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**CHEMISTRY**

**CURRICULUM FOR B.SC. (PASS)**

**CHEMISTRY**

**B.Sc-Paper I**

**GENERAL BIOCHEMISTRY (THEORY)**

A general introduction to the science of biochemistry; Importance and scope of biochemistry forms, functions and brief classification of prokaryotes; cellular architecture and diversity of eukaryotes structure physical properties & importance of water.

Unique properties of carbon, nature of organic matter; overview of biological molecules (Biomolecules) and their structures including proteins, carbohydrates, lipids and nucleic acids. Introduction to Hormones and enzymes buffer prebiotic molecular evolution and rise of living system, review of the variety and ecology of the living world; evolution of life. Use and significance of radioisotope in biochemistry.

**CELL BIOCHEMISTRY**

Introduction to cell theory; structure; chemical composition of cell and cell organelles and their functions; separation of cell organelles; transport properties of cell membrane; molecular organization and functional role. The concept of the unit membrane, the fluid mosaic model, surface receptors and membrane mediated control. Lysosome, micro-bodies; Mitochondria and the conservation of chemical energy: mitochondrial structure and function. Chloroplast structure and the mechanism of photosynthesis. The nucleus: structure and function, the nature of gene, the cell cycle: mitosis, meiosis.

**PHYSICAL BIOCHEMISTRY**

Bronsted’s theory of Acid and Basis. Strength Acid and Basis. Water –the biological solvent, Hydrogen bounding, Dissociation constant of water, Acid and Basis. Relation of [H+] and [OH] in solutions. PH and POH, Measurement &methods of calculating PH. Buffers: Definition, Henderson – Hassel batch equation. Titration of weak acids and basis. Biological applications of buffer system. Solutions, Type of solutions, True solutions, suspensions, colloidal solutions, properties of sols and gels. Separation of colloids from crystalloids. Emulsion and emulsification. Physical properties of matter with biological applications (Diffusion, Osmosis, Osmotic pressure, Viscosity, surface tension, adsorption)

**Principals and Applications of Bio analytical Techniques**

 Principals and Applications of: Homogenization, Filtration, membrane filters. Centrifugation, Chromatography: paper, TLC, and column chromatography, UV / visible spectrophotometer.

**Title, General Biochemistry (Practical)**

1. Solution preparation (percentage, Normal, Molar, Molal, ppm, ppb, etc)
2. Determination of pH by various methods
3. Preparation of solutions:
4. Preparation of molar solutions.
5. Preparation of normal / equivalent solutions.
6. Preparation of Molal solutions.
7. Preparation of ppm and ppb solutions.
8. Preparation of solutions from given stock solution by dilution method.
9. Standardization of given solutions.
10. Study of cell structure using compound microscope and elucidation of ultra- structure from electron micro photographs.
11. Study of prokaryotic and eukaryotic cells.
12. Study of plant and animals cell.
13. Cell structure in the stamina hair of Tradescantia.
14. Cellular reproduction, mitosis: smear / squash preparation of onion roots / check cells.
15. Separation of carbohydrates by paper and thin layer chromatography.
16. Separation of amino acid by paper and thin layer chromatography.
17. Separation of lipids by paper and thin layer chromatography.

**PAPER –II**

**Biochemistry of macromolecules (Theory)**

**Introduction to Carbohydrates:** Historical background, Occurrence and Distribution in Biosphere, Importance in life processes, Nomenclature, Classification, Structural and Dynamic functions.

**Monosaccharide’s:** Nomenclature, Classification, and Structural configuration. Asymmetric carbon, Isomerism, Importance of isomers. Mutarotation, recemic mixture and inter conversion of monomers. Ring structure (pyran and furan). Fischer’s formula and–Haworth projection formula of monosaccharide. Chair, Boat, Cholley and Tollen proposed structure of monosaccharide. Kiliani synthesis of carbohydrates. Structure, occurrence and function of important Trioses, Tetroses, pentoses, Hexoses and Heptoses. Reactions of sugars. Derived sugars; Chemistry and function of sugar alcohols, Sugar acids, Deoxy Sugar and Sugar phosphate.

**Disaccharides & Oligosaccharides:** Classification, Glycosidic linkage. Structure function and Importance reducing and non- reducing sugars, invert sugars. Occurrence, Chemistry, Structure, properties and Hydrolysis of common disaccharides including Sucrose, Lactose, Maltose, Cellobiose, isomaltose and Trehalose.

**Polysaccharides:** Classification, Structural and functional Importance and Distribution in livings. Occurrence, Chemistry, Structure, properties and function of Polysaccharides including Animal, plant and microbial sources. Structure Chemistry of Biochemical function of proteoglycans and Glycoprotein.

**Lipids:** Structure classification and their Biological role. Fatty acids: Structure, classification, nomenclature and property of fatty acids. Prostaglandins, thromboxanes and leukotrienes.

Triacylglycerols: Nomenclature physical and chemical properties including hydrolysis, specification number, rancidity, acid value, iodine number and Reichert – Meissl number. Reaction of glycerol.

Phospholipids: Gycerophospholipids, Sphinogomyelins and glycolipids; their properties and functions. Steroids: Structure, classification, nomenclature and their biological role.

Lipid as signals, cofactors and pigments. Cholesterol, Bile salts, vitamins, steroid hormones, Gall stones formation, Lipo Proteins, HDL, and LDL.

**Amino Acids:** Introduction, classification, properties and biological role of amino acids.

**Proteins:** Introduction, classification, properties, functions and their biological role. Protein sequence and evolution. Overview of protein structure: (Primary, Secondary, Tertiary and Quaternary). Type of plasma proteins and their biological role. Revisable binding of a protein to a legends, Protein interaction modulated by chemical energy. Method of isolation, purification and characterization of proteins.

**Nucleic acids:** , Definition, Classification Nitrogenous bases (Purina and Pyrimidine bases); Nucleosides; Nucleotides and Polynucleotide; Structures of DNA; Types and structures of RNA.

**Enzymes:** General characteristics of enzyme reactions, enzyme nomenclature and classification, substrate specificity, isozymes, co- enzymes regulation of enzyme activity, chemical kinetics and enzyme kinetics, Michaelis- Menten equation, effect of various factor on rate of reactions, inhibition of enzymatic reaction and kinetics, Multi enzyme system and bisubstrate reactions, catalytic mechanisms, structure and mechanism of lysozyme, serine protease and glutathione reeducates, immobilized enzyme application of enzymes.

Title, **Biochemistry of macromolecules (practical)**

1. Qualitative analysis of Carbohydrates
2. Qualitative analysis of amino acids and proteins.
3. Qualitative test for lipids.
4. Extraction of proteins from animal and plant sources / tissues.
5. Extraction of lipids from animal and plant sources / tissues.
6. Extraction of glycogen and starch from various sources.
7. Proteins estimation by various methods.
8. Acids and enzymatic hydrolysis of glycogen and starch.
9. Extraction and estimation of enzymes from plant sources.
10. Acids and enzymatic hydrolysis of starch.

**Paper -III**

**BIOCHEMISTRY OF BODY FLUIDS (THEORY)**

**Issues:** Biochemistry and functions of muscle, liver, kidney and connective tissues, nerve tissues and adipose tissues. Liver function tests and renal function test.

**Body Fluids:** General composition & functions of body fluids including, cerebrospinal fluid and lymph, Ascitic fluid, Peritoneal fluid, Pericardial fluid, synovial fluid, Amniotic fluid, semen, Tears and Sweet,

**Urine:** General composition, Functions, Formation, Regulation, Role of Normal and Pathological Constituents in Diagnosis Chemistry of blood: Composition of blood, Palsma proteins and blood cells, Functions of plasma proteins, and blood cells, Coagulation, mechanism of coagulation: intrinsic and extrinsic pathways of coagulation. Structure, Composition and functions of Haemoglobin. And hemoglobinopathies.

**BIOCHEMISTRY OF BODY FLUIDS (PRACTICAL)**

* Detection of Normal and Pathological constituents of urine including glucose, albumin, uric acid, chloride and phosphate.
* Blood analysis for hemoglobin, ESR, Platelets, TLC, DLC, etc.
* Identification of blood grouping, cross matching, bleeding and clotting time.
* Estimation of Glucose by spectrophotometric method, Glucose tolerance (GTT)
* To determine the normal Physical and chemical properties of urine.
* Detection of normal and abnormal constituents of urine.
* Microscopic study of urinary sediments.

**Paper - IV**

**FOOD AND NUTRITION (THEORY)**

**Nutrition :** Scope and importance of food and nutrition

**Vitamins :** introduction and classification chemistry and functions soures daily allowance deficiency allowance diseases and biological role of the water soluble (B-Complex and Vitamin-C) and fat soluble Vitamins (A,D,E,K)

**Minerals:** Distribution and biological importance of minerals. Metabolism of Ingorganic ions with special reference of indispensable elements. Deficiency diseases of symptoms and toxicity diseases.

**Cencepts of food stuffs:** Food selection and meal planning for healthy individuals. Food exchange lits. Balance diet, Recommended dietary allowances for different categories of the human beings.

**Energy metabolism:** Measurement of energy of foods and energy expenditure. Direct and indirect caloric measurement. Basal metabolism. Factors affecting BMR, Respiratory quotient. Energy requirements of the individuals.

**Effect of dietary alterations on the activity of tissue enzymes:** Effect of dietary carbohydrates, fats, and proteins fasting and restriction.

**Nutritional Diseases:** Food borne diseases, Nutritional aspects and dietetic treatment of a few important primary nutritional and general disease, Starvation and anorexia nervosa, Obesity, Endemic goiter, Diseases of cardiovascular system and G.I. tract Diabetes mellitus, Idiosyncrasies, Food intolerance and food allergies, food nutrition and cancer, Nutrition and infection. PEM, PCM, Kwashiorkor, Merasmus.

**Title:** **FOOD AND NUTRITION (PRACTICAL)**

* Clinical surveys, Physical examination, Anthropometry, Dietary surveys.
* Calculation of energy values of food.
* Calculation of recommended daily allowance (RDA).
* Calculation of basal energy expenditure (BEE),
* Calculations of Basal metabolic rate (BMR),
* Calculations of Body mass index (MBI),

**BOOKS RECOMMENDED:**

Fundamentals of Biochemistry. (2008)3rd Ed. By D.J. Voet, G.J. Voet and C.W. Pratt. J. Wily & Sons Inc.

Lehninger Principal of Biochemistry (2008) 5th Ed. By D.L. Nelson, M.M. Cox. W.H. Freeman Publisher.

Molecular Biology of the Cell, (2008) 5th Edition. B. Alberts, A. Johnson, J, Lewis, M. Raff, K. Roberts & P. Walter 5th Edition Gariand Sciences, Taylor and Francis.

Cell and Molecular Biology: Concepts and Experiments (2008) by G. Karp John Wily & Sons.

Essentials of Carbohydrate Chemistry (1998) by Joh F. Robyt. Springer Verlag

Fundamentals of Biochemistry by J.L Jain. (2008)S. Chan & Co. India

Text Book of Biochemistry 3rd edition (2009) by satyanarayana.

Text Book of Medical Physiology (2008) 10th edition by Arthur C. Gyton, John E.Hall, B Saunders Company.

Human Physiology, (2003) 5th Edition Arthur J. Vender, James H. Sherman, Dorothy S. Luciano, McGraw-Hill Company.

Krause’s Food, Nutrition and Diet Therapy L.Kathleen MahansSylvia Ecott-Stump (2009) 11th Ed. Saunders.

Understanding Nutrition. E.N Withney & S.R. rolfes (2002) 9th Edition.

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| Paper | Course Title | Marks |
| Paper – I  | Analytical Chemistry Theory | 100 |
|  | Analytical Chemistry Practical  | 50 |
| Paper – II  | Organic Chemistry Theory | 100 |
|  | Organic Chemistry Practical | 50 |
|  | Total | 300 |

**PAPER-I**

**B. Sc. (Pass) part-I Analytical Chemistry Marks 100**

**Course Description**

* Introduction to analytical chemistry
* Measuring Apparatus
* Expression of Quantities and concentrations
* Basic Approach Equilibrium
* Errors in Chemical Analyses and Quality of Result
* Chemicals and Reagents
* Use and Handling of Standards
* Sampling
* Errors
* Precision, Accuracy,
* Statistical Evaluation of Data

**Analytical Chemistry Practical**  Marks 50

**PAPER-II**

**B. SC. (PASS) PART-I ORGANIC CHEMISTRY Marks 100**

**Introduction to Organic Chemistry**

Organic chemistry- the chemistry of carbon compounds; the nature of Organic chemistry- a historical prospective.

**Chemical Bonding and Properties of Organic Molecules**

Localized and delocalized chemical bonding; concept of hybridization leading to bound angels, bond lengths, bond energies and shape of organic molecules; dipole moment; inductive and field effects; resonance; aromaticity; tautomerism; hyper conjugation; hydrogen bonding; acids and basses; factors affecting the strengths of acids and basses.

**Classes and Nomenclature of Organic Compounds**

Classification of organic compounds; development of systematic nomenclature of organic compounds; IUPAC nomenclature of hydrocarbons and heteroatom functional group.

**Functional Group Chemistry**

A brief introduction to chemistry of hydrocarbons, Cyclohexane, alkyl halides, alcohols, phenols, ethers, aldehydes, ketones, amines, and carboxylic acid and their derivatives.

**Spectroscopy**

General introduction to electromagnetic radiations and modern spectroscopic techniques.

**Organic chemistry Practical**

Subject to the availability of facilities Marks 50

**B.Sc Part II INORGANIC CHEMISTRY**

**The Periodic Law and Periodicity**

Development of periodic table; Classification of elements based on s, p, d, and f orbital’s, group trends and periodic properties in s, p, d and f block elements i.e., atomic radii, ionic radii, ionization potentials. Electron affinities, electro negativities and redox potential.

**Principles of Chemical Bonding**

Nature and types of chemical bonding, Localized bond approach Lewis concepts, ionic, covalent, coordinate covalent bond; Valence Bond Theory (VBT), Molecular Orbital Theory (MOT) as applied to diatomic and polyatomic molecules, Bond theory of metals and inter metallic compounds, conductors, insulators & semiconductors compounds three center bonds. Bonding in electron deficient compounds : hydrogen bonding: Interpretation of shapes of inorganic molecules on the basis of valence shell electron pair repulsion (VSEPR) theory and hybridization & resonance.

**Acid and Bases**

Concepts of acids and bases including SHAP soft and hard acid base concepts.

Relative strengths of acids and bases, significance of pH, pKa, pKb and buffers

solutions. Theory of indicators: (acid base, redox, adsorption). Solubility, solubility product, common ion effect and their industrial relations.

**Chemistry of the p-block Elements**

Chemistry and structure of p-block elements, main emphasis on the chemistry and structure of noble gases and their compounds. chemistry and structure and structure of inter halogen , pseudo halogen, and poly halides, prediction of shapes of molecules using VSEPR mode and hybridization.

**Transition Elements**

Electronic configuration position in periodic table , general characteristics and properties of d block elements nomenclature of coordinate bond .Werners theory and valence bond theory VBT.

**Chemistry in Industry**

Commercial production of Sulphuric acid Nitric Acid Hydrochloric Acid ,Caustic Soda and washing soda

Production of various types of steel.

**B.Sc Part II Physical Chemistry**

**Physical States of Matter**

Ideal and real gases, equations of state, critical phenomenon and critical constants. Molecules in motion: collision diameter and mean free path. Physical properties of liquids: surface tension, viscosity, refractive index etc. and their applications. Brief account of interactions among the molecules in liquids. Packing of atoms. Unit cells and crystal systems. Methods of crystal structure analysis. Brief account of polymers and composite materials with special emphasis on superconductors, semi-conductors etc. Introduction to plasma.

**Chemical Thermodynamics**

Laws of thermodynamics and their applications. Thermodynamic functions: internal energy, enthalpy, entropy and free energy. Relations between thermodynamic functions. van’t Hoff’s equation. Heat capacities, concept of entropy and probability.

**Chemical Kinetics**

Rate of reaction. Rate law, order and molecularity of the reactions. Zero, first and second order reactions. Determination of reaction order and its rate constant. Effect of temperature on the reaction rate. Concepts of chemical equilibrium. Law of mass action, equilibrium constant, Le-Chatelier principle and its applications. Elementary concepts underlying complex and fast reactions.

**Solution Chemistry**

Ideal and non-ideal solutions. Raoult’s law and its applications. Molecular interactions in solutions. Colligative properties. Distillation and concept of azeotropic mixture.

**Surface Chemistry**

Concept of interfaces. Adsorption and adsorption isotherms: Freundlich and Langmuir adsorption isotherms. Catalysis, colloids, emulsion and their industrial applications.

**Physical Chemistry Practical**

* Determination of viscosity and paraochor values of liquids.
* Determination of percent composition of liquid solutions viscometrically.
* Determination of refractive index and molar refractivity.

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* Determination of percent composition of liquid solutions by refractive index measurements.
* Determination of molecular weight of a compound by elevation of boiling point (ebullioscopic method).
* Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method).
* Determination of heat of solution by solubility method.
* Determination of heat of neutralization of an acid with a base.
* Kinetic study of acid catalyzed hydrolysis of ethyl acetate.
* Determination of partition coefficient of a substance in two immiscible liquids.

**Books Recommended**

**Theory**

1. Alberty, R. ?Physical Chemistry? 17th Ed., John Wiley and Sons (1987).
2. Atkins P.W. ?Physical Chemistry? 6th edition, W. H. Freeman and co. New York (1998).
3. Laidler, K. J., ?The World of Physical Chemistry *”* 1st Ed., Oxford University

Press, pp. 488 (1993).

1. Laidler, K.J., John H. M. and Bryan C. S., ?Physical Chemistry *y”* 4th Ed.,

Houghton Mifflin Publishing Company Inc. (2003 ).

1. Peter, P.A., ?Chemical Thermodynamics?, Oxford University Press (1983).
2. Brain, S. E., ?Basic Chemical Thermodynamics? 4th Ed., E. L. B. S. Publishers (1990).
3. Barrow, M.G., ?Physical Chemistry? 5th Ed., Mc Graw Hill (1992).

**Practical’s**

1. Jaffar, M., ?Experimental Physical Chemistry? University Grants Commission (1989).
2. Levitt B.P., ?Findlay's Practical Physical Chemistry?, 9th Ed., Longman Group Limited.
3. Shoemaker, D., ?Experiments in Physical Chemistry? 5th Ed., McGraw Hill Publishing Company
4. Limited (1989).