

Botany

1. Relation of Botany to Pharmacy:- The broad division of plant kingdom, Botanical nomenclature.
2. General Morphology and modifications of:- Roots, Stems, Leaves, Flowers, Fruits, seeds, and Spores.
3. Elementary structure and formation of cell including mechanical and chemical modification of cell walls tissue and tissue systems, Non living cell contents - starch, calcium oxalate, crystals crystallites etc.
4. General histology of:- Stems , Roots , Leaves , Hairs and Glands. General knowledge of secondary growth including annual rings and autumn and spring wood.
5. General Character of the following angiospermic families:- Liliaceae, Solanaceae, Apocyanaceae, Umbelliferaceae, Compositae and Leguminaceae.
6. Plant Physiology:- Food material of Plants and their sources and formation, Absorption. Ascent of sap. Transpiration, Nutrition and metabolism. Digestion and respiration, growth and movement.

Cell, Structure and ingredients, cell Division-Mitosis, Meiosis

Tissues: - connective, Epithelial, Muscular, Simple Skeletal and Nervous tissue.

Blood Composition, Properties,

Unicellular organisms : Amoeba.

Coelenterata : Hydra.

Annelida : Earthworm.

Arthropoda : Cockroach and Mosquitoes.

Characters of vertebrates and outline classification.

(a) Amphibia, Frog.

(b) Mammal : Rabbit or Rat or Guinea pig.

General Biology : Heredity, Mendel and his laws, Evolution and theories.

## BIOLOGY PRACTICAL

1. Cutting of T.S. of the materials of primary and secondary structures of and Monocot Root, Stem and leaf
2. Dissection of the floral parts of the plants under the families included in syllabus and their description.
3. Practice in "Spotting".
4. Simple physiological experiments.
5. Dissection :
  - (a) Earthworm: General anatomy, Digestive, reproductive and Nervous system.
  - (b) Cockroach : General anatomy, Digestive and nervous system.
  - (c) Frog : general Anatomy, Digestive system, Arterial, Venous and pulmonary systems. Brain and cranial nerves.
6. Studies of permanent slide and charts mentioned in syllabus.
7. Preparation of temporary mounts of followings :- Setae, Ovary, Septal nephridia and spermatheca of earthworm, Mouth parts, Tracheae and salivary glands of cockroach. Striped and unstriped muscles of frog. Blood of frog and mammal.
8. Museum specimens :- Bath sponge, physalia, Aurelia, Sea anemone, Leech, fluke, Taenia solium, Leach, prawn, Pila, crab, Scorpion, Unio, Starfish, Scolopendra, Labeo, Hyla, Wall lizard, Cobra, Karait, Tortoise, Bat.
9. Study of Mammalian characters with the help of permanent slides Model and Charts.

## Human Anatomy & Physiology

General principle of Human Physiology. The structural basis of the body and the elementary and proximate constituents of protoplasm.

**Tissues:** Simple and compound Epithelial tissues, histological studies and their physiological function in the body. Different types of connective and Muscular Tissues and striated muscles, Nervous Tissues, study of Nerve fiber.

**Blood:** its Composition and function, plasma and serum, Different types of Blood cells, classification of white Blood corpuscles Normal count of WBC and RBC, their regulation various factors which influence the RBC and WBC count, Importance in clinics, Haemoglobin - protein Nitrogen substance, normal Value and their importance in clinics. Clotting process and the different steps involved in the clotting of Blood. Various clotting factors-Extrinsic and Intrinsic factor for thromboplastin generation process. Anaemia and its various types. Development and properties of RBC.

**Circulation:** The Heart and its anatomical structure, Different chambers and valves, Cardiac output, Blood pressure, heart Rate, Initiation & conduction of cardiac impulse, Sinoatrial Node, A.V. Node, Bundles of His, Purkinje fibers, Abnormalities in the cardiac rhythm, Artery- Vessel-Vein-Capillary, circulation of Blood, purpose of circulation.

**Skeleton:** Its necessity and importance for the Human body-Different types and classification of Bones. Musculature of a Human body- Different muscles of the body.

**Respiration:** Definition, purpose of Respiration, Respiratory movements, Inspiration and Expiration, Composition of Inspired and expired, Respiration, Regulation of Respiration, Vital capacity, Residual Air, Total Lung volume, Detailed structure of Lungs, Gaseous Interchange, Artificial Respiration, its importance. Different methods of providing artificial Respiration. Carriage of oxygen in the Blood. Brief description about the cyanosis, Anorexia, Dyspnoea.

**Digestion:** Various digestive organs- their functions, salivary, Gastric, Pancreatic and other intestinal digestions Enzymes. Bile, its secretion and physiological functions.

**Histology:** An elementary knowledge concerning the structure of the following- Epithelium, testis, Nerve, Bone, Stomach, Liver, Kidney, Intestines, Cardiac muscle.

**Endocrines:** Thyroid, pancreas, Pituitary and supra Renal glands.

**Urinary system:** Kidney - A detailed structure, Nephron and its functions, Mechanism of urine formation, composition of urine, Mechanism of Maturation, output of urine, Urinary Bladder and its Emptying.

**Nervous system:** structure and functions, cerebrum, cerebellum, mid Brain, Pons, Medulla, spinal cord. The Autonomic nervous system, cranial and spinal Nerves.

Detailed study of the Auditory visual and Taste organs.

### EXT BOOK:

1. A text book of Physiological Practice-Best & Taylor's
2. A Text Book of Physiological Practice- C.C. Chatterjee.

## HUMANITIES AND ENGLISH

- A. English Grammar and Composition :-
- Direct and Indirect Narration
  - Common Expressive words and phrases.
  - Essay
- B. Portrait of the following :-
- How I became a public speaker George Bernard Shaw
  - In the forest- water dela Mare
  - Time and the Machine- Aldous Huxley
- C. English Grammar and Composition:-
- Corrections of Preposition
  - Punctuation
  - Essay
- D. Portrait of the following
- The scientific point view-D. S. Haldane
  - Ideas that have helped Mankind-Bertrand Russell
  - The Birth of stars -Fred Hoyle.
- E. English Grammar and Composition :-
- Precis writing, letter writing, keeping a diary, Paraphrasing and expansion.
  - Figures of speech
  - Essay
- F. Non-detailed study of the following :-
- Posteur
  - Koch
  - Ress Vs. Grast

### Books for Reference :-

- Portrait-edited by L. Brander, Oxford University Press
- Soores and Majumder : Senior Courses in English Composition, Oxford
- Paul Deharuiff : Microbe Hunters.

## PHARMACEUTICAL ANALYSIS-I

Illustration are based on examples from Pharmacopoiial substances.

The scope, aims and methods of quantitative analysis.

Analytical balance and its sources.

Reliability of measurements, Errors in quantitative measurements, precision and accuracy, Precision measures, Rejection of measurement, Rules governing the proper retention of significant figures.

Ionic Reaction, ionization theory, Modern concept of ionization, Modern concepts of Acids and Bases.

The law of mass action, Chemical Equilibrium, Ionic strength and Activity.

Acid base Equilibrium. The water equilibrium, PH scale, ionization of acids and bases, Polyprotic acids, common ion effects, buffer action, Hydrolysis.

II. Preparation of sample for analysis.

III. Fundamentals of titrimetric analysis: Fundamental requirements, standard solutions, primary standards, Detection of end point, types of reactions.

Calculations of Titrimetric Analysis.

Neutralization theory. Titration of a strong acid with a strong base, titration of a strong base with a strong acid, Titration of a weak acid with a strong base, titration of a weak base with a strong acid, weak acid base reaction.

II. Theory of acid-base indicators.

II. Problem related to above topics.

### TEXT BOOKS:-

- Quantitative chemical analysis by G.H. Ayres, 2<sup>nd</sup> ed., Harper International Edition, Harper and Row, New York 2<sup>nd</sup> / Edition, 1969.  
(All the topics except theory of indicators)
- A.T.B. of quantitative inorganic analysis by A.I. Vogel, 3<sup>rd</sup> Ed., ELBS Publication, 1968.

(Theory of Indicators only)

- I. Redox theory Equivalency in Redox reaction, potential in redox reactions, Nernst equation, standard potentials, Calculation of potentials, Calculation of potential and E.M.F. at Nonsatnd conditions, change of E.M.F. during redox titration, oxidation reduction curves, Redox indicators, Equilibrium constants of redox indicators, Equilibrium constants of redox reactions.
- II. Titration involving oxidation with  $KMnO_4$ ,  $K_2Cr_2O_7$ , ceric sulphate and titanous salts.
- III. Iodometry, Iodometry, potassium iodate and potassium bromate titrations.

**TEXT BOOKS:-**

1. Quantitative Chemical Analysis by G.H. Ayers, 2<sup>nd</sup> ed., Harper international edition, Harper & Row New York, 1969.

(Topic I only)

2. A.T.P. of Quantitative Inorganic Analysis by A.I. Vogel, 3<sup>rd</sup> ed. ELBS Publication, 1968.

(Topics II & III).

- I. Precipitation Titrations: Theory of precipitation reactions, precipitation titrations, adsorption indicators, determination of end points in precipitation titrations.
- II. Gravimetric Analysis: precipitate methods in gravimetric analysis, colloidal state, super-saturation and precipitate formation, purification of the precipitate, purity of the precipitate, conditions of precipitation, condition of precipitation from homogeneous solution, washing of precipitate, ignition of precipitate, fractional precipitation, organic precipitants.

**TEXT BOOKS:**

1. Quantitative Chemical Analysis by G.H. Ayers, 2<sup>nd</sup> ed., Harper international edition, Harper & Row, New York, 1969. (Topic I only)
2. A text book of Quantitative Inorganic Analysis by A.I. Vogel, 3<sup>rd</sup> ed. ELBS Publication, 1968. (Topic II only)

**PHARMACEUTICAL CHEMISTRY-I**

The treatment should be on the basis of modern physio-chemical aspects excepting spectroscopic aspects.

**Structure and properties:** Structural theory, Atomic and Molecular orbitals, Modern aspects of covalent bonds,  $sp$  :  $sp^2$  :  $sp^3$  hybridization unshared pair of electrons, polarity of molecules, Dipole movement, Electronic and steric effects, isomerism.

**Ethane:** Structure, source, Physical Properties, Reaction, Oxidation, Heat of combustion. Chlorination, substitution reaction with other halogens, Relative reactivity, mechanism of halogenations, free radicals, chain reaction, inhibitors, bond dissociation energy, Heat of reaction, Energy of Activation, Energy changes during the reaction, rate of reaction, relative rates of reaction, relative reactivities of halogens, structure of methyl radical,  $sp^2$  hybridization Transition state, Reactivity and development of transition state.

**Higher alkenes:** Source, Nomenclature, homologous series, synthetic methods, stereochemistry and stereo isomerism, optical activity, Enantiomerism, enantiomerism and optical activity, prediction of enantiomerism, asymmetric carbon atom, racemic modification, configuration, sequence rule, meso structure, Reaction of dissymmetric molecules, resolution of enantiomerism conformation, conformational isomers, conformational analysis, Classes of carbon atoms and hydrogen atoms, stability of free radicals Reactivity and selectivity, isotopic methods of synthesis & optical activity, pyrolysis, cracking. Unsaturated Hydrocarbons Alkenes Nomenclature, structure, Aromaticity and Geometrical isomerism, physical properties, industrial source, laboratory methods synthesis- dehydro-halogenation of alkylhalides, mechanism, orientation and activity of dehydrohalogenation, ease of formation of alkenes, stability of alkenes, dehydration of alcohols.

**Alkynes:** Nomenclatures, structure, industrial source, synthetic methods, stereoselective reaction, acidity of alkynes, introduction to tautomerism.

**Dienes:** Nomenclature, structure, methods of synthesis, stability of conjugated dienes, Electrophilic addition, 1:4 Vs 1:2 addition.

Free radical addition to conjugated dienes - orientation, reactivity polymerization, copolymerization, ionic polymerization.

**Cyclic Hydrocarbons:** Nomenclature, Industrial source, preparation, physical properties, reactivity, small rings, large rings, Baeyer's strain theory, modern interpretation of Baeyer's theory, Angle strain, performance of cycloalkanes. Equatorial and axial bonds. Stereoisomerism in cyclic compounds. Diastereoisomerism and enantiomerism. Conformational analysis, Cis & trans addition to cycloalkenes stereospecific addition. Substituted methylenes, Dehydration & E-elimination.

**Aromatic Hydrocarbons:** Benzene, structure of Benzene, stability of benzene ring, Aromatic character, condition necessary for aromatic character, Resonance theory, orbital picture of benzene, Hyperconjugation electrophilic aromatic substitution mechanism.

**Arenes:** nomenclature, industrial source, synthesis, electrophilic aromatic substitution mechanism, deactivators, activators, orientation in electrophilic substitution mechanism.

Side chain halogenations, orientation & reactivity, allylic & benzylic hydrogen atom, resonance stabilization of allyl & Benzyl hyperconjugation, Alkenyl benzene conjugation.

**Alkyl Halides:** Nomenclature, Structure, industrial source, preparation reaction nucleophilic substitution, SN1 & SN2 reaction, mechanism & kinetics, evidence of transition state. Elimination Vs substitution.

**Alcohols:** Nomenclature, structure, source, types of alcohols, physical properties, hydrogen bonding, methods of synthesis, hydroboration, Grignard's synthesis, dehydration, Reaction with hydrogen halide, oxidation, haloform reaction.

**Ethers:** Nomenclature, structure, methods of synthesis reaction, peroxides formation, cleavage by acids.

**Epoxides:** preparation, properties - acid catalyzed, base catalyzed cleavage, orientation of cleavage of peroxides, stereochemistry of glycol formation, stereochemistry of halogen addition.

**Aldehydes and Ketones:** Nomenclature, physical properties, industrial source, methods of synthesis of aldehydes and ketones. Reaction- Oxidation, reduction of alcohols reduction to hydrocarbons, reductive amination.

## PHARMACEUTICS - I

### UNIT - I

#### **HISTORY OF PHARMACY**

**History of Pharmacy in ancient and Medieval India.**

#### **Mythology**

**Precharaka Period,** Vedic Sages, First Medical conference, Bharadwaja, Sreya, Dhanwantari.

**Charaka of Buddhist Period,** Charaka, Charaka Samhita, Shushruta Samhita, Sushruta.

**Post Charaka or Buddhistic Period** political India before Buddha, Takshulla, Jivaka, Nagarjuna, Bower's manuscript.

**Medieval Period :** Hindu Alchemy, Shiva Tantra, Tantric Literature, Chemopharmaceutical period, some Indian Alchemist and their works.

#### **The rise of modern Pharmacy in India**

#### **Ancient and Medieval Pharmacy**

The pneumatic school, the Empiric School, the Methodic school, Medicine in Rome, Galen, Post Galenic medicines.

#### **Pharmaceutical Calculations**

Calculation of doses, percentage calculations, proportional calculation, Alligation, Calculation of Extracts, Proof spirit calculations etc.

### UNIT - II

**Principles involved in the preparation of the following Indian Pharmacopoeial products :-**

**Aromatic waters** such as Chloroform, Camphor etc.

**Solutions** Such as Iodine, Ammonium Acetate, Leadsubacetate, Nitromersol, thiomersal etc.

**Spirits** Such as Chloroform, Aromatic Ammonia, Camphor, Peppermint etc.

**Glycerines** Such as Boric Glycerine.

**Elixirs** Such as simple Elixir, Terpene hydrate etc.

**Emulsions** Such as milk of Magnesia, Bentonite, Aluminium hydroxide gel etc.

**Mucilages** Such as Indian Gum Mucilage.

#### **Extraction of Drugs.**

**Principles of Extraction -** Orthodox and newer methods. The extraction of Vegetable drugs. Solvents, Extraction etc. Circulatory Extraction, Multiple Stage extraction, Continuous extraction.

#### **Important Galenicals of I.P.**

**Fluid extracts :** Such as bael, Hyocyamus, Glycyrrhiza, Senna, Cascara etc.

**Tinctures** : Such as orange, Cardamom, Digitalis, Tolu, Benzoin, Belladonna etc.

**Infusion** such as compd. Chirata Infusion etc.

**Extract** : Belladonna Glycerrhiza, Cascara etc.

**Semi Solid dosage forms** : Ointments, Creams, Pastes, and Jellies such as Simple ointment, emulsifying ointment, iodine ointment, Sulphur ointment, Zinc Oxide paste etc.

## UNIT - III

Mechanical subdivision of Drugs and grading of powders as applicable in Pharmacy (Process equipment not to be covered) Objectives of size reduction, Factors affecting size reduction, Mechanism of size reduction, Methods of size reduction cutting, compression, attrition, etc. Standard : for Powders, Sieving, Sieving methods. Fluid classification methods.

### DISPERSE SYSTEMS

Basic Principles involved in preparation and stability of disperse systems

**Colloids** : Introduction Mechanism of Stabilization, Repulsive forces, attractive forces, Effect of Electrolysis Preparation, Purification, Properties, Pharmaceutical applications

**Suspension** : Introduction, Stability, Flocculated & Deflocculated systems, Rheological Properties & application in Pharmacy.

**Emulsion** : Introduction, Emulsifying agents, emulsion type, Determination of types, types of Instability, breaking, Creaming, Stability Preparation and Application. Surface active agents and their use in Pharmacy.

### TEXT BOOKS (UNIT-I):-

1. History of Indian Pharmacy by G.P. Srivastava Vol. I. 1<sup>st</sup> Ed., Pindars Ltd Calcutta, 1953, (Chapter II. to IV).
2. Schroff and srivastava's Pharmaceutical Arithmetic and Latin by K.D. Goswami 3<sup>rd</sup> Edition, National Book Centre, Calcutta, 1970, (Chapter II to IX excepting Chapter -V)
3. A History of Chemistry by J.R. Partington, Vol I., Mac Millan & Co., London, 1970. (Chapter IX only).

### TEXT BOOKS(UNIT-II):

1. Indian Pharmacopoeia, 2<sup>nd</sup> Edition. Ministry of Health, Govt. of India, 1966
2. Introduction to Pharmaceutical dosage forms by H.C. Ansel, 2<sup>nd</sup> Edition Lea and Febiger, Philadelphia, U.S.A., 1978.

(Chapter 4, 5,7,10 & 14 excepting the topic not mentioned in the Syllabus)

### TEXT BOOKS(UNIT-III):

Cooper and genn's Tutorial Pharmacy, Edited by S.J. Carter, 6<sup>th</sup> edition., Pitman House, Edition, 1972. (Chapter 5 & 6)

Van der Waals equation, Law of corresponding state, liquefaction of gases.

**Physical properties of liquids** :- Molar volume, surface tension, parachor, molecular refractivity, optical rotation and dipole moment.

**Electro Chemistry** :- Law of electrolysis, conductivity-equivalent conductance its variation with dilution, Ionization, Ion transport.

**DILUTE SOLUTIONS**:- Osmosis, osmotic pressure and its determination, osmotic coefficient, van't Hoff's law of dilute solution, lowering of vapour pressure and its relation to the osmotic pressure. Determination of lowering of vapour pressure, elevation of boiling point and lowering of freezing point, Applications in calculating molecular weights. Abnormal molecular weights. Van't Hoff factor.

**CHEMICAL EQUILIBRIUM**:- Law of mass action and its application to homogenous equilibrium. Le-Chatelier and Braun principle.

**PHASE RULE**:- Terms involved application to one and two components system.

**PHOTO CHEMISTRY** :- Introduction, sources of photo chemical radiation, Basic laws of photo-chemistry, quantum yield, photo-chemistry reactions, photo sensitization and photosynthesis.

**SURFACE CHEMISTRY AND CATALYSIS**:- Physical adsorption and adsorption-isotherm. Homogeneous and heterogeneous catalysis, acid base catalysis, enzyme catalysis.

**THERMODYNAMICS**:- First law, energy, work and heat changes, Enthalpy, heat capacity reversible processes, isothermal expansion, adiabatic changes, spontaneous processes, second law, Carnot's cycle, Entropy, Free energy, and work functions, Gibb's Helmholtz equation. Clapeyron equation, Clausius clapeyron equation, van't Hoff's isotherm, van't Hoff's isochore.

**THERMO CHEMISTRY**:- Definitions and Conventions, Heat of reaction, heat of formation, heat of solution, heat of neutralization, Heat of combustion, Hess's law, Numerical problems, Bond energies, Kirchoff's equation.

## TEXT BOOKS:

Essential of physical chemistry Bahl and Tuli 21<sup>st</sup> Edition. 1979.

Experiment involving the principles covered in theory Pha 1.2T as illustrated below

1. To determine the velocity constant for hydrolysis of methyl acetate.
2. To determine the partition coefficient of iodine between water and kerosene Oil.
3. To determine surface tension of the given liquid by drop pipette method.
4. To determine molecular weight of the given substance by Rast's Camphor method.
5. To study adsorption isotherm of Oxalic acid from aqueous solution.
6. To titrate silver nitrate against sodium chloride conductometrically.
7. To determine the molecular refraction of a series of homologous alcohol and ester and deduce the refraction equivalence of the methylene group, Carbon hydrogen, and Oxygen.
8. To estimate chromium in potassium dichromate potentiometrically.
9. To determine specific & molecular rotation of sucrose by polarimeter.
10. To test the validity of Beer-Lamert's law by colorimeter.
11. To study the influence of chain length on surface tension.
12. To determine the value of dissociation constant of acetic acid.
13. To determine the order of reaction for the hydrolysis of cane sugar.
14. To determine the pH of the given solution by colorimetric method.
15. To determine the percentage of sodium chloride in the given solution sodium chloride by critical solution temperature method.
16. To determine the equilibrium constant of an esterification reaction.
17. To determine the concentration of the given unknown solution by refractive index method.
18. To carry out potentiometric titration of a precipitation reaction.

## COMPUTER SCIENCE AND STATISTICS

### THEORY

#### Part-A: Computer Science

**Introduction to Computers:** History, evolution, generation of computers. Introduction to computer and associate terms. Hardware, software, operating systems and windows.

**Windows applications:** Notepad, file handling and directory handling.

**MS world:** Basics of MS-world like editing and formatting.

**MS-Power Point:** Features and working with objects.

**MS-Excel:** Identification of parts, creating, editing, graphic objects and charts.

**Introduction to computer Networks:** LAN, Wan and Internet.

**Internet Applications:** Mail, chat, discussion groups and library access.

Publishing information on internet.

#### Part-B: Statistics

Definition, frequency, distribution, general graphical representation of data, histogram, frequency curve and frequency polygon and ogive.

Measures of central tendency, arithmetic mean, geometric mean, harmonic mean, median and mode.

Measures of dispersion, range, quartile deviation, mean deviation, variation and coefficient skewness.

Correlation, regression, linear correlation, coefficient of correlation, Karl Pearson formula and rank method, curve fitting by method of least square, linear equation only, regression lines, regression equation of 'Y' on 'X' and 'X' on 'Y'.

### PRACTICALS

#### Computer Sciences:

1. DOS commands familiarization.
2. Windows applications.
3. Study of applications:
  - a) MS World- Document preparation.
  - b) Excel- Spread sheets, Graphs.
  - c) Power point- Slide presentations.
  - d) Statistical Package- Familiarization of various statistical tests.
4. Internet applications.
5. Publishing information on internet.