

B.Sc - Semester I

Each theory course of Credit 04 (4 hour per week over a semester)

Each practical course of Credit 02 (6 hour per week over a semester)

1. Course Outcome (CO) : (Core: Atomic structure, bonding, General organic chemistry and aliphatic hydrocarbons)

From Inorganic Chemistry,

CO1: Student will learn, atomic structure, various theories of quantum mechanics,

CO2: Schrodinger wave equation, quantum numbers, filling of electron rule,

CO3: chemical bonding and molecular structure, ionic and covalent bonding,

CO4: VSEPR and hybridization theory,

CO5: MO and LCAO theory by giving suitable examples.

From Organic Chemistry:

CO6: Student will learn the fundamental of organic chemistry and structure, shape of molecule

CO7: Types of intermediates structure involved in a chemical reaction

CO8: Aromaticity and reactivity of organic molecules,

CO9: Stereochemistry and isomers of organic molecules

CO10: Synthesis and reaction of alkane, alkene and alkynes.

2. Course Outcome (CO) : (Core-Lab: Atomic structure, bonding, general organic chemistry and aliphatic hydrocarbons)

From Inorganic Chemistry laboratory course:

CO1: In this part student will estimation of carbonate, Fe(II), Cu(II), oxalic acid from solution using volumetric methods

From Organic Chemistry laboratory course:

CO2: In this part student will perform experiment to detect the extra elements present in organic compounds such as N, S, Cl, Br, I

CO3: Separate two organic compounds from mixture using paper chromatography.

CO4: Separate two amino acids from mixture using paper chromatography.

Programme Specific Outcome (PSO) : (Core/Lab: Atomic structure, bonding, general organic chemistry and aliphatic hydrocarbons)

PSO1: From **atomic structure, bonding** student will learn various theories related to atomic structure, bonding, electronic configuration and energy levels in atoms and molecules. This helps student to understand why certain material exhibits electronic, magnetic or electrical properties.

PSO2: From **general organic chemistry and aliphatic hydrocarbons** student will learn structure and bonding and reactivity of organic molecules, synthesis of some of the aliphatic hydrocarbons. This helps students to understand the chemical, biological reactions and research ability towards developing efficient organic material.

PSO3: In Inorganic laboratory course, student will estimate metal ions using volumetric techniques

PSO4: In Organic laboratory course, student will identify organic compounds from various sources.

B.Sc - Semester II

Each theory course of Credit 04 (4 hour per week over a semester)

Each practical course of Credit 02 (6 hour per week over a semester)

1. Course Outcome (CO) : (DSC 2B: Chemical Energetics, Chemical Equilibrium & Functional organic chemistry)

From physical chemistry,

PO1: Student will learn various thermodynamics laws and thermodynamics parameter, electrolytes, degree of ionization, factors affecting and its applications.

From organic chemistry:

PO2: Student will learn various synthetic reactions of organic compounds with varying functional group.

2. Course Outcome (CO) : (Core-Lab: DSC 2B LAB: Chemical Energetics, Chemical Equilibrium & Functional organic chemistry)

From Physical Chemistry laboratory course:

PO1: In this part student will learn and calculate experimentally various thermodynamic parameters, (heat capacity of calorimeter, enthalpy of neutralization of acid-base reaction, enthalpy of ionization of acid, integral enthalpy of solution, etc.

PO2: Students gain knowledge about of buffer solution and measure the pH of buffer and different solutions used in our day to day life.

From Organic Chemistry laboratory course:

PO3: In organic laboratory course, student will purify organic compound using crystallization method.

PO4: Ability to synthesize organic compounds using reaction like bromination, benzylation, etc.

Programme Specific Outcome (PSO) : (Core/Lab: Chemical Energetics, Chemical Equilibrium & Functional organic chemistry)

PSO1: Student will gain knowledge about thermodynamics and experimentally determine thermodynamic parameter of a chemical reaction

PSO2: Student will learn how to determine the pH of solutions used in our day to day life.

PSO3: Ability to synthesize, purify and crystallization of organic compounds.

PSO4: This course provide students a platform for thinking theoretical as well as observed experimentally what is taught in the classes.

B.Sc -Semester III

Each theory course of Credit 04 (4 hour per week over a semester)

Each practical course of Credit 02 (6 hour per week over a semester)

1. Course Outcome (CO) : (Core: Solutions, Phase equilibrium, conductance, electrochemistry & functional group chemistry-II)

Section A: Physical Chemistry

CO1. Student will learn the thermodynamics of ideal solutions, partial miscibility of liquids.

CO2. Phase rule and phase diagrams of few one component and two component systems.

CO3 conductivity, transference number, applications of conductance measurements, conductance titrations, reversible, irreversible cells and potentiometric titrations.

Section B: Organic Chemistry

CO1. Student will learn the functional groups like carboxylic acid, amines and diazonium salts.

CO2. Student will learn the functional groups like amines and diazonium salts.

CO3. Student will learn the functional groups like amino acids, Peptides and Proteins.

CO4. Student will learn chemistry of carbohydrates.

2. Course Outcome (CO) : (Core-Lab: Solutions, Phase equilibrium, conductance, electrochemistry & functional group chemistry-II)

From Physical Chemistry:

CO1: The students will learn determination of critical solution temperature and composition of phenol system

CO2: Determination of cell constant, performing conductometric and potentiometric titrations

CO3: Systematic qualitative organic analysis of organic compounds possessing monofunctional groups

CO4: Separation of amino acids by paper chromatography

CO5: Differentiation between a reducing /nonreducing sugar.

Programme Specific Outcome (PSO) : (Core/Lab: Solutions, Phase equilibrium, conductance, electrochemistry & functional group chemistry-II)

PSO1: From **Solutions, Phase equilibrium, conductance, electrochemistry** student will learn various theories of ideal and real solution, which help them to generate industrial of great importance.

PSO2: Phase equilibrium principle helps them in separating various components from mixture samples such as ore.

PSO3: From conductance and electrochemistry, student will learn importance of electrodes and

their use in metal detection and purification.

PSO4: From **organic chemistry** student will learn various synthetic methods of organic and biologically important molecules like amino acids.

PSO5: In Physical laboratory course, student will learn various physical methods to determine component in mixtures of sample solution, strong and weak electrolytes using conductometric and potentiometric methods

PSO6: In Organic laboratory course, student will learn how to separate and detect organic compounds and amino acids, sugars using chromatography techniques.

B.Sc -Semester IV

Each theory course of Credit 04 (4 hour per week over a semester)

Each practical course of Credit 02 (6 hour per week over a semester)

COs of the course “ DSC- 2 D: Coordination Chemistry, States of Matter & Chemical Kinetics ”

CO 1 To develop a general understanding of different states of matter and the characteristic properties of each state of matter that defines their physical and chemical attributes.

CO 2 To view chemical reactions in terms of equations and rate laws.

CO 3 To train students in arithmetic methods in chemistry through integral and differential forms of zero order, first order and second order reactions in chemical kinetics and their graphical representations.

CO 4 Classification of transition elements in terms of group trends and their ability to exist in more than one oxidation states and to form complexes.

CO 5 To understand the chemistry of lanthanoids and actinoids.

CO 6 To bring out the difference in d-block and f-block elements due to their electronic configuration.

CO 7 To enhance the knowledge of students regarding coordination chemistry and Crystal Field Theory through Valence Bond Theory (VBT) and Crystal Field Effect, respectively.

CO 8 To introduce Octahedral and Tetrahedral geometries of complexes through Crystal Field Stabilization Energy (CFSE).

Cos of the Course “ Chemistry Lab-Dsc 2 D: Coordination Chemistry, States Of Matter & Chemical Kinetics ”

- CO 1 To familiarize students with chemicals and methods used for semi-micro qualitative analysis of cations and anions.
- CO 2 To develop precision skills amongst students when doing experiments in surface tension and viscosity and practically verify the properties of liquids that they have learnt in theory classes.
- CO 3 To get an opportunity to prepare complexes in quantitative estimation of Mg^{2+} or Zn^{2+} with EDTA.
- CO 4 To provide initiation in quality control methods like determining total hardness of a given sample of water.
- CO 5 To train students in writing reports for the labwork in their practical note book.

Programme Specific Outcome (PSO) : (Core/Lab: Coordination chemistry, states of matter & chemical kinetics)

PSO1: Students will learn about the structure and properties of transition metals, lanthanoids, coordination complexes of Cr, Fe, Co, Ni and Cu.

PSO2: Understand the mechanism of complex formation using VBT and CFT theory.

PSO3: Students learn the kinetics of ideal and non-ideal gases.

PSO4: Structure of solids lattice, liquids and kinetics of chemical reactions.

PSO5: From laboratory experiment, student will learn various qualitative analysis of ionic species

PSO6: Student learn various physical techniques that help to calculate physical parameters of liquids and chemical reactions.

B.Sc -Semester V

Each theory course of Credit 04 (4 hour per week over a semester)

Each practical course of Credit 02 (6 hour per week over a semester)

1. Course Outcome (CO) : (DSE: ANALYTICAL METHODS IN CHEMISTRY)

CO1: describes qualitative and quantitative aspects of analysis of research data such as accuracy, error, precision.

CO2: describes optical methods of data analysis using UV-Vis, IR, Flame atomic absorption and emission spectrometry. Basic principle and instrumentation are also discussed.

CO3: describes thermal methods of data analysis using thermogravimetry (TG) techniques, for example estimation of calcium and magnesium are discussed using TG.

CO4: describes electroanalytical methods of data analysis using pH metric, conductometric and potentiometric titration of weak and strong electrolyte.

CO5: describes different types of Separation techniques such as solvent extraction, metal ion extraction through chelation, chromatography techniques,

2. Course Outcome (CO) : (DSE Lab: Analytical methods in chemistry)

CO1: From this unit, student will learn and separate inorganic mixture using chromatography technique such as TLC and paper chromatography.

CO2: Separate organic mixture using chromatography technique such as TLC and paper chromatography

CO3: Separate metal ion using chelation technique.

CO4: Separate metal ion and amino acid using ion exchange chromatography.

Programme Specific Outcome (PSO) : (DSE theory/ Lab: Analytical methods in chemistry)

PSO1: From DSE course Analytical methods in chemistry, student will learn various qualitative and quantitative aspects of data analysis through optical, thermal, electroanalytical and chromatography techniques.

PSO2: This course, prepared a student for, how to approach a research problem using various instrumentation and data analysis techniques.

PSO3: From DSE Lab: Analytical methods in chemistry, student will learn, how to separate metal ion as well as organic compounds using chromatography and chelation techniques.

PSO4: Ability to develop analytical mind, which helps student to absorb in industry in analytical research work.

B.Sc -Semester VI

Each theory course of Credit 04 (4 hour per week over a semester)

Each practical course of Credit 02 (6 hour per week over a semester)

1. Course Outcome (CO) : (DSE: Organometallics, biorganic chemistry, polynuclear hydrocarbons and UV, IR spectroscopy)

CO1: From Organometallic, student will learn the preparation and properties of 3d metals complexes such as peroxo compounds, organometallic compounds

CO2: From Bioorganic chemistry, student will understand the role of metal ions in biological systems such as stabilization of protein structures.

CO3: From Organic Chemistry section, student will learn the synthesis of polynuclear and heteronuclear aromatic compounds.

CO4: Student will learn various chemical reactions (electrophilic and nucleophilic substitution reactions) of polynuclear and heteronuclear aromatic compounds.

CO5: Students will learn about the applications of spectroscopy (UV-Vis, IR) in characterizing the organic molecules.

2. Course Outcome (CO) : (DSE Lab: Organometallics, biorganic chemistry, polynuclear hydrocarbons and UV, IR spectroscopy)

CO1: From Inorganic Chemistry - Students will learn and carry out preparation of 3d metal complexes

CO2: Carry out separation of 3d metal complexes using chromatography methods such as paper chromatography.

CO3: From Organic Chemistry - Students will learn how to synthesize organic compounds

CO4: Ability for qualitative analysis of organic compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines)

Programme Specific Outcome (PSO) : (DSE theory/ Lab: Organometallics, biorganic chemistry, polynuclear hydrocarbons and UV, IR spectroscopy)

PSO1: DSE laboratory course, student will learn and develop ability to synthesize 3d metal complexes

PSO2: Develop ability to characterize organic compounds using qualitative methods.

PSO3: Ability to develop synthetic and analytical research work, which helps student to absorb in pharmaceutical as well as electronics device industry..

Skill Enhancement Course (Credit: 02 each)- SEC1 to SEC2

Each theory course of Credit 02 (2 hour per week over a semester)

BSc-III sem

1. Course Outcome (CO) : (Skill-SEC-1: Basic Analytical Chemistry)

CO1: Describes concept of sampling, analytical measurement, presentation of experimental data.

CO2: Describes analysis of soil using pH concept and complexometric titration.

CO3: Describes analysis of water of data analysis using thermogravimetry, pH concept and BOD and COD techniques.

CO4: Describes analysis of food products like preservatives, adulterants in common food items such as coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.

CO5: Describes separation of metal ions using chromatography techniques such as paper and TLC .

CO6: Describes analysis of major and minor components of cosmetics, deodorants, talcum powder and antiperspirants, Al, Zn, boric acid, chloride, sulphate, magnesium oxide, calcium oxide, zinc oxide and calcium carbonate etc.

Programme Specific Outcome (PSO) : (Skill-SEC-1: Basic Analytical Chemistry)

PSO1: **From Basic Analytical Chemistry**, student will learn various analytical measurement and detection of impurities, toxic material in our day to day used common items such as water, cosmetics, foods, soil using pH, chromatography and other analytical techniques.

BSc-VI sem

1. Course Outcome (CO) : (Skill-SEC-2: Green Methods in Chemistry)

CO1: Describes 12 principles of green chemistry with suitable example.

CO2: Describes the real world cases in green chemistry with suitable examples for each principle mention above.

CO3: Students learn to synthesize environmentally safe marine antifoulant, synthetic azo pigments used in dye industry instead of toxic organic and inorganic pigments,

CO4: Green synthesis of a compostable and widely applicable plastic (poly lactic acid) from corn, etc.

Programme Specific Outcome (PSO) : (Skill-SEC-2: Green Methods in Chemistry)

PSO1: From **Skill-SEC-2: Green Methods in Chemistry**, student will learn 12 principle of green chemistry.

PSO2: Identified various factor responsible for environment pollution.

PSO3: Student will learn, how to do green chemistry in our day today life and keep the environment green and pollution free.

Course Outcome (CO) : (Skill-SEC-Polymer Chemistry)

CO1 Introduce the history and classifications of polymers to students.

CO2 To explain the kinetics and mechanisms of polymerization to students.

CO3 The students will learn the morphology of polymers ;crystallinity, and glass transition temperature.

CO4 The course introduces to the students some aspects of thermodynamics of polymer solutions.

CO5 The students will learn about the physical, thermal, flow and mechanical properties of polymers.

Program Specific Outcome (PSO) : (Skill-SEC-Polymer Chemistry)

PSO1: The program forms a basic foundation in polymer chemistry. It is designed to prepare the student for vocational skill development.