

**DEPARTMENT OF CHEMISTRY
BASIRHAT COLLEGE
CHEMISTRY HONOURS**

Course Outcome

SEMESTER I

1A. COURSE NAME: ORGANIC CHEMISTRY-I. (CODE: CEMACOR01T) CREDIT: 04

- CO1: To impart students a broad outline of the basic organic chemistry in general.
- CO2: The students will learn the Bonding of organic compounds in the light of valence bond and MO theories, Hybridization of organic compound and their Physical Properties, different types of organic reactions like ionic, radical and pericyclic etc., different types of reaction like: addition, elimination and substitution reactions, electrophiles and nucleophiles.
- CO3: They will also learn about reactive intermediates like carbocation (carbenium and carbonium ions), carbanions, carbon radicals, carbenes to explain different types of reaction.
- CO4: Student will know stereochemistry and various possible conformations of organic compounds, Concept of chirality and symmetry.

1B. COURSE NAME: ORGANIC CHEMISTRY-I LAB. (CODE: CEMACOR01P)CREDIT: 02

- CO1: Based on solubility separation of different inorganic and organic liquid and solid compounds are discussed.
- CO2: Recrystallization of the separated compounds is to be done.
- CO3: Determination of boiling point of common organic liquid compounds is to be discussed.
- CO4: Student will learn how different solid and liquid organic compounds are identified

2A. COURSE NAME: PHYSICAL CHEMISTRY-I. (CODE:CEMACOR02T). CREDIT: 04

- CO1: Following aspects of gas are discussed: Kinetic Theory of gases,Maxwell's distribution of speed and energy,Real gas and virial equation.
- CO2: Zeroth, firstand second law of thermodynamics, laws of thermochemistry, different thermodynamic relations are discussed.
- CO3: In this course a detailed study of Chemical kinetics is to be discussed.
- CO4: Learners will learn about homogeneous catalysis in different processes.
- CO5: Students will know about the equipartition of energy.

2B. COURSE NAME: PHYSICAL CHEMISTRY-I LAB. (CODE: CEMACOR02P) CREDIT: 02

- CO1: Some experiments of pH, kinetics of acid-catalyzed hydrolysis, kinetics of decomposition of H_2O_2 , heat of neutralization, heat of solution are to be performed.

SEMESTER II

1(A): COURSE NAME: INORGANIC CHEMISTRY-I (CODE: CEMACOR03T) CREDIT:04

- CO1: Fundamental ideas of atomic structure are discussed.
- CO2: Chemical periodicity in the light of screening effects, Slater's rules, atomic radii, ionic radii, covalent radii, lanthanide contraction. Ionization potential, electron affinity and electronegativity are to be accustomed with the students.
- CO3: Different laws and principles of acid & base reactions are discussed.
- CO4: Different aspects of Redox Reactions and precipitation reactions like balancing of reaction, Nernst equation, redox indicators, Redox potential diagram etc. are discussed.
- CO5: Solubility product and common ion effect and their applications in chemistry are discussed.

1(B): COURSE NAME: INORGANIC CHEMISTRY-I LAB (CODE:CEMACOR03P) CREDIT: 02

- CO1: They will learn how simple acid base titrations are to be done.
- CO2: Student will gather knowledge about different oxidation reduction titrations which helps them to estimate ions in a solution.

2(A): COURSE NAME: ORGANIC CHEMISTRY-II (CODE: CEMACOR04T)

- CO1: Students will get a clear conception on "Chirality arising out of stereoaxis".
- CO2: The students will learn about "Prostereoisomerism" and related topics.
- CO3: They will know elaborately about "Conformation" and related aspects of organic molecules.
- CO4: Reaction thermodynamics will be explained with various examples.
- CO5: Elaborative discussion will be made on organic acids and bases, tautomerism and reaction kinetics.
- CO6: Free-radical substitution reaction will be stated with some examples.
- CO7: Nucleophilic substitution reactions will be discussed thoroughly.
- CO8: Students will know about the elimination reactions namely E1, E2, E1cB and Ei (pyrolytic syn eliminations).

2(B): COURSE NAME: ORGANIC CHEMISTRY-II LAB (CODE: CEMACOR04P) CREDIT: 02

- CO1: They will learn about the preparation of some common organic reaction product.
- CO2: Student will learn how to purify the crude product and to make crystal from water/alcohol.
- CO3: Student will learn to determine the melting point of the purified product.

SEMESTER-III

1(A): COURSE NAME: PHYSICAL CHEMISTRY-II. (CODE: CEMACOR05T).CREDIT:04

- CO1: Transport properties of liquid like viscosity, conductance and transport number are discussed in detail. Application of conductance measurement, conductometric titrations is also discussed.

- CO2: Different thermodynamic properties like partial properties and chemical potential, thermodynamic conditions for equilibrium, nernst's distribution law, thermodynamic properties of ideal substances- pure and mixtures etc. are discussed.
- CO3: Some fundamentals of Quantum Mechanics like black body radiation, wave function, concepts of operators, particle in a box, simple harmonic oscillations are discussed.

**1(B): COURSE NAME: PHYSICAL CHEMISTRY-II LAB. (CODE: CEMACOR05P)
CREDIT:02**

- CO1: Study of viscosity, partition coefficient, conductometric titration, verification of ostwald,s dilution law etc. are to be done.

2(A): COURSE NAME: INORGANIC CHEMISTRY-II. (CODE: CEMACOR06T).CREDIT:04

- CO1: General characteristics of ions and ionic bonds and covalent bonds are discussed in general.
- CO2: Lattice energy Concept is revealed.
- CO3: In the second part molecular orbital concepts of bonding, qualitative idea of valence bond and band theories, different weak chemical forces in molecules are discussed.
- CO4: H-bonding concept is discussed.
- CO5: Theories of radioactivity and uses of radioactive elements are discussed.

**2(B): COURSE NAME: INORGANIC CHEMISTRY-II LAB. (CODE: CEMACOR06P)
CREDIT: 02**

- CO1: Iodometric titrations for estimations of metal ions, vitamin C and available chlorine in bleaching powder are to be done. Estimation of metals in brass, steel and cement are also to be done.

3(A): COURSE NAME:ORGANIC CHEMISTRY-III. (CODE:CEMACOR07T). CREDIT 04

- CO1: Students will learn about addition reaction to alkenes and alkynes.
- CO2: Electrophilic aromatic substitution and nucleophilic aromatic substitution will be discussed elaborately.
- CO3: They will know clearly about various reactions of carbonyl compounds and will get elementary ideas of green chemistry including various green syntheses. Some specific mechanisms *BAC2*, *AAC2*, *AAC1*, *AAL1* will be discussed with evidence in connection to hydrolysis of esters.
- CO4: Elaborative discussion will be made onorganometallic reagents which includesGrignard reagent, Organolithiums, Gilman cuprates etc.

3(B): COURSE NAME:ORGANIC CHEMISTRY-III. (CODE:CEMACOR07P). CREDIT 02

- CO1: Qualitative Analysis of Single Solid Organic Compounds like elemental detection, solubility and classification, functional group, melting points and derivative preparations are to be done.

SEMESTER IV

1A. COURSE NAME: PHYSICAL CHEMISTRY-III.(CODE: CEMACOR08T) CREDIT:04

- CO1: This course helps in understanding about dilute solution behavior and colligative properties and their applications for measurements different properties.
- CO2: How to study phase rule and phase diagram for different component systems are discussed. This study helps in chemical engineering.
- CO3: Chemical potential of an ion in solution, activity and activity coefficients of ions for electrolytes using Debye-Huckel limiting law are discussed.
- CO4: Here the formations of different chemical and electrochemical cells and their behavior are discussed elaborately.
- CO5: Detailed study of quantum mechanics for rigid rotator model of rotation of diatomic molecule and Schrödinger equation are discussed.

1B. COURSE NAME: PHYSICAL CHEMISTRY-III LAB.(CODE: CEMACOR08P) CREDIT:02

- CO1: Some experiments with potentiometer, phase diagram, determination of solubility of sparingly soluble salt in water, effect of ionic strength on rate and pH-metric titrations are to be done.

2A. COURSE NAME: INORGANIC CHEMISTRY-III.(CODE: CEMACOR09T) CREDIT: 04

- CO1: General Principles of Metallurgy is discussed.
- CO2: Chemistry of *s* and *p* Block Elements, noble gases are to be known.
- CO3: Types of inorganic polymers, synthesis, properties and comparison with organic polymers are given here.
- CO4: A brief idea of coordination chemistry is discussed.

2B. COURSE NAME: INORGANIC CHEMISTRY-III LAB.(CODE: CEMACOR09P) CREDIT: 02

- CO1: Complexometric titration of few metal ions in solution and preparation of few inorganic complex compounds are to be performed.

3A. COURSE NAME: ORGANIC CHEMISTRY-IV.(CODE: CEMACOR10T) CREDIT: 04

- CO1: Preparations and reactions of amines, nitro compounds, alkyl nitrile and isonitrile, diazonium salts and their related compounds are to be studied.
- CO2: Different organic rearrangement reactions should be known with mechanism.

SEMESTER V

1A. COURSE NAME: INORGANIC CHEMISTRY-IV, COURSE CODE: CEMACOR11T

- CO1: Crystal Field Theory of coordination compounds and its related aspects like magnetic moments, d-d transition, Orgel diagram etc, are discussed in detail.
- CO2: CFSE can be calculated.
- CO3: Students can differentiate between CFT and VBT concepts.
- CO4: General comparison of 3d, 4d and 5d elements in terms of electronic configuration, oxidation states, redox properties are elucidated.
- CO5: General properties of Lanthanoids and Actinoids are discussed.

1B. COURSE NAME: INORGANIC CHEMISTRY-IV LAB, COURSE CODE: CEMACOR11P

- CO1: Learners will be accustomed with chromatography for separation of metal ions from solution mixture.
- CO2: Gravimetry is another tool for quantitative estimation and student will learn it.
- CO3: Use of Spectrophotometry, learners also can estimate chloride ions in solution. Other uses of it are also discussed here.

2A. COURSE NAME: ORGANIC CHEMISTRY-V, COURSE CODE: CEMACOR12T

- CO1: Synthetic methods of Polynuclear hydrocarbons and their derivatives and their reactions are discussed.
- CO2: Synthesis of 5- and 6-membered Heterocyclic compounds and their reactivity are discussed.
- CO3: Stereochemistry of cyclic compounds, substitution reactions, elimination reactions are discussed.
- CO4: Mechanism, stereochemistry, regioselectivity of Pericyclic reactions are discussed.
- CO5: Chemistry of carbohydrates are discussed here. Different reactions of aldose, ketose and different properties are also discussed.
- CO6: Synthesis of Biomolecules like Amino acids, peptides, nucleic acids and their properties are discussed.

2B. COURSE NAME: ORGANIC CHEMISTRY-V LAB, COURSE CODE: CEMACOR12P

- CO1: Chromatographic Separations of amino acids and different pigments are discussed.
- CO2: Spectroscopic Analysis (IR, UV VISIBLE, NMR) of Organic Compounds are discussed.

SEMESTER VI

1A. COURSE NAME: INORGANIC CHEMISTRY-V, COURSE CODE: CEMACOR13T

- CO1: Bioinorganic Chemistry i.e., Basic chemical reactions in the biological systems and the role of metal ions in biological systems are discussed.
- CO2: Definition and classification of organometallic compounds on the basis of bond type, 18- electron rule, preparation, properties of inorganic organometallic compounds are discussed.
- CO3: Catalysis by Organometallic Compounds in industrial processes are discussed.
- CO4: Introduction to inorganic reaction mechanisms, theories of trans effect, Mechanism of nucleophilic substitution, Ligand field effects etc are discussed.
- CO5: Metal complex and their application in drug synthesis are discussed.

1B. COURSE NAME: INORGANIC CHEMISTRY-V LAB, COURSE CODE: CEMACOR13P

- CO1: Qualitative semimicroanalysis of mixtures containing radicals of inorganic salts are discussed.

2A. COURSE NAME: PHYSICAL CHEMISTRY- IV, COURSE CODE: CEMACOR14T

- CO1: Interaction of electromagnetic radiation with molecules are discussed.
- CO2: Rotation spectroscopy, Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules are discussed.
- CO3: Vibrational spectroscopy, Classical equation of vibration, Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines, Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, interpretation of PMR spectra of organic molecules, Electron Spin Resonance (ESR) spectroscopy: Its principle are discussed.
- CO4: Laws of photochemistry, photochemical Processes: potential energy curves, rate of photochemical processes: Photochemical equilibrium etc are discussed.
- CO5: Surface tension surface energy of liquid flow are discussed.
- CO6: Adsorption: Physical and chemical adsorption; Freundlich and Langmuir adsorption isotherms; multilayer adsorption and BET isotherm etc are discussed.
- CO7: Colloids, Coagulation and Schultz-Hardy rule, Zeta potential, Stability of colloids, micelle formation etc are discussed.

2B. COURSE NAME: PHYSICAL CHEMISTRY- IV LAB, COURSE CODE: CEMACOR14P

- CO1: Determination of surface tension of a liquid, CMC, verification of Beer and Lambert's Law, pH spectrophotometrically are to be done

DSE (FOR HONOURS)

1A. COURSE NAME: ADVANCED PHYSICAL CHEMISTRY, COURSE CODE: CEMADSE01T(CREDIT 04)

- CO1: This course deals with the Bravais Lattice and Laws of Crystallography.
- CO2: In this course the learner will learn the following: The distance between consecutive planes of crystals, Miller indices, Determination of crystal structure: Powder method; Structure of NaCl and KCl crystals etc.
- CO3: In this course Statistical Thermodynamics are discussed highlighting the following: Macrostates, microstates, Boltzmann distribution, Partition function etc.
- CO4: Specific heat of solid, 3rd law of thermodynamics, adiabatic demagnetization etc are discussed.
- CO5: Classification of polymers, nomenclature, Mechanism and kinetics of step growth and copolymerization, conducting polymers etc are discussed.

1B. COURSE NAME: ADVANCED PHYSICAL CHEMISTRY LAB, COURSE CODE: CEMADSE01P (CREDIT 02)

- CO1: Computer programs based on numerical methods for Roots of equations, Numerical differentiation, Numerical integration, Matrix operations, Simple exercises using molecular visualization software are to be done.

2A. COURSE NAME: ANALYTICAL METHODS IN CHEMISTRY, COURSE CODE: CEMADSE02T(CREDIT 04)

- CO1: Qualitative and quantitative aspects of analysis of sampling, evaluation of analytical data, errors, accuracy and precision, etc are discussed.
- CO2: Basics of Optical methods of analysis are discussed. Basic principles of instrumentation of UV-Visible Spectrometry, Infrared Spectrometry, Flame Atomic Absorption and Emission Spectrometry
- CO3: Techniques for the quantitative estimation of trace level of metal ions from water samples
- CO4: Theory of thermogravimetry (TG), basic principle of instrumentation and techniques for quantitative estimation of Ca and Mg from their mixture are discussed.
- CO5: Basic principle of pH metric, potentiometric and conductometric titrations and techniques used for the determination of equivalence points, pKa values are discussed.
- CO6: Different experiments of **Separation techniques like** Solvent extraction, Chromatography, IC, GLC, GPC, TLC and HPLC etc are discussed.
- CO7: Basic principles of Stereoisomeric separation and analysis are also to be done.

2B. COURSE NAME: ANALYTICAL METHODS IN CHEMISTRY LAB, COURSE CODE: CEMA DSE02P (CREDIT 02)

- CO1: Learners will be accustomed with Separation and identification of the monosaccharides, Separate a mixture of Sudan yellow and Sudan Red, active ingredients of plants, flowers and juices by TLC.
- CO2: Solvent Extractions for separation of metal ions and Spectrophotometry for determination of BOD and COD and pKa values of indicator are to be done.

3A. COURSE NAME: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS, COURSE CODE: CEMA DSE03T (CREDIT 04)

- CO1: Recap of the spectroscopic methods covered in detail in the core chemistry syllabus.
- CO2: Interpretation of spectrum of UV-Visible/ Near IR, FTIR and related aspects of the instruments are discussed.
- CO3: Types of Chromatography and their use in separation techniques are discussed.
- CO4: Principle, Instrumentation and data analysis of Mass spectrometry, Atomic absorption, Atomic emission, and Atomic fluorescence, NMR spectroscopy to be done.
- CO5: Principle, Instrumentation and data analysis of Potentiometry & Voltammetry, X-ray analysis and electron spectroscopy are to be done.

3B. COURSE NAME: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS LAB, COURSE CODE: CEMA DSE03P (CREDIT 02)

- CO1: Safety Practices in the Chemistry Laboratory.
- CO2: Determination of a Mixture by UV/Vis spectra, Gas Chromatography, HPLC, Cyclic Voltammetry, NMR
- CO3: Detection of illegal drugs or steroids in athletes, Detection of pollutants or illegal dumping, Fibre analysis etc.

4A. COURSE NAME: GREEN CHEMISTRY, COURSE CODE: CEMA DSE04T (CREDIT 04)

- CO1: This course deals with Principles of Green Chemistry and Designing a Chemical synthesis.
- CO2: Examples of Green Synthesis/ Reactions and some real world cases are to be studied.
- CO3: Students have to know about Future Trends in Green Chemistry.

4B. COURSE NAME: GREEN CHEMISTRY LAB, COURSE CODE: CEMA DSE04P (CREDIT 02)

- CO1: Preparation and characterization of nanoparticles of gold using tea leaves.
- CO2: Using renewable resources like preparation of biodiesel, use of enzymes as catalysts instead of other hazardous catalyst, alternative green solvents extraction, use of alternative sources of energy like sunlight in chemical reactions etc are to be studied.

5A. COURSE NAME: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE, COURSE CODE: CEMA DSE05T (CREDIT 04)

- CO1: Composition, properties, uses of different Silicate materials like glass, Ceramics, cements are discussed.
- CO2: Compositions, industrial preparation and use of different types of fertilizers are discussed.
- CO3: Chemistry about Surface Coating materials like paints, pigments dyes, additives are discussed.
- CO4: Chemistry of different cells (batteries), alloys, catalyst are discussed.
- CO5: Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

5B. COURSE NAME: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE LAB, COURSE CODE: CEMA DSE05P (CREDIT 02)

- CO1: Estimation to be done of essential components fertilizer.
- CO2: Determination of composition of dolomite, analysis of (Cu, Ni); (Cu, Zn) in alloy, analysis of Cement are to be done.

6A. COURSE NAME: POLYMER CHEMISTRY, COURSE CODE: CEMA DSE06T(CREDIT 04)

- CO1: This course includes Introduction and history of polymeric materials, Functionality and its importance of polymer.
- CO2: Kinetics of Polymerization: Crystallization and crystallinity of polymeric materials are focused.
- CO3: This course includes nature and structure of polymers, determination of molecular weight of polymers, glass transition temperature (T_g) and determination of T_g, polymer solubility.
- CO4: Physical, thermal, Flow & Mechanical Properties of polymers are discussed. A brief idea of conducting polymers is also to be studied.

6B. COURSE NAME: POLYMER CHEMISTRY LAB, COURSE CODE: CEMA DSE06P (CREDIT 02)

- CO1: Technique and principles of free radical solution polymerization, Emulsion polymerization, purification of monomer, interfacial polymerization, preparation of urea-formaldehyde resin are discussed.
- CO2: Polymer characterization and polymer analysis are also included.

**COURES OUTCOME
SKILL ENHANCEMENT COURSE IN CHEMISTRY
FOR HONOURS AND GENERAL**

1. COURSE NAME: BASIC ANALYTICAL CHEMISTRY. CODE: CEMSSEC001 (CREDIT 02)

- CO1: This course deals with the introduction to analytical chemistry with emphasizing concept of sampling, accuracy, precision, error in analytical measurements, presentation of experimental data etc.
- CO2: Analysis of pH of soil, presence of different metal ions are to be done.
- CO3: Analysis of pH of water, contamination, dissolve oxygen etc. are to be done.
- CO4: Analysis of food preservations and adulteration, coloring materials are to be done.
- CO5: General introduction on principles of chromatography, separation of mixture of metal ion, , ion-exchange chromatography, Analysis of cosmetics, Determination of constituents of talcum powder are to be done.
- CO6: Some brief idea of flame photometric estimation, spectrophotometric Identification is to be given.

2. COURSE NAME: ANALYTICAL CLINICAL BIOCHEMISTRY. CODE: CEMSSEC002 (CREDIT 02)

CO1: In this course review of concepts from core course like Carbohydrates, Proteins, Enzymes, lipids, Lipoproteins, Enzymes are discussed.

CO2: The points to be discussed: Biochemistry of disease, A diagnostic approach by blood/ urine analysis.