

CHEMISTRY

Module–I: PERIODIC PROPERTIES

(9Hours)

Periodic Properties, Effective Nuclear Charge, Penetration of Orbitals, Variations of *s*, *p*, *d* and *f* Orbital Energies of Atoms in the Periodic Table, Electronic Configurations, Atomic and Ionic Sizes, Ionization Energies, Electron Affinity and Electronegativity, Polarizability, Oxidation States.

Module–II: FREE ENERGY IN CHEMICAL EQUILIBRIA

(9 Hours)

Concepts of Entropy, Entropy in Physical and Chemical Changes, Free Energy Concepts, Gibbs Helmholtz Equation, Free Energy Change and Criterion of Spontaneity of Chemical Equation and Chemical Equilibrium, Van't Hoff Equation.

Module–III: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

(9 Hours)

Basic Terms and Principles of Spectroscopy

Molecular Rotational (Microwave) Spectroscopy: Basic Principle and Application to Diatomic Molecules, Selection Rules.

Molecular Vibrational (IR) Spectroscopy: Basic Principle, Types of Vibrations, Vibrational Frequency, Selection Rules.

Electronic (UV-Visible) Spectroscopy: Laws of Absorption, Basic Principle, Types of Electronic Transitions, Chromophores and Auxochrome.

Module–IV: STEREOCHEMISTRY

(9 Hours)

Structural and Stereoisomer (Geometrical and Optical), Symmetry and Chirality, Enantiomers, Diastereomers, Optical Activity, Configurational and Conformational Analysis, Representations of Three Dimensional Structures (E, Z and R,S only).

Module–V: ORGANIC REACTIONS AND SYNTHESIS

(9 Hours)

Introduction to Reaction Intermediates {Carbocation, Carbanion, Free Radical (Formation, structure and stability)}, Reactions involving Substitution, Addition, Elimination (Examples and Mechanisms)

Essential Reading:

1. Engineering Chemistry: fundamental to Applications by Shikha Agarwal, Cambridge University Press, Second Edition, 2019.
2. Engineering Chemistry by B. Rama Devi, P. Aparna, and Prasanta Rath, Cengage Learning, First Edition, 2023.

Supplementary Reading:

1. Atkins' Physical Chemistry by Peter Atkins, Julio de Paula, and James Keeler, Oxford University Press, Eleventh Edition, 2018.
2. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma, and Madan S. Pathania, Vishal Publishing, Forty Eighth Edition, 2021.
3. Fundamentals of Molecular Spectroscopy by C.N. Banwell and E.M. MacCash, 5th Edition, McGraw-Hill Education, Fourth Edition, 2017.
4. Concise Inorganic Chemistry by J.D Lee, Oxford University Press; Fifth Edition, 2008.
5. Principles of Inorganic Chemistry by B.R. Puri, L.R. Sharma, and K.C. Kalia, Vishal Publishing, Fifty Fifth Edition, 2020.
6. Stereochemistry: Conformation and Mechanism by P.S. Kalsi, New Age International, Eighth Edition, 2015.
7. Organic Chemistry Concepts and Applications by Jagdamba Singh, Pragati Prakashan, Eighth Edition, 2015.

8. Organic Chemistry by R.T. Morrison and R.N. Boyd, Pearson Education, Seventh Edition, 2010.
9. Organic Chemistry: Structure and Function by P. Volhardt and N. Schore, WH Freeman; Eighth Edition, 2018.

Course Outcomes:

CO1: To demonstrate and realise the trend in various periodic properties associated with different elements present in different groups and periods of modern periodic table.

CO2: To acquire the knowledge of free energy concept for the thermodynamics associated with chemical reactions and equilibria.

CO3: To analyze and implement the concepts of spectroscopic techniques for identification of various organic and inorganic compounds.

CO4: To evaluate and visualize the concept of configurations and conformations of various organic compounds

CO5: To assess the generation, reaction and identification of intermediates involved during organic reactions and their applications in different organic reaction mechanisms.

Course Articulation Matrix

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 1 | 2 | 2 | 2 | 3 |
| CO2 | 3 | 2 | 2 | 2 | 0 | 0 |
| CO3 | 3 | 1 | 2 | 2 | 2 | 2 |
| CO4 | 3 | 1 | 2 | 2 | 1 | 1 |
| CO5 | 3 | 2 | 2 | 2 | 2 | 1 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix Row for this Course

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|--------|-----|-----|-----|-----|-----|-----|
| Course | 3 | 2 | 2 | 2 | 1 | 1 |