Course Type	Course Code	Name of the Course	L	T	P	Credit
IC	CYI101	Chemistry	3	0	0	9

Course Objective
Engineering undergraduate students should develop a conceptual understanding of reactions, kinetics, and thermodynamics, which will be useful for most engineering branches. Need to develop an understanding of the relationship between the structure and function of organic and inorganic materials they may work with
Learning Outcomes
• Understanding the physical principles that govern the chemical reactions, thermodynamics and kinetics that is the backbone of physical chemistry • Understanding of the chemistry behind red-ox reactions • Develop an understanding of the structure and property relationship of aromatic and aliphatic compounds • Understand the role of chirality in deciding the property of molecules • Understand the chemistry behind thermal and photochemical transformations • Develop an understanding of the role of polymeric materials, lipids, proteins etc. and their interaction with drugs • Understand the origin of color, electronic and magnetic properties of substances • Develop the ability to reason the choice of enzymes and catalysts used in the Industry

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Module 1:Thermodynamics**: Second law of thermodynamics, entropy change accompanying various processes, Third law of thermodynamics, Spontaneity of a chemical reaction and Gibbs energy, Gibbs Helmholtz equation, Chemical potential	4	To understand the efficiency of heat engine, the feasibility of several processes, Understanding of open system
	Module 2: Phase Equilibria: Phase, components, degree of freedom, Phase rule, the Phase diagram of single component and two-component systems, eutectic point, Lever rule.	3	Stability of phases in different pressure and temperature, understanding of heterogeneous equilibria
	Module 3: Electrochemistry: Different type of electrode, Electromotive force, Nernst equation, Relationship between thermodynamic properties and EMF of a cell, Battery, fuel cell, Corrosion, corrosion control.	3	Understanding of electrode potentials, use of electrochemical cell for determining several parameters like solubility product, equilibrium constant etc.
	Module 4: Chemical Kinetics: Parallel, opposing and consecutive reaction, Unimolecular reaction, Lindemann-Hinshelwood approach, Adsorption Isotherms.	3	Getting the idea of the rate of reaction, steady-state concept and physisorption phenomena
2	**Module 1: Aromaticity** Aromatic, non-aromatic and anti-aromatic compounds	2	Provides a brief idea about aromatic/anti-aromatic/non-

			aromatic/homo-aromatic compounds
	Module 2: Stereochemistry Concept of chirality, Axial chirality, enantiomers and diastereomers, specific rotation, optical purity, Racemic modification and resolution, R/S, D/L and E/Z nomenclature	4	Fundamentals about the three-dimensional structures of organic compounds, their nomenclature
	Module 3: Pericyclic reactions Definitions, Classifications, photochemical [2+2] and thermal [4+2] cycloaddition, Sigmatropic rearrangement	3	To get an idea about abnormal organic reactions that proceed through thermal/photochemical activation
	Module 4: Macromolecules Introduction to peptides and proteins. Basics of Polymer Chemistry, Polymerization techniques, natural and synthetic polymer	4	Corelates with fundamentals of polymers and their uses in a day-to-day life brief ideas on proteins and peptides
3	**Module 1: Coordination chemistry** Crystal Field Theory; d-orbital splitting in Octahedral and tetrahedral ligand field; Jahn-Teller distortion; factors influencing magnitude of crystal field splitting; Spectrochemical Series, CFSE, Limitations and Consequence of CFT, Introduction to LFT	4	Develop an understanding of the effect of ligand field on d-orbital energy, Understand the origin of color, electronic and magnetic properties of compounds
	Module 2: Spectroscopy FT-IR spectroscopy vibration modes, Hooke's Law, UV-Visible spectroscopy Instrumentation: Source, Dispersion devices, sample area, detectors; types of electronic transitions, selection rules, ground state term symbol, chromophores; effect of conjugation, substituent effects	4	Understand the reason behind the origin of Infrared spectra and the origin of electronic spectra. Able to predict electronic transitions in molecules. Identify electronic transitions
	Module 3: Organometallic Chemistry 18 and 16 electron rule, M-M bonding, bonding modes of CO, activation of metal carbonyls, Catalysis by organometallic compounds: hydroformylation, Ziegler-Natta catalysis	3	Understand the origin of 18 electron rule and predict the stability of metal complexes. Develop the ability to reason the choice of enzymes and catalysts used in the Industry
	module 4: Solid state Chemistry Miller indices; Miller Indices for Planes, inter-planar spacing; defects; semiconducting and superconducting materials.	3	Understand identification of planes in crystal lattice. Understand the role of defects in defining the properties of solids

Text Books:

- Shriver Atkin's Inorganic Chemistry by P. Atkins, T. Overton, J. Rourke, M. Weller, M. Armstrong, 5th Edn, Oxford University Press, 2009
- Inorganic Chemistry by C.E. Housecroft, A. G. Sharpe, 4th Edn, Pearson Education, 2017
- Introduction to Spectroscopy by PAVIA, LAMPMAN, KRIZ, VYVYAN, Cengage Learning India Private Limited; 5 edition.

- Advanced Physical Chemistry by B. R. Puri, L. R. Sharma & M. S. Pathani, Milestone Publisher.
- Organic Chemistry, J. CLayden, N. Greeves, S. Warren, P. Wother, Oxford University Press, 2000.

Reference Books:

- Atkins' Physical Chemistry, P. Atkins and J. de Paula, 8th edition, Oxford University Press, 2006.
- Principles of polymerization, George G. Odian, 4th Edn, John Wiley & Sons, Inc., Publication, 2004.