



Ph / I B / T / 114

Physics IB

3 pds / week

I) Stastical relations in living system

Conservation in biochemical energetics, Lose of thermodynamics in living system(irreversible and non equilibrium system), solution thermodynamics, Chemical potential, Electrolytic potential, Free energy, Thermodynamics of flexible linear polymers, Transport Phenomenon, Elements of coordination geometry.

II) Bonds, orbitals and spectra:

Nature of chemical bonds , molecular orbitals, Resonance, Sigma and Pi bonds, Bonding and antibonding orbitals, hydrogen bonds, Homonuclear and heteronuclear molecules, polar molecules, Dielectric properties of

Solutions, Electronegativity, Huckel's theory of orbitals , Strong and weak forces, London dispersive forces, Excited Molecular spectra.

III) Structures of biomolecules:

Biological fitness of organic compounds, water, protein, nucleic acids, lipids, phase transitions, X-ray Crystallographic and spectroscopic studies, correlation between structure and function, Circular dichroism and ORD, steric effects, Muscle fiber and muscle behavior.

IV) Cell Biology:

Cell structure and function ( Self regulation of cell reaction, self replication, laws of genetics etc.), functions of various intracellular organelles, membrane and its conformational properties, Nature of a nerve cell electron microscopy, radiation biology, Optical interference and phase contrast microscopy, centrifugation-ultracentrifuge.

V) Biological membranes:

Membrane structure, facilitated diffusion, Active membrane transport, membrane receptors, Membrane capacitance, membrane resistance, Membrane potential, Rheobase and chromaxie, cable properties and electronus; Action potential.

VI) Radioactivity:

Radio active emissions, Radioactive decay, radioisotopes, Detection and measurement of radioactivity, Radiation dosimetry, Biological applications of radio isotopes.

VII Gravity and G forces

Effect of gravity, G forces, Effect of G forces, protection against G forces, Effect of zero gravity.

VIII Lens aberration, Chromatic aberrations, Achromatic doublet, Spherical aberration and its remedies, Eye pieces and its objectives, Ramsden and Huygen's eyepieces, Principle of construction of simple microscope and compound microscope.

IX) nature of light waves, Interference of light waves, Young's Experiment, Spatial and temporal coherence, Fresnel' Biprism, interference from thin film, Newton's ring ,Determination of refractive index of a liquid by Newton's ring, Diffraction of light waves, Fresnel's and Fraunhofer diffraction pattern due to single slit and plane grating. Qualitative discussion on the pattern due to circular aperture. Resolving power of a microscope, Phase contrast microscope, Idea of an electron microscope, Spectrophotometer, Polarization of light waves, Brewster's law. Methods to obtain plane and circularly polarized light. Ordinary and extraordinary rays. Crystal anisotropy, double refraction, optical activity, determination of specific rotation.

Books:

Current topics in membrane transport: Bronner, F & Kleinzeller, A

Physics for Biology and premedical students: Burns, D.M. and  
 MacDonald, S.S.G.  
 Physics Part-I : R. Resnik and D. Halliday.  
 Fundamentals of Optics :R.A. Jenkins and H.E. White.  
 College Physics :D.B. Sinha & J.N.Das Sharma

**Hu / B / T / 115**

**Humanities---B**

**3 pds/ week**

**Syllabus for English**

- a) Comprehension
- b) Formal letter and writing a curriculum vitae : report writing ; paragraph writing(description and narration)
- c) Grammar and vocabulary
- d) Texts: any two of following
  - "Dear as the moon"
  - "Scientific Research for amateurs"
  - "Governmental checks industrial growth"
  - "Modern improvements"
  - "English for everyone"

**Pharm / Math / T /116**

**Mathematics I M**

**3 pds / week**

**CALCULUS**

- I) Differential calculus: Successive differentiation, Leibnitz theorem, Rolle's theorem (statement only), Mean Value Theorem, Taylor's theorem, Indeterminate forms, Functions of two variables, Partial differentiation, Maxima and Minima.
- II) Integral calculus: Properties of definite integrals, Beta and Gamma functions.
- III) Ordinary differential equations: Second and Higher order Differential equations with constant coefficients.

**Elementary matrix Algebra:**

- I) Introduction to matrix algebra.
- II) Determinants.
- III) Inverse matrix.
- IV) Rank and equivalence.
- V) Linear equations and linear dependence.
- VI) Laplace transform (preliminary treatment)

**Statistics: Overview of the following:**

- I) Frequency distribution.
- II) Measures of central tendency.
- III) Measures of dispersion.
- IV) Elementary probability theory.
- V) The Binomial, Normal and Poisson distribution.
- VI) Elementary Sampling Theory.
- VII) Statistical Estimation Theory.

- VIII) Statistical Decision Theory.
- IX) Small Sampling Theory- Tests of Hypothesis and Significance.
- X) The Chi Square Tests.
- XI) Curve Fitting: the methods of least squares.
- XII) Correlation theory.
- XIII) Multiple and partial correlations.
- XIV) Analysis of variance.
- XV) Non-parametric tests and parametric.

**Pharm/S/111****Pharmaceutical Biology Lab****3 Pds/Week**

- Identification of Invertebrate and Vertebrate species.
- Study of human Physiology by dissecting Mammalian species and demonstration by charts, models and slides.
- Study of Osteology of man and demonstration human skeleton and models.
- Microscopic study and slide preparation of Monocot and Dicot root and Stem.
- Morphological study of Phytochemically important Plants, as used in Ayurvedic and Homeopathic medicines.
- Dissection of Toad/Frog and identification of different organs.

**Pharm / Ph / S / 112****Physics Lab****3 pds/ week**

(Selected Experiments will be conducted from amongst the listed terms)

1. Determination of galvanometer resistance by half- deflection method.
  2. Determination of galvanometer resistance by Thomson's method.
  3. To find high resistance by galvanometer deflection method.
  4. To measure J by electrical method by copper colorimeter (radiation correction to be done).
  5. To compare low resistance by drop of potential method.
  6. To determine resistance per unit length of a wire using Carey Foster bridge.
  7. To estimate the strength of a current by using copper voltameter.
  8. A) To compare the e.m.f.s of two cells by using a potentiometer.  
B) To measure the current by using a potentiometer.
  9. To measure the horizontal component of Earth's magnetic field industry by using deflection and magnetometer.
  10. Determination of thermal conductivity of a metal by Searles method.
  11. To determine the coefficient of viscosity of a liquid by Capillary flow method.
  12. Determination of Young's modulus by Flexure method.
  13. To draw the mutual and anode characteristic of a triode and hence to find  $R_a$ ,  $\mu$ , and  $g_m$  from both sets of curves.
  14. To draw the transistor characteristics (NPN/PNP) in the given configuration.
- Book: A textbook of Practical Physics for B. Sc (Pass) Students by K.G. Majumder

**Pharm / ME / S / 113****Engineering drawing****4 pds / week**

I.S conventions of drawing- Lettering, scales, etc. orthographic projections- first and third angle concepts, isometric drawing and dimensioning.

Sections and sectional view.

Bolted and riveted joints, Welded joints , Pipe joints and fittings,

Types of flanges and working drawing of pulley , key etc. pressure vessel and auxiliaries- skirt, saddle etc.

Line drawing of agitator, ball mill, mixer , filter press, centrifuge, dryer , evaporator calandria, granulator, sieving machine, tablet machine etc.

Concept of flow diagram

Books:

Machine drawing by N.D. Bhat

Engineering drawing M. Bhattacharya.

**Pharm / ME / S / 114****Work shop practice****6 pds / week**

Pattern Making, Operation of lathe and operation of milling machine.

### First Year, Second Semester

**Pharm / T / 121****Pharmaceutics-II****4 pds/weeks**

Suspension: Theoretical consideration, preparation, evaluation, stability.

Emulsions: Definition, type of emulsion, theories of emulsification, pharmaceutical applications, preparation , stability and preservation.

Ointments: Classification, ointment bases, preparation and evaluation.

Paste: Bases of paste, preparation of paste.

Jelly: Type of jelly, jelling agents and their properties, preparation of jellies.

Lozenges: Definition and preparation.

Suppositories: Bases, method of preparation, quality control.

**Pharm / T / 122****Pharm. Chem – I ( Organic- 1)****4 pds/weeks**

1. Mechanistic aspects of organic reactions of different categories of aliphatic and aromatic compounds:

Hydro carbons, alcohols, alkyl and aryl halides, esters, carbonyl compounds, carboxylic acids and their derivatives, sulfonic acids, nitro compounds, amino compounds, diazonium salts, phenols.

2. Alicyclic compounds
3. Polynuclear aromatic hydrocarbons

**Pharm / T / 123**

**Pharm. Chem - II (Analytical I)**

**4pds / week**

### PHARMACEUTICAL ANALYSIS – I THEORY

Significance of quantitative analysis of quality control. Different technique of analysis, significant figures. Rules of 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.

#### ACID BASE TITRATIONS

Acid base concepts, Role of solvent, Relative strengths of acids and bases, ionisation, law of mass action, common ion effect, ionic product of water, pH, hydrolysis of salts, Henderson-Hasselbalch equation, buffer solutions, neutralisation curves, acid base indicators, theory of indicators, choice of indicators, mixed indicators, polyprotic system, polyamine and amino acid system, amino acid titration, application of assay of  $H_3PO_4$ , NaOH,  $CaCO_3$ , etc.,

#### OXIDATION-REDUCTION TITRATION

Concept of oxidation and reduction, redox reaction, strength and equivalent weights of oxidising and reducing agents, theory of redox titration, 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-dichloro phenol indophenol.

#### PRECIPITATION TITRATIONS

Precipitation reactions, solubility products, effect of acids, temperature and solvent upon the solubility of a precipitate, argentometric titrations and titration involving ammonium or potassium thiocyanate, mercuric nitrate and barium sulphate, indicators, Gay-Lussac method, Mohr's method, Volhard's method and Fajan's method.

#### GRAVIMETRIC TITRATIONS

Precipitation techniques, solubility products, the colloidal state, super saturation co-operation, post precipitation, 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.

#### NON-AQUEOUS TITRATIONS

#### COMPLEXOMETRIC TITRATIONS







effects of temperature and concentration of dispersed phase on viscosity, reological properties of suspension and emulsions, gels and paste.

Complexation: Metal complexes, organic molecular complexes, occlusion compounds; Methods of analysis; Thermodynamic treatment of stability constants; Complexation and drug action; Protein binding; physical properties of drug molecules.

**Pharm / T / 212**                      **Pharmaceutical Chemistry - III (Organic II)**                      **4 pds/ week**

- a) Orientation and reactivity in electrophilic aromatic substitutions
- b) Introduction to heterocyclic chemistry nomenclature with special reference to fused ring system and drugs.
- c) Five membered ring containing one and two hetero atoms and related drugs.
- d) Six membered ring containing one and two hetero atoms and related drugs.
- e) Fused ring system:  
Indole, benzofuran, benzimidazole, quinoline, isoquinoline, pteridine, quinazolone, purine, 1,4-benzodiazepine,  $\beta$ - lactam ring, coumarins, thioxanthenes and their related compounds.

**Pharm / T / 213**                      **Pharmaceutical Chemistry - IV (Physical)**                      **4 pds/ week**

1. Properties of real gases.
2. Properties of solids
3. Thermodynamics: The first law, Thermochemistry, The second Law, Free energy functions and applications.
4. Homogenous and Heterogenous chemical equilibria.
5. Solutions of non-electrolytes
6. Solutions of electrolytes
7. Ionic equilibria.
8. Buffered and isotonic solutions.
9. Solubility and distribution phenomena
10. Reaction kinetics
11. Adsorption and surface phenomena
12. Rheology; Viscosity.
13. Colloids.
14. Electrochemistry.

**Pharm / T / 214**                      **Pharmaceutical Chemistry - V (Inorganic)**                      **4 pds/ week**

1. **Water:** Chemical properties, natural water, potable water, softened water, purified water, water for parenterals, selection of suitable water

2. **Silicates in Pharmacy:** General chemistry of silica, silicic acid, amorphous silica system, kaolin, bentonite, talc, magnesium trisilicate, soluble silicates, glasses etc.
3. **Minerals I:** Fluid electrolytes and trace ions, fluid electrolyte replinisher, ionic structure and physiological suitability of electrolytes, calcemic and tonics. Fluorides and general health, iodine as antioiterogenic
4. **Mineral II:** Essential trace elements, transitional elements and their compounds, iron and the hematinics, mineral supplements
5. **Germicide and related substances:** General background, oxidising germicides, per oxides, halogen, and their oxo compounds
6. **Radio isotopes & radio - opaque:** Nuclear decomposition , uses of radio- isotopes
7. **Inorganic cathartics**

**Pharm / T / 215**  
week

**Introduction to Pharmaceutical Engineering**

**4 pds/**

1. Different unit systems, dimensional analysis, different types of plotting methods.
2. Problems related to stoichiometry. Concept of material balance. Definitions related to humidity, use of psychometric chart. Problems on humidity.
3. Theory and problems related to vapour pressure and thermophysics. Concept of heat balance.
4. a) Fluid statics, Measurement of pressure drop-- Simple, differential, inclined etc. , Fluid Dynamics in Newtonian system: Types of flow, Reynolds number, Bernoulli's theorem, Fluid friction, pipe roughness, sudden contraction and enlargement in pipes and pipe fittings, Flow measuring devices—Orificemeter, venturimeter, rotameter, pitot tube, weirs; pumps—centrifugal , gear, reciprocating, gear peristaltic etc.  
b) Non- Newtonian Fluid flow – Theory of various types of Non- Newtonian Fluid flow, modified Reynolds number etc.

**Pharm / T / 216**

**Human Anatomy and Physiology II**

**4 pds/ week**

- **RESPIRATORY SYSTEM:** Anatomy of the respiratory pathway, mechanism of respiration, lung capacities and volume, carriage of the respiratory gases, control of respiration – related disorders.
- **CENTRAL NERVOUS SYSTEM** (Conduction of nerve impulse, synapse, reflex action, postural equilibrium, condition reflex, sleep, cerebrum and cerebrospinal fluid) – related disorders.
- **AUTONOMIC NERVOUS SYSTEM** (classification), general arrangement, autonomic ganglia, sympathetic and parasympathetic systems – related disorders.
- **DIGESTIVE SYSTEM:** Physiology of digestion and absorption, liver and pancreas – related disorders.
- **REPRODUCTIVE SYSTEM** – related disorders.
- **Special Senses-in respect of Taste, Vision, Olfaction and Hearing.**

**Pharm / S / 211**

**Pharmaceutics Lab - II**

**4 pds/ week**

1. To study on the effect of complexing agents on the solubility of sparingly water soluble drug.
2. To study on the effect of co-solvent on the solubility of sparingly water soluble drugs.
3. To study on the effect of surfactant on the solubility of sparingly water soluble drugs.

4. To determine the bulk density and void porosity of powdered drugs.
5. To study the effect of lubricants on angle of repose of granules / powdered drugs.
6. Quantitative analysis of Salicylic acid using Spectrophotometer.
7. To study particle size distribution of granules by sieve method.
8. Determination of critical micelle concentration of surfactants.
9. Determination of HLB value of a surfactant.
10. Evaluation of physical stability of suspension.
11. To study the effect of pH on the solubility of a slightly soluble weak acid.
12. Determination of dissolution of tablets.
13. Determination of rate constant and half life of pseudo first order reaction.
14. Determination of second order reaction rate constant of ethyl-acetate in sodium hydroxide.
15. Determination of shelf-life of aspirin in 0.1(N) HCl using accelerated stability study.

**Pharm / S / 212      Pharmaceutical Chemistry Lab – III (Organic)      4 pds/ week**

Preparation of simple organic compounds based on different types of reactions such as nitration, sulfonation, oxidation, reduction, diazotization, hydrolysis, acylation etc. Examples: Aspirin, Acetanilide, Nitrobenzene, m-Dinitrobenzene, Benzamide etc.

Estimation of functional groups like carboxyl, hydroxyl, amino, acetyl, carbonyl, unsaturation, ester group and amino nitrogen.

**Pharm / S / 213      Physiology Lab      4 pds/ week**

- Identification of different visceral organs.
- Histological studies of different visceral organs (i.e. liver, lungs, kidney, spleen, pancreas, endocrine glands, muscle- skeletal, smooth, cardiac, Spinal cord, cerebellum, cerebrum,, testes, ovary etc.)
- Blood Pressure measurement.
- Human physiology: TC, DC, Hb, ESR, Clotting time, Bleeding time, ABO- Grouping, etc.
- Experimental Physiology: Handling, weighing, numbering, anaesthetizing and injection of mice/rat/rabbit.
- Canulation of trachea, artery, vein etc.
- Heart Curve: Normal curve, effect of temperature, ions and neurohormonal substances on normal heart curve.
- Muscle curve: Normal curve, effect of temperature, ions, loads, on normal muscle curve.

To study genesis of Tetanus

**Second year, Second semester**

**Pharm / T / 221      Pharmaceutics- IV      4 pds/ week**

Micromeritics: Definition, particle size distribution, particle size measurement, particle volume measurement, derived properties of powder: porosity, density of particles, packing arrangements, flow properties etc. Particle size analysis-newer developments.

Cosmetics: Shampoo, shaving products, hair oil, lipstics, antiperspirants, nail polish, nail polish remover, cleanser, toner, moisturizer, vanishing cream, cold cream, anti aging cream.

Surgical dressings: Features of an ideal dressing, fibres, fabrics, impregnated fabrics, bandages, self adhesive, plasters, and compound dressings.

Suture, ligature and catgut: Absorbable and non-absorbable sutures and ligatures; Preparation and sterilizations of surgical catgut; Blood and blood related products.

Incompatibility: physical, chemical and therapeutical.

Radiopharmaceuticals: Biological half life, medicinal and diagnostic uses of radio isotopes, Measurement of Radioactive molecules: Isotope dilution techniques, activation analysis.

**Pharm / T / 222      Pharmaceutical Chemistry - VI ( Natural products)      4 pds/ week**

Chemistry of natural products:

1) An introduction to medicine from natural resources

Insight to alternative systems of medicine; Drug development from natural products. Role of natural product in primary health care and the aspects related to their safety and toxicity. Ethnobotany and aspects biodiversity for development of natural products.

2) Phytopharmaceuticals development and evaluation

General technique used for extraction and isolation; Isolation and characterization of different classes of phytochemicals- qualitative test procedures; Phytomedicines with different dosage forms, their formulation and development.

3) Standardization and quality control of natural products:-

Secondary metabolites with therapeutic importance in natural products. Standardization of raw materials and herbal products, Factors related to quality of natural products. WHO guidelines for assessment of natural products, Sampling procedures, morphological examination, microscopical evaluation, evaluation of assessment parameters based on WHO guidelines, modern techniques used for evaluation of natural products; HPTLC, HPLC and GC, Stability testing of herbal drugs.

1) Drugs from natural origin with Phytochemical and therapeutic importance:

Chemistry, test, isolation and characterization and estimation of phytopharmaceuticals belonging to the group of Carbohydrate, Glycoside, Tannin, Saponin, Flavonoids, Lipids, Volatile oil and Resin, Alkaloids, Carotenoids, Steroids and Terpenoids. Pesticides of natural origin and miscellaneous products.

5) Regulatory and legal parameters for drug development from natural resources;

Various official monograph on natural products of therapeutic importance, regulation and guidelines on drug development from natural sources - Indian and global perspectives.

**Pharm / T / 223      Pharmaceutical Chemistry - VII (Advanced organic)      4 pds/ week**

1. Stereochemistry - Geometrical and Optical Isomerism

2. Physical properties of drug molecules: Electromagnetic radiation, Atomic spectra, Molecular spectra, UV and Visible spectrophotometry, Fluorescence and Phosphorescence, Dielectric constant and induced polarization, Permanent dipole moment of polar molecules, Infrared spectroscopy -- an

- elementary treatment, Electron spin resonance and NMR spectroscopy -- an elementary treatment, Refractive index and molar refraction, Optical rotation, Circular dichroism, Partition coefficient.
3. Nucleophilic aromatic substitutions  
 $\alpha, \beta$ -unsaturated carbonyl compounds  
 Molecular orbitals -- Orbital symmetry, Aromatic character, Electrocyclic reactions, Cycloaddition reactions, Sigmatropic shift.
  4. Organic name reactions with mechanisms

**Pharm / T / 224****Applied Microbiology - I****4 pds/ week**

- 1) Classification and nomenclature of microorganisms.
- 2) Microbiology of bacteria, yeast, molds and viruses specifically their structure, shape, size, distribution and their pathogenicity. Beneficial role of microorganisms
- 3) Cultivation and growth of bacteria and fungi.
- 4) Isolation of pure culture and identification.
- 5) Staining agents and staining methods of microorganisms e.g. - Simple staining, Differential Staining, Negative Staining and Acid Fast Staining.
- 6) Principles of sterilization and different methods, Sterilization of pharmaceutical products, Sterilization control and sterility testing.
- 7) Fundamentals of immunology: Toxoids, Vaccines, Antisera.
- 8) Disease and disease producing microorganisms, Virulence factors.
- 9) Microbial genetics and their role in industrial and medical microbiology.
- 10) Microbiological assay of antibiotics, vitamins and amino acids.

**Pharm / T / 225****Applied Biochemistry - I****4 pds/ week**

Basic elementary chemistry of carbohydrates, lipids, proteins and nucleic acids.

Metabolism : basic concepts and designs

Glycolysis, Citric acid cycle, Oxidative phosphorylation, Pentose phosphate pathway and gluconeogenesis, Glycogen and disaccharide metabolism.

Fatty acid metabolism, Introduction to biological membranes.

Food and nutrition:

General considerations, Vitamins, Growth factors, Mineral proteins caloric malnutrition.

**Pharm / S / 226****Industrial management****4 pds/ week**

Industrial management and record keeping:

Principles of economics: Want, Activity, Satisfaction of wants; Distribution under Laissez Faire and under socialism; public sector and private sector of Indian economy. Types of markets and goods; factors of production, optimization of factors inputs; Demands and supply; Price determination; specialization, location of industry; concept of social cost.

Principles of management :

Planning, organizing, staffing, Leading coordination and control: marketing, advertisements; Problems of uncertainty and risks; General principles of insurance. Inland and foreign trade, outlines of Factories Act and E.S.I. Act. Industrial organization; Limited liability system

**Pharm / S / 221****Pharmaceutical Chemistry Lab - IV ( Physical)****4 pds/ week**

- 1) Determination of viscosity of a liquid using Ostwald Viscometer
- 2) Determination of Surface tension of a pure liquid using different methods.
- 3) Determination of Interfacial tension between two liquids by the drop count method
- 4) Determination of transition temperature of sodium carbonate by solubility method.
- 5) Determination of mutual solubility curve of phenol and water.
- 6) Determination of variation of refractive index with the composition of liquid mixtures.
- 7) To test the validity of Beer-Lambert law using
  - I) Duboscq colorimeter:
  - II) Photoelectric colorimeter.
- 8) Determination of end point in a typical titration by Conductometric method.
- 9) Determination of the specific and molecular rotation of a compound using polarimeter.
- 10) Determination of velocity constant of a first order reaction.
- 11) Determination of coefficient of an organic compound between two solvents.
- 12) Determination of equilibrium constant of the equilibrium
 
$$KI + I_2 = KI_3$$
 by partition method.
- 13) study on the absorption of acetic acid on charcoal----- verification of Freundlich's adsorption isotherm.
- 14) Potentiometric titration.

**Pharm / S / 222****Applied Biochemistry Lab****4 pds/ week**

Experiments of sugar: Test of reducing sugar, Colorimetric estimation of sugar, Chromatography on sugars.  
 Experiments on lipids: Saponification number, iodine number. Experiments on amino acids and proteins:  
 Colorimetric estimation of proteins, Separation of amino acids by paper chromatography.  
 Experiments on clinical Biochemistry: Blood Glucose Estimation, Cholesterol in Blood. Separation of  
 plasma proteins by paper electrophoresis, Non protein nitrogen in blood, Separation of plasma proteins by  
 fractionation .  
 Experiments on Vitamins from sources: Assay of thiamine, riboflavin and vitamin B<sub>12</sub> .  
 Experiments on Enzymes : Effect on pH, Effect on temperature, Use of inhibitors.  
 Fundamental methods of analysis: Spectrophotometric, Fluorimetric and Electrophoretic .

### THIRD YEAR FIRST SEMESTER

**Pharm / T / 311****Pharmaceutics - V****4 pds / week**

Tablet: Definition, types, additives; Methods of preparation; Processing problems, evaluation, commercial processing equipments, other compressed tablets, flow design for tablet manufacturing.

Tablet coating: Sugar coating process, characteristics and requirements of uncoated tablet, equipments, film coating process-materials, solvents, and additives for film coating, air suspension coating and dip coating, film testings and film defects, electrostatic coating, laminated coating, physiological availability.

Capsules: Manufacturing area design, lay-out and flow diagram of capsule manufacture; hard gelatin capsule; materials for capsule; method of capsule shell production; capsule filling equipments; capsule filling operations; soft gelatin capsule; Size and shape, methods of manufacture; nature of capsule shell and capsule content, and evaluation.

. Biopharmaceutical consideration of the following dosage forms such as solution, suspension, capsule, tablets, coated tablets, prolonged released products, injectables, aerosols, ophthalmic preparation, and topical dermatological preparation. Bioavailability and Bioequivalence.

**Pharm / T / 312      Pharmaceutical Chemistry - VIII ( Analysis II)**

**4 pds / week**

1. Extraction procedure including separation of drugs from excipients,
2. Chromatography:

Following techniques will be discussed with relevant example of Pharmacopoeial products - TLC, HPLC, GLC, HPTLC, Paper chromatography, column chromatography.

3. Instrumental Analysis:- Theory and application of the following instruments, Potentiometry, UV -Visible Spectrophotometry, conductimetry, NMR, Mass spectrometry, polarography, X-Ray diffraction analysis. Amperometry, Fluorimetry, Flame photometry, Atomic absorption Spectroscopy, Radio Immuno assay.

4. Quality assurance. GLP, ISO 9000, TQM, Quality review and Quality Documentation

5. Regulatory control, regulatory drug analysis, interpretation of analytical data.

6. Validation, Quality audit, quality of equipment, validation of equipments, validation of analytical procedures.

**Pharm / T / 313**

**Medicinal Chemistry - I**

**4 pds / week**

**THEORY AND BASIC PRINCIPLES OF MEDICINAL CHEMISTRY**

Physicochemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action, drug receptor interaction including transduction mechanisms.

**PRINCIPLES OF DRUG DESIGN (THEORITICAL ASPECTS)**

Different aspects of structure-activity relationships in drug design (general treatment). Concept of Pharmacophore and lead optimization.

**SYNTHETIC PROCEDURES OF SELECTED DRUGS, MODE OF ACTION, USES, STRUCTURE ACTIVITY RELATIONSHIP INCLUDING PHYTOCHEMICAL PROPERTIES OF THE FOLLOWING CLASSES OF DRUGS:**

- A) Drugs acting at synaptic and neuroeffector junction sites:

- 1) Cholinergics and anticholinesterases
- 2) Adrenergic drugs
- 3) Antispasmodic and antiulcer drugs
- 4) Neuromuscular blocking agents

- B) Autocoids:

- 2) Antihistamines

3) Eicosanoids

4) Analgesic, Antipyretics, Antiinflammatory (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.

**Pharm / T / 314**

**Pharmacology - I**

**4 pds / week**

- General Pharmacology: Introduction, Routes of Administration of Drugs, Mechanism of action of Drugs (Absorption, Distribution, Metabolism and Excretion of Drugs).
- Basic idea of mechanism of Drug action, Drug Toxicity.
- Pharmacology of ANS - Neurohumoral transmission, Drug acting on Sympathetic and Parasympathetic system.

Principles of Toxicology- Poisons and Antidote

**Pharm / T / 315**

**Applied Biochemistry - II**

**4 pds / week**

Introduction to protein structure and function:

Three dimensional structure, Stability and denaturation of proteins, Allosteric proteins, Amino acid degradation and urea cycle, Introduction to enzymes , Mechanism of enzyme action.

Storage, transmission and expression of genetic information , DNA, Genetic code,

Gene protein relation. protein synthesis, control of gene expression, Gene rearrangement. Molecular diseases: Sickle cell anemia.

Enzyme & coenzymes,: Classifications, Enzyme kinetics, Michaelis-Menten Equation, Modification of enzyme activity, Mechanism of enzyme action

Protein and Nucleic acid metabolism: Metabolism of important amino acids, urea cycle, creatine, creatinine, phospholipids, Metabolism of cholesterol and bile acids, Role of hormones in metabolism, ketogenesis and ketolysis

Structure and conformation of proteins, Protein ligand interaction as the basis of antibody receptor and enzyme action; Active site and allosteric site for enzymes. Feed back regulation and drug development; Enzymes in Pharmacopoeias.

Study of metabolism in relation to drug development:

Differential centrifugation and biofunction of organelles; Glycogen metabolism and cyclic AMP as second messenger; Nucleotide sugars, amino acid transformation , histamine , and serotonin;

Purine Biosynthesis and therapy of neoplasm; Cholesterol biosynthesis and steroidogenesis;

Enzymatic basis of biotransformation of drugs, cytochrome.

Hormones : Mechanism of secretion, Mode of action of steroid hormones and protein and peptide hormones, their preparation & biochemical functions, Assay methods and role as a drug.

Vitamins; Mode of action of vitamins, Assay methods from sources.

Elements of molecular biology: DNA as hereditary material, DNA double helix, different types of functions of RNAs. Phage cycle and message transformation, Basic steps in replication, Transcription and translation, Genetic code.

**Pharm / T / 316**

**Forensic Pharmacy**

**4 pds / week**

A study of the dangerous drug act 1930, Opium Act, poison act, the Excise act and rule, the Drug and Magic Remedies act and such other acts as materially affect the pharmaceutical profession. Code of ethics for the



pharmacists. Study of the various enquiry commission which have been set up by the Government of India or the State Governments to enquire into affairs of Drug Industry, trade or profession.

A study of Drugs & Cosmetics Act, 1940 and Rules there under: 1945 in the context of manufacture and sale of different drugs and their formulations. Labeling of Pharmaceutical Products.

A survey of the Pharmacy Act 1948 and its impact on the development of the pharmacy profession in India. Study of other relevant legislations affecting the profession of Pharmacy and the drug industry in India.

**Pharm / S / 311**

**Pharmaceutics Lab - III**

**4 pds / week**

Non systemic liquid antacid preparation, Application and related emulgents, Non staining iodine preparation, Syrup IP, Syrup based liquid preparation, Effervescent preparation, Tooth Powder, Liquid Disinfectant, and Ointment

**Pharm / S / 312**

**Pharmaceutical Chemistry Lab - V (Natural products)**

**4 pds / week**

1. Estimation of alkaloid content in crude drugs and pharmaceutical formulations.
2. Estimation of functional groups like hydroxyl, acetyl, methoxyl, carboxyl, esters etc.
3. Qualitative identification tests for drugs and pharmaceuticals in official formulations.
4. Assay of drugs and bioactive substances using HPLC, GLC etc
5. Chromatographic Analysis

**Pharm / S / 313**

**Applied Microbiology Lab**

**4 pds / week**

- 1) Different methods of sterilization : Moist heat, Dry heat, Filtration through Bacterial filter.  
Sterility testing of injectables according to I.P.
- 2) Microscopic examination of microbes including bacteria, yeast and fungi. Gram staining of bacteria.
- 3) Preparation of basic media for culture of microorganisms : Liquid and solid media. Growth on slants and Petridis. Cultivation and isolation of bacteria. Bacterial counts. Fermentation reactions.
- 4) Evaluation of antiseptic / disinfectants: Rideal-Walker Test (Phenol Co-efficient)
- 5) Assay of antibiotics : Well diffusion and Disc diffusion method; MIC and MBC of antibiotics.
- 6) Assay of vitamins/ amino acids.

**THIRD YEAR SECOND SEMESTER**

**Pharm / T / 321**

**Pharmaceutics - VI**

**4 pds / week**

Parenteral products: Route of administration, selection of vehicles, added substances; containers; suspension and emulsion for injections; production-facilities; environmental control, personnel; cleaning of containers and closures; sterilization of equipments; compounding, filtration, filling and sealing procedures; sterilization of products; various quality control test for parenteral products.

Ophthalmic products: Eye drops, eye lotions, eye ointments, formulation, additives, preparation, sterilizing, packaging; contact lens solutions.

Aerosol: Mode of operations, propellants, containers, valves, actuators, buttons, diptubes; packing, application and testing.

Biopharmaceutics: Mechanism of drug absorption, factors affecting drug absorption ( biological, physical, chemical, dosage form, excepients), distribution of drugs; excretion

Basic Concepts of sustained and controlled release dosage form:

Microcapsules, gastro retentive, mucoadhesives, buccal and sublingual preparations, transdermal patches & other topical products,

Iontophoresis & Sonophoresis: Fundamental and applications

An overview on Nutraceuticals including role of antioxidants in optimal health.

**Pharm / T / 322**

**Medicinal Chemistry - II**

**4 pds / week**

Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including physico-chemical properties of the following class of drugs:

**STEROIDS AND RELATED COMPOUNDS**

Steroidal nomenclature and stereochemistry, androgens and anabolic agents, estrogens and progestational agents, adrenocorticoids.

**DRUGS ACTING ON THE CENTRAL NERVOUS SYSTEM**

General anaesthetics, local anaesthetics, hypnotics and sedatives, opioid analgesics, antitussives, anticonvulsants, antiparkinsonian drugs, CNS stimulants, psycho pharmacological agents, (Neuroleptics, antidepressants, anxiolytics).

**DIURETICS, ANTICOAGULANT AND ANTIPLATELET DRUGS AND CARDIOVASCULAR DRUGS**

Antihypertensives, cardiotonics, antianginals, antiarrhythmics and antihyperlipidemic drugs.

**Pharm / T / 323**

**Pharmacology - II**

**4 pds / week**

- Drugs acting on CNS - Sedative and Hypnotic agents, Psychotropic drugs including Psychomimetics, Drugs used for Epilepsy.
- Analgesics - Anti-inflammatory drugs, anti arthritic and anti gout drugs, Narcotic analgesics. .
- Drugs acting on Endocrine system –  
Drugs used in the treatment of thyroid disorders, Drugs acting on Pituitary and Adrenal Cortex, Hypoglycemic agents
- Drug Discovery – including concepts of Clinical Trials.

**Pharm / T / 324**

**Pharmacognosy - I**

**4 pds / week**

1. Definition, history, scope and development of Pharmacognosy
2. Classification of drugs: Alphabetical, Morphological, Taxonomical, Chemical and Pharmacological classification of Drugs.
3. Systematic pharmacognostic study of the following:
  - a) Carbohydrates and derived products: Agar, guar gum, acacia, honey, Isapgul, pectin, Starch, Sterculia and Tragacanth.
  - b) Lipids, Beeswax, Castor oil, Cocoa butter, Cod liver oil, Hydnocarpus oil, kokum butter, Lard, Linseed oil, Rice Bran oil, Shark liver oil and Wool fat.
4. Pharmaceutical Aids: Study of Pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors.

5. 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.
6. 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.
7. Fibres: Study of Fibres used in pharmacy such as cotton, silk, wool, nylon, glasswool, polyester and asbestos.
8. 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.
9. Tannins: Study of tannins and tannin containing drugs like Gambier, black Catechi, gall and Myrobolan. The holistic concept of drug administration in traditional systems of medicine. Introduction to ayurvedic preparations like Arishtas, Asavas, Gutikas, Churnas, Lehyas, and Bhasmas.
10. Plant growth Regulators and Tissue culture and its application in Pharmacy.

**Pharm / T / 325****Pharmaceutical Engineering- I****4 pds / week**

1. Heat transfer: Theory of heat transfer by conduction, convection and radiation. Concept of film and overall heat transfer coefficients; heat transfer from condensing vapour, heat transfer to boiling liquids; heat exchangers. Problems on heat transmission.
2. Evaporation: Types of evaporators. Calculation on evaporator. Overall heat transfer coefficient, steam economy and problems related to evaporator.
3. Size reduction: Crushing and grinding theory , milling equipments and related problems.
4. Separation : (a)Screening, theory of sedimentation, Stoke's law, classification of particle size by elutriation.(b) Theory of filtration, various industrial filtering equipments. (c) Theory of centrifuging, centrifuges.
5. Mixing: Theory of agitation of liquid system and related problems. Mixing of powder and semisolid materials.
6. Crystallization: Basic concept on solubility, Meirs supersaturation theory, caking of crystals, crystallizers and related problems.

**Pharm / T / 326****Applied Microbiology - II****4 pds / week**

- 1) Chemotherapy, Chemotherapeutic agent/Antimicrobial agents, Chemoprophylaxis/Chemoprevention, Antibiotics.
- 2) Classification of chemotherapeutic/antimicrobial drugs and their origin.
- 3) Manufacture of antibiotics and mechanism of action of antibiotics.
- 4) Bacterial resistance to antibiotics.
- 5) Chemical disinfectants, antiseptics and preservatives: Evaluation and mode of action.
- 6) Ecology of microorganisms affecting pharmaceutical industry.
- 7) Microbial spoilage and preservation of pharmaceutical products.
- 8) Pharmaceutical products of microbial origin.



**Pharm / T / 412****Medicinal Chemistry - III****4 pds / week**

1. Drug metabolism and concept of prodrugs.
2. Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship (including physiochemical aspects) of the following drugs (biochemical approaches in drug designing wherever applicable should be discussed).
  - i. Antibiotics : Detailed studies on penicillin, cephalosporins, macrolides, tetracyclines, chloramphenicol.
  - ii. Synthetic agents : sulphonamides, quinolones, fluroquinolones.
  - iii. Chemotherapeutic agents : Antiamoebic, antifungal, antimalarials, anthelmintics.
  - iv. Anticancer agents
  - v. Antiviral including anti HIV agents.
  - vi. Diagnostic agents.
  - vii. Antimycobacterial agents
3. Amino acids, peptide, nucleotide and related drugs.
  - a. Thyroid and antithyroid drugs.
  - b. Insulin and oral hypoglycemic agents.
  - c. Peptidomimetics and neucleomimetics.

**Pharm / T / 413****Pharmacology - III****4 pds / week**

- Renal Pharmacology: Diuretics.
- Autocoids: 5-HT, GABA, Bradykinin and lipid derived eicosanoids.
- Anti allergic drugs.
- Respiratory pharmacology: Drugs used in the treatment of various disorders of the respiratory tract.
- Chemotherapy:
  - a) Bacterial infections: Anti bacterial drugs (drugs acting on the cell wall, affecting protein synthesis, topoisomerase inhibitors, anti-tubercular drugs and miscellaneous agents).
  - b) Viral diseases: Anti viral drugs.
  - c) Protozoal diseases:
    - (i) Malaria and anti malarial agents.
    - (ii) Leishmaniasis and anti Leishmanic drugs
    - (iii) Drugs with trypanocidal activity.
    - (iv) Anti amoebic drugs.
    - (v) Helminthic infection and anthelmintic drugs.
- Cancer chemotherapy.

**Pharm / T / 414****Pharmacognosy - II****4 pds / week**

1. Quality control of Crude drugs; Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation.
2. Phytochemical Screening:
  - a) Preparation of Extracts.

- b) Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthroquinones, Triterpenoids cyanogenetic glycosides, amino acids in plant extracts.
3. Plant bitters and sweeteners.
4. Biological sources, preparation, identification tests, and uses of the following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.
5. Natural allergens and photosensitizing agents and fungal toxins.
6. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substituents, 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, hyocysamus, datura, duboisia, coca and withania.
  - c) Quinoline and Isoquinoline: Cinchona, ipecac, opium.
  - d) Indole: ergot, rauwolfia, catharanthus, nux-vomica and physostigma.
  - e) Imidazole: Pilocarpine.
  - f) Steroidal: Veratrum and Kurchi.
  - g) Alkaloidal amine: Ephedra and Colchium.
  - h) Glycoalkaloid: Solanum
  - i) Purines: Coffee, tea and cola.
7. 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) Cardiovascular sterols: Digitalis, squill, strophanthus and thevetia.
  - iii) Anthroquinone Cathartics: aloe, senna, rhubarb, and cascara.
  - iv) Others: Psoralea, Ammi majus, Ammivisnaga, gentian, saffron, chirata, quassia.
8. Chemistry and biogenesis of medicinally important lignans and quassionoids, flavonoids.
9. Alkaloids; Chemistry, biogenesis, and pharmacological activity of Atropine and related compounds; Quinine, Reserpine, Morphine, Papavereine, Ephedrine, Ergot and Vinca alkaloids.
10. Marine pharmacognosy, novel medicinal agents from marine sources.
11. Herbal cosmetics.
12. Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.

**Pharm / T / 415****Elective - I****4 pds / week****a) INDUSTRIAL PHARMACY I**

Bioavailability: the concept of bioavailability of drugs formulated as dosage forms, Generic Equivalence and inequivalence of oral product, Bioequivalence and therapeutic equivalence, Bioinequivalence, and therapeutic inequivalence. Illustrative examples.

Current G.M.P and Pharmaceutical processes validation; Scope and definition, organization and personnel etc.

Instrumentation in pharmaceutical industry: Measurement of temperature, pressure, density, humidity, viscosity, level and flow rate, and pollution control devices.

Pilot plant study and scale-up techniques: Details of Pilot Scale-up methods, scope and uses.

Manufacturing or isolation of the following groups or categories from plants and animals; Secondary metabolites or drug constituents and secondary metabolites or Pharmaceutical Adjuvant.

Sterilization in Pharmaceutical Industry and its control

Fundamentals of immunology: toxins (bacterial, fungal etc.) preparation of antitoxins, toxoid standardization;

Manufacture of immunological products

And their quality control, toxicity tests for vaccines and disinfectants.

a) Newer Drugs And Biotechnological Applications—I

Drug Discovery Technology: Drug Design, Free-Wilson analysis, Hansch Analysis, Fujita-Ban analysis.

Carbohydrate, lipid, protein and nucleic acid metabolism; Genetic Engineering.

Isolation, Purification and Standardization of biologically active compounds.

**Pharm / S / 411**

**Pharmaceutics Lab - V**

**3 pds / week**

Evaluation of dosage form as per compendium.

**Pharm / S / 412 Pharmaceutical Chemistry Lab - VII (Med Chem Lab II)**

**3 pds / week**

1. Assay of antibiotics, ( like Streptomycin , Penicillin e.t.c.), Vitamins (like ascorbic acid), hormones by instrumental and other methods.
2. Assay of various classes by novel and classical methods e.g. INH, Sodium salicylate by iodimetry; Phenobarbitone, metronidazole, Ephedrine, e.t.c. by non aqueous titration; Hetrazan by extraction followed by residual alkalimetry; Paracetamol by UV spectrophotometry; Piperazine Citrate by Gravimetry; Sulpha drugs by potentiometric titrimetry etc.
3. Estimation of water content , alcohol content , ash content , fat content in medicinal and pharmaceutical agents.
4. Preparation of medicinal agents

**Pharm / S / 413**

**Pharm. Engineering Lab**

**4 pds / week**

Pharmaceutical Engineering Laboratory

Experiments:

1. Experiments on Reynolds Apparatus—determination of critical point.
2. Particle size measurement by Stoke's law.
3. Experiment on filtration by laboratory apparatus- determination of specific cake and filter medium resistance.
4. Study of the effect of filter aids on rate of filtration.
5. Experiment on pot mill—determination of Rittinger's law and Kick's law coefficient.
6. Experiment on cabinet tray dryer.
7. Experiment on cabinet bench scale tray dryer.
8. To study the performance of laboratory fluid bed dryer.
9. Determination of overall heat transfer coefficient.
10. Experiment on batch distillation to verify Rayleigh's equation.
11. Determination of humidity of air by dew point method.
12. Determination of crystallization.
13. Engineering drawing on different laboratory equipments like vacuum tray dryer, pot mill, fluid bed dryer, leaf filter setup, batch crystallizer, bubble cap column and spray dryer etc.

**Pharm / S / 414****Pharmacology Lab****3 pds / week**

- Study of different apparatus and experimental devices in pharmacology with particular reference to Isolated tissue preparation.
- Drugs acting on the eyes.
- Narcotic analgesic activity.
- Non-Narcotic analgesic activity.
- Sedatives, hypnotics and muscle relaxants.
- Anti convulsive activity.
- Local Anaesthetic activity.
- Pyrogen testing
- Drugs activity on smooth muscle.
- Drug activity on Skeletal muscle.
- Drug activity on perfused heart.
- Assessment of Anti-inflammatory activity.

#### **FOURTH YEAR SECOND SEMESTER**

**Pharm / T / 421****Pharmaceutics - VIII****4 pds / week**

Regulations of clinical trials: Ethical guidelines, regulatory guidelines & legislation, clinical trial directives, GMP.

Intellectual property rights (IPRs) with reference to the Patents Act: What is a patent? Criteria adopted for grant of a patent, when should an application for patent to be filed, essential documents needed to be submitted by a potential patentee. An opposition under the Indian Patent Act, 1970, cost of filling a patent, where to apply?

Pharmacokinetics

Principles of Pharmacokinetics: first order, zero order, Biological half life , Pharmacokinetics of Multiple Dosing ,Dosage regimen design based on mean average , minimum and maximum plasma concentrations, Concept of Steady state plasma concentration and Renal clearance, One compartmental open model and calculation, Basic idea of two compartmental model and its use, concept of AUC,  $C_{max}$ ,  $T_{max}$ , Absorption and Elimination rate constants, lag time, onset of action, duration of action, termination of action, Flip-flop phenomena .

Non-Linear Kinetics: Special reference to Michaelis-Menten equation.

Hospital pharmacy practice: Professional aspects of hospital pharmacy organizations and administration, functions, standards, planning, legal aspects, formulary.

**Pharm / T / 422****Medicinal Chemistry - IV****4 pds / week**



1. Theoretical aspect of rational drug design
  - a) Influence of structural variations and physicochemical properties on drug action.
  - b) The drug development process.
  - c) An introduction to Classical QSAR
  - d) Computers in Medicinal Chemistry
2. Hormones
3. Vitamins
4. Immunosuppressants.

**Pharm / T / 423****Pharmacology - IV****4 pds / week**

1. Bioassay and biological standardization of drugs.
2. General and Local Anaesthetics.
3. Drugs that act on haemopoietic system.
4. Drugs acting on cardiovascular system: Anti arrhythmic drugs, Cardiotonic drugs, Anti anginal drugs, Anti hypertensives and Hypolipidemics.
5. The drugs acting on Gastro Intestinal Tract and Antiemetics.
6. Respiratory pharmacology: Drugs used in treatment of various disorders of the respiratory tract.

**Pharm / T / 424****Pharm. Engineering - II****4 pds / week**

1. Interphase mass transfer and gas absorption: Diffusion in gas and liquid systems, and related theory; packed tower operations and related problems.
2. Distillation: Raoult's law and Henry's law; Boiling point diagram, relative volatility. Different types of distillations for example: batch distillation (Raleigh's equation) , and distillation in different rectification columns etc; theory on rectification , McCabe Thiele design method , plate efficiencies. Problems on distillation.
3. Extraction: Leaching, liquid- liquid extraction, related theory, equipment and problems.
4. Drying: Theory of drying, related factors (humidity, airflow etc), various drying equipment and related problems. Shrinkage and case hardening in drying operation.
5. Materials of construction: Metals and alloys for fabrication pharmaceutical equipments and properties of materials. Corrosion problem and its prevention.
6. Basic idea on Unit process.
7. Basic instrumentation and control in pharmaceutical industry. Measuring devices for a) Temperature b) Pressure c) Flow d) Level e) Density f) Humidity, and g) Level.

**Pharm / T / 425****Elective - II****4 pds / week****a)Industrial Pharmacy—II**

Stability studies of Pharmaceuticals: Stability program at preformulation and formulation stages of Pharmaceuticals, Stability prognosis for marketed batches of products.

Physics of tablet compression: Physicochemical and physicomechanical properties of granules affecting the degree of compression, Static and dynamic factors involved in compression, Binding mechanisms in compression, Illustrative examples.

Bioprocess: Fermentation technology, Fermenter design ; basic knowledge on batch microbial production ; continuous and fed batch fermentation; fermenter design; media formulation; batch and continuous types in sterilization of media, and recovery of products of fermentation.

Chemical process: Reactors used in the production of synthetic chemicals of pharmaceutical uses by nitration, amination, halogenation, oxidation, hydrolysis, esterification, alkylation etc.

Principles and equipment involved for processing any categories under “A” and for the following topics: Size reduction of tissues, dehydration or drying, solvent and solubility, filtration, Preservation of Extractives or Isolates, Packaging or Labeling.

Ecology of Microorganisms affecting Pharmaceutical is processing: Aspect of microbiological technique in Pharmaceutical Industry.

Microbiological Aspects of fermentation for drugs of microbial origins.

Production of therapeutically useful substance by recombinant DNA technology.

b) Newer Drugs and Biotechnological Application—II

Modern Concept relating to design and analysis of drugs including GMP.

Mechanism at the cellular, enzymatic and molecular level, development of diagnostic kits, future perspectives.

Screening of Newer drugs

Target sites of drug action. Different aspects of drug metabolism, clinical trial.

**Pharm / S / 421**

**Project / Seminar**

**6 pds / week**

Syllabus : pertaining to the syllabus covered under theory for final year

**Pharm / S / 422**

**Pharmaceutics Lab - VI**

**4 pds / week**

Cosmetic preparations, Creams and gels, Shampoo, After-shave lotion, Body powder, Face powder, Face compacts, Nail polish, Nail polish remover, Lipsticks, Perfumes.

**Pharm / S / 423**

**Pharm. Chemistry Lab – VIII ( Med Chem Lab III)**

**4 pds / week**

Assay of various classes of drugs using modern techniques.