scale up techniques in pharmaceuticals.

4-P-1 Pharmaceutical Technology- I

Experiment based on theory topics

Approved in meeting of Board of Studies in Faculty of Technology, Subject: Pharmacy Dt. October 03, 2013

4-T-2 Pharmaceutical Analysis- II

Theoretical considerations and application in drug analysis and quality control of the following analytical techniques:

1. Non-aqueous titrations
2. Complexometric titrations
3. Miscellaneous Methods of Analysis: Diazotisation titrations, Kjeldahl method of nitrogen estimation, Karl-Fischer titration, Oxygen flask combustion.
4. Extraction procedures including separation of drugs from excipients
5. Chromatography: The following techniques will be discussed with relevant examples of pharmacopoeial products.

TLC, HPLC, GLC, HPTLC, paper chromatography and column chromatography.

6. Potentiometry
7. Conductometry
8. Coulometry
9. Polarography
10. Amperometry

4-P-2 Pharmaceutical Analysis- II

Experiment based on theory topics

4-T-3 Pharmaceutical Biochemistry

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 pentose phosphate pathway.

6. The Citric Acid Cycle: Significance, reactions and energetic of the cycle, Amphibolic role of the cycle, and Glyoxylic acid cycle.

7. Lipids Metabolism: Oxidation of fatty acids, β-oxidation & energetic, α-oxidation, co-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 deoxyribounucleotides.

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. Regulation of gene expression.

4-P-3 Pharmaceutical Biochemistry

Experiment based on theory topics

4-T-4 Pharmacognosy-I

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. Cultivation, Collection, 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.

5. Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods and properties.

6. Introduction to active constituents of drugs: their isolation, classification and properties.

7. 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, cod liver oil, lard, linseed oil, rice bran oil, shark liver oil and wool fat.

4-P-4 Pharmacognosy–I

Experiment based on theory topics

4-T-5 Applied Mathematics

1. Algebra : Equations reducible to quadratics, simultaneous equations (linear and quadratic), Determinants, properties of solution of simultaneous equations by Cramer's rule, matrices, definition of special kinds of matrices, arithmetic operations on matrices, inverse of a matrix, solution of simultaneous equations by matrices, pharmaceutical applications of determinants and matrices. Evaluation of Enl, En2, and En3, mensuration and its pharmaceutical applications.

2. Measures of Central Value: Objectives and pre-requisites of an ideal, measure, mean, mode and median.

3. Trigonometry: Measurement of angle, T-ratios, addition, subtraction and transformation formulae, T-ratios of multiple, submultiple, allied and certain angles. Application of logarithms in pharmaceutical computations.

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

5. Calculus:

Differential: Limits and functions, definition of differential coefficient, differentiation of standard functions, including function of a function (Chain rule). Differentiation of implicit functions, logarithmic differentiation, parametric differentiation, successive differentiation.

Integral: Integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, substitution and partial fractions, formal evaluation of definite integrals.

B. Pharm. Fifth Semester

5-T-1 Pharmaceutical Technology-II

1. Liquid Dosages Forms: Introduction, types of additives used in formulations, vehicles, stabilisers, preservative, suspending agents, emulsifying agents, solubilizers, colours, flavours and others. Manufacturing, packaging, labelling and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.
2. 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.
3. Suppositories: Ideal requirements, bases, displacement value, manufacturing procedure, packaging and evaluation.
4. Capsules: Advantages and disadvantages of capsule dosage form, Material for production of hard gelatin capsule, size of capsule, formulation, method of capsule filling. Soft gelatin capsules: Shell and capsule content, manufacture. Importance of base absorption and minimum/gm factors in soft capsules. Quality control, stability testing and storage of capsule dosage forms.
5. Tablets: Advantages and disadvantages of tablets, applications and formulations of different types of tablets, granulation technology on large-scale by various techniques, 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, coating process, evaluation of coated tablets. Stability kinetics and quality assurance.
6. Blood Products and Plasma Substitutes: Collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, foam plasma substitutes, ideal requirements, PVP, dextran, etc.
7. Pharmaceutical Aerosols: definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications.
8. Ophthalmic Products: Requirements, types, formulation, methods of preparation, labeling, containers, evaluation.

5-P-1 Pharmaceutical Technology-II (Practical)

Experiments based on Theory topics.

5-T-2 Pharmaceutical Microbiology

1. Scope of Microbiology - Historical development - applications to pharmaceuticals
2. Classification of micro-organisms into bacteria, yeast and fungi, rickettsia and viruses. Stains and types of staining techniques, introduction to microscopy and its techniques.
3. Biology of micro-organisms:
a). Bacteria - Size and shape, structure, cell wall, cytoplasm, capsules, spores (properties, formation, germination), locomotion, reproduction (binary fission, reproduction involving genetic exchange, transformation, conjugation and transduction), growth, (growth requirements, culture media, growth curve, measurement of bacterial growth and mean generation time), counting methods (total count and viable count),characteristics of disease causing bacteria (Staphylococcus, Streptococcus, Neisseria, Clostridium, Corynebacterium, Pseudomonas, Vibrio, Hemophillus, Escherichia, Salmonella, Mycobacterium).
b). Yeasts and Fungi - Introduction, classification and characteristics of fungi class with their clinical significance.
c). Rickettsia - Introduction - clinical significance and applications.
d). Viruses - Introduction - general properties (size, nucleic acid content, metabolism) - structure of viruses (helical symmetry and icosahedral symmetry) - effect of chemical and physical agents on viruses - virus-host cell interactions - bacteriophage and its epidemiological uses (lytic growth cycle and lysogeny) – human viruses and their cultivation in cell culture, chick embryo and animal inoculation - multiplication of human viruses - interferon's - HIV - tumor viruses - prions.
4. Sterilisation - Definition - Classification into thermal and non-thermal methods - details of hot air sterilization, autoclaving, gaseous, radiation, sterile filtration - bio burden determination - sterilisation monitors (physical, chemical and biological indicators) - sensitivity of micro organisms, survivor curves, expression of resistance (D-values and z-values), sterility assurance - Applications of autoclaving in hospitals
5. Disinfection and Sanitation - Definition (antiseptics, preservatives and sanitising agents) – Chemical classification (acids and esters, alcohols, etc.) - factors affecting choice of antimicrobial agent (properties of chemical agent and microbiological challenge, environmental factors and toxicity of agent) - factors affecting disinfection process - evaluation of disinfection (RW coefficient, Kelsey-Sykes test) - dynamics of disinfection.
6. Microbial Epidemiology - portal of entry (respiratory tract, intestinal tract, urionogenital tract, skin and conjunctiva) - resistance to host defence, inflammatory response, avoidance of phagocytosis – manifestation of disease - damage to tissues.
7. Industrial Microbiology: Preparation, standardization of various antibiotics, vitamins and glycerides.

5-P-2 Pharmaceutical Microbiology (Practical)

Experiments based on Theory topics

5-T-3 Pharmaceutical Analysis- III

1. Introduction, pharmacopoeial monograph, literature collection, data handling and expression of analytical results - Documentation and record keeping.
2. Validation: Validation of analytical Methods and Equipment as defined in USP
3. General physical method- Density, Solubility, Molecular weight, Refractometry, Optical activity, Viscosity, Surface tension.
4. Analysis of Drugs and Excipients in Solid State- Introduction - particle size analysis and scope of methods.
5. Instrumental methods in the development and use of medicines -Introduction, product characterisation for drug development, product development, production and pharmacopoeial controls, drug metabolism and pharmacokinetics.
6. The basis of spectrophotometry- Introduction, atomic spectra, molecular spectra, instrumentation, spectrophotometer.
7. Ultraviolet-visible absorption spectrophotometry- Introduction, quantitative spectrophotometric assay of medicinal substances, assay of substances in multi-component samples, optimum condition for spectrophotometric measurements, structural analysis.
8. Atomic emission spectrometry and atomic absorption spectrophotometry.
9. Spectroflurimetry- Introduction, instrumentation, application and quantitative aspects.
10. Radiochemistry - Radio-immuno assay (RIA) and related immunoassay techniques. ELISA-technique - theory, Instrumentation and applications.
11. Nuclear Magnetic resonance spectroscopy- Introduction, instrumentation, application and quantitative aspects, carbon-13 NMR (CMR) spectroscopy.
12. Mass spectrometry- Introduction, instrumentation and practical application.
13. The application of spectroscopic techniques to structural elucidation- Introduction; aids to spectral interpretation, exercise and solutions.

5-P-3 Pharmaceutical Analysis- III

Experiments based on Theory topics

5-T-4 Medicinal Chemistry –I

1. Introduction and History
2. Biopharmaceutical Properties of Drug Substance
3. Structural features and Pharmacological activity
4. Theoretic aspects of drug design
5. Molecular Modelling
6. Receptors and Drug action
7. Physicochemical Properties in relation to biological action.
8. Metabolic changes of drugs and related organic compounds.
9. The synthesis and SAR of the compound, Classification under each class and Biochemical approaches in drug design wherever possible should be discussed.

a. Adrenergic agents: Phenyl ethylamine analogs, Epinephrine, Norepinephrine, Ephedrine, Pseudo-ephedrine HCl, Metaraminol bitartrate, Triminopeptane and Naphazoline HCl.
b. Cholinergic and anticholinergic: Acetylcholine and its analogs, Atropine
c. Neuromuscular Blocking Agents
d. General anaesthetics: - Cyclopropane, halothane, vinyl ether, tribromethanol, Sodium thiopental
e. Local anaesthetics: - Cocaine, Procaine Hydrochloride, Benzocaine, Butacaine sulphate, Metabutethiamine HCl , Dibucaine HCl, Lignocaine HCl, Diperodon HCl.

5-P-4 Medicinal Chemistry –I (Practical)

Experiments based on Theory topics

5-T-5 Pharmacology-I

1- General Pharmacology

a. Introduction to Pharmacology- Definition, scope and various branches, source of drugs, dosage form and routes of drug administration. Factors affecting absorption from gut
b. Pharmacodynamics-Mechanism of drug action, Receptors, classification and drug receptors interaction, combined effect of drugs, factors modifying drug action, drug dose and response.
c. Pharmacokinetics-Mechanism and principle of Absorption, Distribution, Metabolism and Excretion of drugs. Principles of basic and clinical pharmacokinetics. Bioavailability and bioequivalence studies.
d. Pharmacogenetics
e. Adverse drug reactions, Drug interactions
f. Discovery and development of new drugs-Preclinical and clinical studies.

2. Pathophysiology of common diseases

a. Basic Principles of Cell Injury and Adaptations- Causes of Cellular injury, pathogenesis, morphology of cell injury, adaptations and cell death.
b. Basic mechanisms involved in the process of inflammation and repair- Vascular and cellular events of acute inflammation, chemical mediators of inflammation, pathogenesis of chronic inflammation, brief outline of the process of repair.
c. Immunopathophysiology- T and B cells, MHC proteins, antigen presenting cells, immune tolerance, pathogenesis of hypersensitivity reactions, autoimmune diseases, AIDS, Amyloidosis.
d. Pathophysiology of diseases- Asthma, diabetes, rheumatoid arthritis, gout, ulcerative colitis, neoplasia, psychosis, depression, mania, epilepsy, acute and chronic renal failure, hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, congestive heart failure, peptic ulcer, anemias, hepatic disorders, tuberculosis, urinary tract infections and sexually transmitted diseases. Wherever applicable the molecular basis should be discussed.

3. Bioassay

Bioassay of Drugs and Biological Standardization- Principles and methods of bioassay, Bioassay of insulin, oxytocin, vasopressin, ACTH, histamine and 5-HT

4. Principles of Toxicology

a. Definition for acute, sub acute and chronic toxicity, genotoxicity, carcinogenicity, teratogenicity and mutagenicity studies.
b. Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning.
c. Heavy metals and heavy metal antagonists.

5. Classification, Principle of drug action, Receptors, mechanism of action, dynamics of absorption, distribution, metabolism, excretion, doses and side effect of drugs acting on peripheral nervous system:

a. Neurohumoral transmission (Autonomic and somatic).
b. Parasympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics, Ganglionic stimu**lants and blockers.**
c. **Neuromuscular blocking ag**ents and skeletal muscle relaxants (peripheral).
d. Local anesthetic agents.
e. Drugs used in Myasthenia Gravis and Alzheimer's disease.

5-P-5 Pharmacology–I (Practical)

Experiments based on Theory topics

B. Pharm. Sixth Semester

6-T-1 Pharmaceutical Technology-III

1. Preformulation studies:
   a) Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, Solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability.
   b) Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization, etc., and their influence on formulation and stability of products.
   c) Study of pro-drugs in solving problems related to stability, bioavailability and elegancy of formulations
2. Parenteral Products.
   a. Pre-formulation factors
   b. Prefilling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large-scale manufacture and evaluation of parenteral products.
   c. Aseptic Techniques-source of contamination and methods of prevention, Design of aseptic area, Laminar flow bench services and maintenance
   d. Sterility testing of pharmaceuticals.
3. Validation: Introduction, types and validation methods for pharmaceutical operations involved in the production of following pharmaceutical products: Capsules, Tablets, Solutions, Suspensions, Emulsions, Ointments and Cream.
4. Kinetics and drug stability: general consideration and concepts, half-life determination, accelerated stability study and expiration dating.
5. Microencapsulation: Concept, core material, coating materials, techniques, application.
6. Controlled/Sustained Released Products: Oral, transdermal and parenteral systems and their evaluation.
7. Targeted drug delivery: Rationale, drug delivery systems (Microparticles, nanoparticles, liposomes, resealed erythrocytes)
8. GMP,quality assurance, quality audit, GLP, ISO 9000 series, TQM. Drug Regulatory Affairs, Introduction to WHO and ICH guidelines.

6-P-1 Pharmaceutical Technology-III (Practical)

Experiments based on Theory topics

6-T-2 Medicinal Chemistry-II

The synthesis and SAR of the compound, Classification under each class and biochemical approaches in drug design wherever possible should be discussed.

1. **Hypnotic and Sedatives:** Barbitone sodium, Allobarbitone Hexabarbitone and Glutethimide, Sulfonals.
2. **Tranquilizers:** Reserpine, Benzquinamide, Chlopromazine HCl,Triflupromazine HCl, Chlorcyclizine HCl, Chlordizepoxid and Diazepam.
3. **Anticonvulsants:** Phenobarbital, Dipheny hydantion,Trimethadione,paramethadione, phensuximide.
4. **Antidepressant:** Imipramine, amitryptyline, Doxepine, Trimipramine, clomipramine, Desipramine, Nortriptyline, Maprotilline, Amoxapine, MAO inhibitors, Lithium Compounds
5. **Analgesics, antipyretics and Anti-inflammatory agents:** Morphine HCl, Mefenamic acid, Indomethacin, Acetaminophen , aminopyrin, Phenybutazone and Ibuprofen, Analgin, pethidine , Dexapropoxyphen, Ketoprofen.
6. **Antihypertensive:** Piperoxan, Dibenamine, Azapentine phosphate, Tolazoline Hydrochloride, Propranolol hydrochloride, Hexa-methonium Bromide, Pentolinium tartrate. dopa-Guanethidine Sulphate. A study of Rauwolfia veratrum and Ergot alkaloids in general
7. **Analeptics:** Picrotoxin, Pentylenetetrazol, Nikethamide, Caffeine, amphetamine and N-allylmorphine.
8. **Anticoagulants:** Bishydroxy coumarin, Ethyl biscoumacetate, Sodium warfarin, Diphenadione, and Heparin.
9. **Plasma Extenders:** General Survey of important compounds.
10. **Immunosuppressive and immunostimulants**

6-P-2 Medicinal Chemistry-II (Practical)

Experiments based on Theory topics

6-T-3 Pharmacology –II

1. Pharmacology of Central Nervous System

Management of CNS disorders (Epilepsy, parkinsonism, schizophrenias, depression)

a. Neurohumoral transmission in the C.N.S with special emphasis on pharmacology of various neurotransmitters.
b. General anesthetics.
c. Alcohols and disulfiram.
d. Sedatives, hypnotics and centrally acting muscle relaxants
e. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
f. Anti-epileptic drugs.
g. Anti-parkinsonism drugs.
h. Analgesics, antipyretics, and anti-inflammatory agents.
i. Management of rheumatic diseases and drugs used in gout.
j. Narcotic analgesics and antagonists.
k. C.N.S stimulants.
l. Drug addiction, drug abuse, tolerance and dependence.

2. Pharmacology of Cardiovascular system

Management of CVS disorders (Hypertension, CCF, Angina, Acute Myocardial Infarction, cardiac Arrhythmias)

a. Introduction of haemodynamics and Electrophysiology of heart.
b. Cardiac glycosides: Digitalis & Coronary dilators
c. Anti-hypertensive drugs.
d. Anti-anginal drugs.
e. Anti-arrhythmic drugs.
f. Drugs used in congestive heart failure & atherosclerosis
g. Anti-hyperlipidemic drugs.
h. Vasodilator drugs including calcium channel blockers and beta adrenergic antagonists
i. Drug used in the therapy of shock.

3. Drugs acting on the Hemopoietic system:

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

4. Peptides and Proteins as Mediators:

a. General Principles of peptide pharmacology.
b. Biosynthesis and regulation of peptides.
c. Peptide antagonists.
d. Protein and peptide as drugs.

5. Miscellaneous agents

a. Immunostimulants and immunosuppressants.
b. Therapeutic Drug Monitoring
c. Concept of Essential Drugs and Rational Drug use

6-P-3 Pharmacology–II (Practical)

Experiments based on Theory topics

6-T-4 Pharmacognosy –II

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. Tannins: 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.

6-P-4 Pharmacognosy –II (Practical)

Experiments based on Theory topics

6-T-5 Hospital and Community Pharmacy

1. Organization and Structure: Organization of a hospital and hospital pharmacy, Responsibilities of a hospital pharmacist, Pharmacy and therapeutic committee, Budget preparation and Implementation.

2. Hospital Formulary: Contents, preparation and revision of hospital formulary.

3. Drug Store Management and Inventory Control:
(a) Organization of drug store, Types of materials stocked, storage conditions.
(b) Purchase and Inventory Control principles, purchase procedures, Purchase order, Procurement and stocking.

4. Drug distribution Systems in Hospitals:
(a) Out-patient dispensing, methods adopted.
(b) Dispensing of drugs to in-patients. Types of drug distribution systems. Charging policy, labeling.
(c) Dispensing of drugs to ambulatory patients.
(d) Dispensing of controlled drugs.

5. Central Sterile Supply Unit and their Management: Types of materials for sterilization, Packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.

6. Manufacture of Sterile and Nonsterile Products: Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, Master formula Card, production control, Manufacturing records.

7. Drug Information Services: Sources of information on drugs, disease, treatment schedules, procurement of information, Computerized services (e.g., MEDLINE), Retrieval of information, Medication error.

8. Records and Reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases, etc.

9. Nuclear Pharmacy: Introduction to Radio- pharmaceuticals, radio-active half-life, Units of radio-activity Production of radio-pharmaceuticals, methods of isotopic tagging, preparation of radio-isotopes in laboratory using radiation dosimetry, radio-isotope generators, Permissible radiation dose level, Radiation hazards and their prevention, specifications for radio-active laboratory.

6-P-5 Project work

Submission of Project report as Review/ Research/field survey, etc.

B. Pharm. Seventh Semester

7-T-1 Biopharmaceutics

1. Introduction to biopharmaceutics: Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion, ion-pair formation and pinocytosis); Factors influencing absorption- biological, physico-chemical, physiological and pharmaceutical. Drug disposition: Factors affecting distribution and barriers, drug-protein binding in blood and tissue.

2. Phamacokinetics: Significance of plasma drug concentration measurements. Compartment model-definition and scope. Pharmacokinetics of drug absorption-Zero order and first order absorption rate constant using Wagner-Nelson and residual methods. Volume of distribution and distribution coefficient.

3. Compartment kinetics – One compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route. Clearance concept, Mechanism of renal clearance, clearance ratio, determination of renal clearance. Excretion ratio, hepatic clearance, biliary excretion, Extra-hepatic circulation. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration.

4. Clinical Pharmacokinetics: Definition and scope-Dosage adjustment in patients with and without renal and hepatic failure. Design of single dose bio-equivalence study and relevant statistics. Pharmacokinetic drug interactions and their significance in combination therapy.

8. Bioavailability and bioequivalence: Measures of bioavailability, C_{max}, t_{max}, K_{el} and Area Under the Curve (AUC); Design of single dose bioequivalence study and relevant statistics; Review of regulatory requirements for conducting bioequivalent studies. Biopharmaceutical Classification System (BCS) of drugs.

9. Performance evaluation methods
   a) In vitro dissolution studies for solid dosage forms, methods, interpretation of dissolution data.
   b) In vivo methods of evaluation and statistical treatment.

8. Software used in biopharmaceutics and pharmacokinetics and its importance.

7-T-2 Medicinal Chemistry –III

The synthesis and SAR of the compound, Classification under each class and Biochemical approaches in drug design wherever possible should be discussed.

1. **Diuretics:** Mersalyl, Ehacrynic acid Aminophyline, Aminometradine, Triameterene Acetazolamide and Bendroflumethiazide, Chlorthiazide, Chlorthalidone, Furesemide and Spironolactone mercurials, Carbonic anhydrase inhibitors and benzothidiazines
2. **Antihistaminic:** Ethanolamine derivatives- Diphenhydramine HCl, Dymenhydrinate, Pyrulaminemaleate, Pheniramine maleate, Chlorpheniramine maleate, Promethazine HCl
3. **Expectorants and Antitussive:** Potassium glucosulphonate, Terpene hydrate, Noscapine, Carbetapentane citrate.
4. **Antineoplastic drugs:** Drugs covered in major groups of anticancer drugs viz., alkylating agents, antimetabolites, antitumour antibiotics and plant alkaloids.
5. **Sulfonamides:** Mechanism of action of Sulfonamides, synthesis and uses of Sulphacetamide, Sulphaguandine, Sulphadiazine, Sulphamerazine, Sulphasomidine, Trimethoprim, Phathiazole, Sulphadoxin.
6. **Antibiotic:** Chemistry, Biosynthesis and semi-synthetic penicillin, Chloramphenicol & tetracycline, A study of the properties and use of Ampicillin, Kanamycin, Neomycin, Erythromycin, streptomycin, Nystatin, Bacitracin and Cycloserine. Structural variations in chloramphenicol and Tetracycline.
7. **Antitubercular drugs:** Study of PAS, Isonicotinaldehyde, thiosemicarbazine, Isoniazid, streptomycin, pyrazinamide, Ethambutol, Rifampicin, Ethionamide.
8. **Antifungal Agents:** Drugs covered in major classes of antifungal agents viz., polyene, imidazoles, thiazole, triazole, griseofulvin, tolnaftate.
9. **Anti-malarial:** Structure activity relationship in 4-amino-quinolines and 8- amino-quinolines. Synthesis and uses of Chloroquine, Amodiaquine, pamaquine, primaquine, Quoinacrine , proguanil and pyrimethamine.
10. **Antiviral including anti HIV agents**
11. **Anthelmintics:** A study of santonin, Ascaridol, Filicit, Antimalarial & antibiotics & anthelminitics. Synthesis of Diethyl carbamazine, Mebandazole, Piperazine citrate, Tetramisole, Levamisole
12. **Anti-amoebics:** Factors affecting the efficiency of antiamoebic drugs, Drug combination. A study of Emetine, conesine-9-quinolinals and antibiotics as antiamoebics, synthesis and uses of Bially-lunical, Mantomide and Dihydroxy quinoline, Metronidazole, Tinidazole.

7-P-2 Medicinal Chemistry –III (Practical)

Experiments based on Theory topics

7-T-3 Pharmacology – III

1. Drugs acting on urinary system:

a. Diuretics & anti-diuretics
b. Fluid and electrolyte balance

2. Autacoids:

a. Histamine and Antihistaminic drugs, 5-HT- its agonists and antagonists, drugs used in the treatment of migraine.
b. Prostaglandins, thromboxanes and leukotrienes.
c. Angiotensin, Bradykinin and other vasoactive peptides
d. Non-steroidal anti-inflammatory drugs

3. Drugs acting on the respiratory system:

a. Anti-asthmatic drugs including bronchodilators, nasal decongestants and mucolytics.
b. Anti-tussive and expectorants.
c. Respiratory stimulants.

4. Pharmacology of Drugs acting on the Gastrointestinal Tract

Management of Gastrointestinal Disorders- Peptic ulcer, Ulcerative colitis, Hepatitis and Cirrhosis.

a. Antacids, anti-secretary and antiulcer drugs.
b. Laxatives and antidiarrhoeal drugs.
c. Appetite stimulants and suppressants.
d. Digestants and carminatives
e. Emetics and anti-emetics.

5. Pharmacology of Endocrine system

Management of Endocrine Disorders-Diabetes mellitus and Thyroid disorders.

a. Basic concepts in endocrine pharmacology.
b. Hypothalamic and pituitary hormones.
c. Thyroid hormones and anti-thyroid drugs, parathormone, calcitonin and vitamin-D.
d. Antidiabetics, Insulin, Oral hypoglycemic agents and glucagon.
e. ACTH and corticosteroids.
f. Androgens and anabolic steroids.
g. Estrogens, progesterone and oral contraceptives.
h. Drugs acting on the uterus.

6. Chemotherapy

a. General Principles of chemotherapy.
b. Sulfonamides and co-trimoxazole.
c. Antibiotics- Penicillins, Cephalosporins, Chloramphenicol, Macrolides, Quinolines and Fluoroquinolins, Quinolones, Tetracyclines, Amino glycosides and Miscellaneous Antibiotics.
d. Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, AIDS, protozoal diseases, worm infestations, urinary tract infections and sexually transmitted diseases.
e. Chemotherapy of malignancy.
f. Anthelmintics and Anti-amoebics

7-P-3 Pharmacology – III

Experiments based on Theory topics

7-T-4 Pharmacognosy –III

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, Punarnava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi, Adusa, Arjuna, 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, Churnas, Lehyas and Bhasmas.

4. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy.

5. Marine pharmacognosy, novel medicinal agents from marine sources.

6. Natural allergens and photosensitizing agents and fungal toxins.

7. Chemotaxonomy of medicinal plants.

8. Herbs as health foods.

7-P-4 Pharmacognosy –III

Experiments based on Theory topics

7-T-5 Chemistry of Natural Products

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, ergot and vinca alkaloids.
7. Chemistry and biogenesis of medicinally important lignans and quassanoids, flavonoids.
8. Chemistry and therapeutic activity of penicillin, streptomycin and tetracyclines.

B. Pharm. Eighth Semester

8-T-1 Cosmetic Technology

1. Introduction to cosmetics: their applications, origin and development of cosmetic sciences. Fundamental of cosmetic science. Structure and functions of skin and hair. Formulation considerations of cosmetics
2. Formulation considerations: Preparation, packaging and evaluation of the following categories of cosmetics-
    i. **Face Preparation:** Face powder, Compact powder, Talcum powder, Face packs and Masks.
    ii. **Skin Preparation:** Skin creams, Anti-wrinkle preparations, Barrier materials, Protective creams and gels, Vanishing creams, Cold creams, Cleansing creams, all purpose creams, emollient, Anti-perspirant,/ deodorant, Moisturising and foundation formulation. Bleaching creams, Night and Massage creams, Hand creams Protective skin tonics, Skin moisturizers, Sun-screen, Suntan, and anti-sun burn preparation.
    iii. **Shaving Preparation:** Lather shaving stick, Lather shaving creams, Shaving foams, Shaving gels, Pre-and after shave lotions.
    iv. **Shampoo and Bath preparations:** Clear liquid shampoos. Aerosol shampoos, dry shampoos, Acid-balanced shampoos, Egg shampoos, Anti-dandruff Shampoos, Bath oils, Foam baths.
    v. **Hair Preparations:** Hair tonics, Hair conditioners, Hair lotions, Hair sprays, Hair dressings, Hair setting lotions and creams, Hair dyes, Bleaches, Hair waiving, Hair straightners and Hair strengtheners.
    vi. **Dentifrice:** Tooth powders, Tooth pastes, Denture cleansers.
    vii. **Foot Preparation:** Foot powders, Foot sprays, Foot creams, Corn preparations and Athelete's foot preparation.
    viii. **Baby care products:** baby powder, baby oils, baby lotions, baby creams, baby soaps
    ix. **Manicure Preparation:** Nail polish, Nail lacquers and Nail bleaches.
    x. **Herbal Cosmetics:** Cosmetics containing Aloe, Babul, Brahmi, Chandan, Cucumber, Haldi, Jatamansi, Khus, Mehandi, Neem, Reetha, Shikakai, Tulsi, Arnica, Bhringraj and Volatile oils .
    xi. **Colored make-up preparations:** Lipsticks, Rouge, Mascara, Eye make-up, Eye-liner, Eyebrow pencils.
3. Packaging and labelling of cosmetics. Safety and Toxicity Testing of various types of Cosmetics.
4. Perfumes in cosmetics: Synthetic, natural and artificial perfumes, classification of perfumes, manufacturing and blending of perfumes.
5. Emerging cosmetic products, use of drug delivery systems like liposomes, microcapsules, cosmetic patches, elastic vesicles as topical/transdermal drug delivery systems
6. Legal aspect of cosmetic products, Ingredient prohibited & restricted by FDA. Safety and current amendments, different specific regulatory systems, Legal authority and manufacture of cosmetics for sale,

8-P-1 Cosmetic Technology

Experiments based on Theory topics

Approved in meeting of Board of Studies in Faculty of Technology, Subject: Pharmacy Dt. October 03, 2013

8-T-2 Pharmaceutical Biotechnology

1. **Immunology and Immunological Preparations**: Principles, antigens and haptens, immune system, cellular humoral immunity, immunological tolerance, antigen-antibody reactions and their applications. Hypersensitivity, active and passive immunization; Vaccines- their preparation, standardization and storage.

2. **Genetic Recombination**: Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies. Study of biotechnology derived drugs such as Activase, Humulin, Humatrope, HB, etc.

3. **Fermentation**: Fermenter, its design, control of different parameters. Isolation of mutants, factors influencing rate of mutation. Design of fermentation process. Isolation of fermentation products with special reference to penicillins, streptomycins, tetracyclines and vitamin B_{12}, etc.

4. **Microbial Transformation**: Introduction and Principle, types of reactions mediated by microorganisms, design of biotransformation processes, selection of organisms, biotransformation process and its improvements with special reference to steroids.

5**. Enzyme immobilization**: Techniques of immobilization, factors affecting enzyme kinetics. Study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylases and proteases etc. Immobilization of bacteria and plant cells.

8-P-2 Pharmaceutical Biotechnology

Experiments based on Theory topics

8-T-3 Medicinal Chemistry –IV

The synthesis and SAR of the compound, Classification under each class and Biochemical approaches in drug design wherever possible should be discussed.

1. **Sex-hormones:** Synthesis of testosterone, progesterone & oestrone from diosgenin & cholesterol. Preparation & use of non steroidal estrogens, diethylstilbestrol, Monomesterol, Hexosterol, Ethinyl estradiol, Ethisterone, Testosterone, Propionate and methyl Testosterone.
2. **Cortex Hormones:** Synthesis of cortisone acetate from diosgenin and cholesterol. Preparation & uses of dexa-corticosterone acetate, hydrocortisone acetate, prednisolone & prednisone, dexamethasone, betamethasone.
3. **Non-Steroidal hormones**: Adrenaline & Thyroxin.
4. **Antidiabetic agents:** Insulin, Carbutamide, Chloropamide. Tolbutamide.
5. **Vitamins:** Constitution & physiological importance, vitamin A, thiamine, riboflavin, ascorbic acid, folic acid, pantothenic acid & pyridoxin.
6. **Medicinal Dyes:** Synthesis & uses of gentian violet, malachite green, brilliant green, amaranth, resochin brown, 9-aminoacridine, acriflavin,methylene blue and diloxinate furoate.
7. **Diagnostic agents:** General survey of important compounds.

8-T-4 Pharmacognosy –IV

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. Role of medicinal and aromatic plants in national economy. 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, taxol and tropane alkaloids.
3. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.
4. General techniques of biosynthetic studies and basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance.
5. Plant bitters and sweeteners.
6. Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.
7. 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.
8. Herbal cosmetics ingredients.

8-T-4 Pharmacognosy –IV

Experiments based on Theory topics

8-T-5 Industrial Management and Accountancy

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.

2. Accountancy: Principles of Accountancy, Ledger posting and book entries, preparation of trial balance, columns of cash book, Bank reconciliation statement, rectification of errors, Profits and loss account, balance sheet, purchase keeping and pricing of stocks, treatment of cheques, bills of exchange promissory notes and hundies, documentary bills.

3. Economics: Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labour welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.

4. Pharmaceutical Marketing: Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.

5. Salesmanship: Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing Recruitment, training, evaluation, compensation to the pharmacist.

6. Market Research: Measuring & Forecasting Market demands-Major concept in demand measurement, Estimating current demand, Geodemographic analysis, Estimating industry sales, market share & future demand. Market segmentation & Market Targeting.

7. Materials Management: A brief exposure or basic principles of materials management major areas, scope, purchase, stores, inventory control and evaluation of materials management.

8. 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.

9. Financial Management: Budget and its types: financial budget, expenditure budget, performance budgeting.