

CHEMISTRY

Atoms and Molecules (CHE-01)

2 credits

Block 1 : Structure of Matter-I

- Unit 1 Old Quantum Theory
- Unit 2 Wave Mechanics
- Unit 3 Electronic Theory of Valency
- Unit 4 Valence Bond Theory
- Unit 5 Molecular Orbital Theory

Block 2 : Structure of Matter-II

- Unit 6 Molecular Properties
- Unit 7 Molecular Spectroscopy-I
- Unit 8 Molecular Spectroscopy-II
- Unit 9 Nuclear Chemistry

Inorganic Chemistry (CHE-02)

4 credits

Block 1 : Periodicity and s- Block Elements

- Unit 1 The Periodic Table
- Unit 2 Periodicity
- Unit 3 Hydrogen
- Unit 4 Alkali Metals
- Unit 5 Alkaline Earth Metals

Block 2 : p-Block Elements-I

- Unit 6 Elements of Group 13
- Unit 7 Elements of Group 14
- Unit 8 Elements of Group 15

Block 3 : p-Block Elements-II

- Unit 9 Elements of Group 16
- Unit 10 Elements of Group 17
- Unit 11 Elements of Group 18

Block 4 : d- and f- Block Elements

- Unit 12 Transition Elements
- Unit 13 Inner-Transition Elements

Unit 14	Coordination Compounds
Unit 15	Isolation and Purification of Metals

Chemistry Lab-I (CHE-03(L))

2 credits

Block 1 : Quantitative Analysis-I

Unit 1	Laboratory Techniques and Procedures
Unit 2	Acid-Base Titrations-I
Unit 3	Acid-Base Titrations-II

Block 2 : Quantitative Analysis-II

Unit 4	Estimation of Iron
Unit 5	Estimation of Copper
Unit 6	Estimation of Water

Physical Chemistry (CHE-04)

4 credits

Block 1 : States of Matter

Unit 1	Units and Dimensions
Unit 2	Kinetic Theory of Gases
Unit 3	Real Gases and Their Liquefaction
Unit 4	Liquids
Unit 5	Solid State

Block 2 : Chemical Thermodynamics

Unit 6	The First Law of Thermodynamics
Unit 7	Thermochemistry
Unit 8	The Second Law of Thermodynamics
Unit 9	Free Energy Functions

Block 3 : Solutions and Phase Rule

Unit 10	Solutions-I
Unit 11	Solutions-II
Unit 12	Colligative Properties
Unit 13	Phase Equilibria

Block 4 : Chemical Equilibria and Electrochemistry

Unit 14	Chemical Equilibria
Unit 15	Ionic Equilibria
Unit 16	Electrolytic Conductance of Solutions
Unit 17	Electrochemical Cells

Block 5 : Dynamics and Macromolecules

Unit 18	Chemical Kinetics
Unit 19	Photochemistry

Unit 20	Colloids and Macromolecules
Unit 21	Surface Chemistry and Catalysis

Organic Chemistry (CHE-05)

4 credits

Block 1: Fundamental Concepts

Unit 1	Bonding, Functional Group Classification and Nomenclature
Unit 2	Stereochemistry-I
Unit 3	Stereochemistry-II
Unit 4	Effect of Molecular Architecture on Physical Properties
Unit 5	Structure-Reactivity Relationships

Block 2: Basic Skeleton : Hydrocarbons and Heterocycles

Unit 6	Alkanes
Unit 7	Alkenes
Unit 8	Alkynes
Unit 9	Aromatic Hydrocarbons and Polynuclear Aromatics
Unit 10	Heterocyclic Compounds

Block 3: Derivatives of Hydrocarbons-I

Unit 11	Halogen Derivatives
Unit 12	Alcohols and Phenols
Unit 13	Ethers and Sulphur Analogues of Alcohols and Ethers
Unit 14	Aldehydes and Ketones

Block 4: Derivatives of Hydrocarbons-II

Unit 15	Monocarboxylic and Sulphonic Acids
Unit 16	Substituted Carboxylic Acids
Unit 17	Functional Derivatives of Monocarboxylic Acids
Unit 18	Nitro Compounds
Unit 19	Amino Compounds and Diazonium Salts
Unit 20	Natural Products

Organic Reaction Mechanism (CHE-06)

4 credits

Block 1: Basic Concepts and Substitution Reactions

Unit 1	Reaction Mechanism
Unit 2	Kinetics and Mechanism of Reactions
Unit 3	Aliphatic Nucleophilic Substitution
Unit 4	Aromatic Electrophilic and Nucleophilic Substitution

Block 2: Addition and Elimination

Unit 5	Addition to Carbon-Carbon Multiple Bond System
Unit 6	Nucleophilic Addition to Carbonyl Compounds
Unit 7	Elimination Reactions
Unit 8	Oxidation and Reduction

Block 3 : Reaction Intermediates and Molecular Rearrangements

Unit 9 Carbenes, Nitrenes and Benzynes

Unit 10 Free Radicals

Unit 11 Molecular Rearrangements

Unit 12 Pericyclic Reactions

Block 4 : Photochemistry and Synthetic Methods

Unit 13 Organic Photochemistry

Unit 14 Strategy of Organic Synthesis

Unit 15 Case Study of Some Chemicals of Daily Use-I

Unit 16 Case Study of Some Chemicals of Daily Use-II

Chemistry Lab-II [CHE-07(L)]

2 credits

Block 1 : Inorganic Preparations and Gravimetry

Unit 1 Apparatus and Experimental Techniques

Unit 2 Inorganic Preparations

Unit 3 Gravimetric Analysis

Block 2 : Qualitative Inorganic Analysis

Unit 4 Detection of the Anions

Unit 5 Detection of the Cations-I

Unit 6 Detection of the Cations-II

Chemistry Lab-III [CHE-08(L)]

2 credits

Block 1 : Preparatory Organic Chemistry

Unit 1 Techniques and Apparatus

Unit 2 Organic Preparations

Block 2 : Qualitative Organic Analysis

Unit 3 Preliminary Qualitative Analysis

Unit 4 Qualitative Classification Tests and Preparation of Derivatives-I

Unit 5 Qualitative Classification Tests and Preparation of Derivatives-II

Biochemistry (CHE-09)

4 credits

Block 1 : Biomolecules-I

Unit 1 Cell Structure and Function

Unit 2 Carbohydrates

Unit 3 Lipids

Unit 4 Nucleic Acids

Block 2 : Biomolecules-II

Unit 5 Proteins

Unit 6 Enzymes

Unit 7 Vitamins, Coenzymes and Minerals

Block 3 : Bioenergetics and Metabolism

- Unit 8 Bioenergetics
- Unit 9 Metabolism-I
- Unit 10 Metabolism-II
- Unit 11 Regulation of Metabolism
- Unit 12 Photosynthesis

Block 4 : Gene Expression

- Unit 13 Replication and Transcription of DNA
- Unit 14 Protein Biosynthesis
- Unit 15 Biotechnology
- Unit 16 Immunology

Spectroscopy (CHE-10)

4 credits

Block 1 : Basic Concepts and Rotational spectra

- Unit 1 Spectra of Atoms
- Unit 2 Symmetry and Basic Aspects of Group Theory
- Unit 3 Rotational Spectra

Block 2 : IR and Raman Spectra

- Unit 4 Vibrational Spectra of Diatomic Molecules
- Unit 5 IR Spectra of Polyatomic Molecules
- Unit 6 Raman Spectroscopy

Block 3 : Electronic Spectra and Instrumentation

- Unit 7 Electronic Spectra-I
- Unit 8 Electronic Spectra-II
- Unit 9 Optical Spectroscopy : Instrumentation & Sampling

Block 4 : Resonance Spectroscopy and Mass Spectrometry

- Unit 10 Nuclear Magnetic Resonance Spectroscopy
- Unit 11 Electronic Spin resonance spectroscopy
- Unit 12 Mass spectrometry
- Unit 13 Exercises in Problem Solving, Using IR, UV-Visible, NMR, Mass Techniques

Chemistry Lab-IV [CHE-11(L)]

4 credits

Block 1 : Laboratory Skills and Techniques

- Unit 1 Basic Lab Skills
- Unit 2 Handling of Data
- Unit 3 Use of Instruments—Low Cost Instruments

Block 2 : Properties of Liquids and Thermochemistry

- Unit 4 Surface Tension of an Aqueous Solution
- Unit 5 Viscosity of NaCl/CuSO₄/Cane Sugar Solution
- Unit 6 Enthalpy of Solution
- Unit 7 Enthalpy of Neutralisation

Block 3 : Application of Thermodynamics

- Unit 8 Depression of Freezing Point—Rast Method
- Unit 9 EMF Measurements
- Unit 10 Adsorption — Oxalic Acid on Charcoal
- Unit 11 Phase Equilibria-I
- Unit 12 Phase Equilibria-II

Block 4 : Chemical Kinetics

- Unit 13 Basic Concepts
- Unit 14 Initial Rate Method
- Unit 15 Integrated Rate Equation Method

Chemistry Lab-V (CHE-12(L))

4 credits

Environmental Chemistry (AEC-1)

8 credits

(6 cr Theory + 2 cr Lab work)

Block 1: Soil

- Unit 1 Nature and Formation of Soil
- Unit 2 Soil Quality Parameters
- Unit 3 Soil Fertility and Productivity

Block 2: Water

- Unit 4 Water Resources**
- Unit 5 Water Characteristics**
- Unit 6 Water Quality Criteria and Uses**

Block 3: Atmosphere

- Unit 7 Atmosphere : Nature and Importance
- Unit 8 Meteorological Aspects of Air Pollution
- Unit 9 Air Pollutants
- Unit 10 Air Quality Monitoring and Control

Block 4: Pollutants in Soil and Water

- Unit 11 Industrial Effluents
- Unit 12 Agrochemicals
- Unit 13 Municipal and Domestic Wastes
- Unit 14 Effects of Soil and Water Pollution

Block 5: Non-Instrumental Methods of Analysis

- Unit 15 Sampling Techniques and Preservation
- Unit 16 Classical Techniques
- Unit 17 Modern Techniques

Block 6: Instrumental Methods of Analysis

- Unit 18 Electroanalytical Methods
- Unit 19 Optical Methods

EXPERIMENTS

- Exp.1 Sampling and preservation of soil and water samples.
- Exp.2 Determination of pH and conductivity of soil and water samples.
- Exp.3 Determination of percent organic matter content in a soil sample.
- Exp.4 Determination of total available nitrogen in a soil sample.
- Exp.5 Determination of available sulphur in a soil sample.
- Exp.6 Determination of available phosphorus in a soil sample.
- Exp.7 Determination of extractable manganese and iron in a soil sample.
- Exp.8 Determination of alkalinity of a water sample.
- Exp.9 Determination of soluble chlorides in a water sample.
- Exp.10 Determination of soluble sulphates in a water sample.
- Exp.11 Determination of soluble nitrates in a water sample.
- Exp.12 Determination of dissolved oxygen in a water sample.
- Exp.13 Determination of hardness of a water sample.
- Exp.14 Determination of chemical oxygen demand of a water sample.
- Exp.15 Determination of dust fall, rainfall and humidity.
- Exp.16 Detection of CO₂ and NO₂ in ambient air/gaseous emissions.
- Exp.17 Determination of suspended particulate matters in ambient air and NO₂ in ambient air/gaseous emissions.
- Exp.18 Determination of SO₂ ambient in air/gaseous emissions.
- Exp.19 Identification of Pesticides in pesticide residues.