Semester-IV

UCB029: General Chemistry – II

L	T	P	Cr
3	1	2	4.5

Course Objective: The student will get an introduction to phase transformation, kinetics, chemical equilibrium, thermodynamics and structure-property relationship.

Liquids, Solids and Phase Changes: States of matter, Phase, Component and Degree of freedom, Physical properties of liquids, Surface tension, Viscosity, Crystal, Lattice, Unit cell, Miller indices, Diffraction of X-rays, Bragg's law.

Solutions and their properties: Raoult's law, Vapor pressure of ideal and non-ideal solutions, Colligative properties.

Chemical Kinetics: Introduction, Rate laws of chemical reactions, Order and molecularity, Rate constantans and half-life time, Arrhenius equation.

Chemical Equilibrium: Equilibrium constant, Temperature dependence of equilibrium constant:van't Hoff reaction isotherm,Relations between K_p, K_c and K_x.

Aqueous Equilibria of Acid-Base and Applications: Concepts of acids and bases, Dissociation of acids and bases, pH scale, Henderson-Hasselbalch equation, Buffer solutions.

Thermodynamics: Laws of thermodynamics, Spontaneous and non-spontaneous process, Partial molar quantities, Chemical Potential.

Electrochemistry: Specific, equivalent and molar conductivity of electrolytic solutions, Migration of ions, Electrochemical cell, Concentration cells, Liquid junction potential.

Nuclear Chemistry: Nuclear Reactions, Mass defect and binding energy, Nuclear fission and fusion, Radioisotopes and its applications.

Transition Elements and Coordination Chemistry: Recapitulation of basic concepts, General properties and electronic configurations of d-block elements, Crystal field theory, Crystal field splitting in octahedral, tetrahedral and square planar complexes, Spectrochemical series, Jahn-Teller distortion.

Metals and Solid-State Materials: Dislocations in solids, Band theory of solids, Semiconductors and classifications.

Main Group Elements: General trends in main group elements (Group IA-VIIIA).

Organic and Biological Chemistry: Structural and stereo isomerism, Optical rotation, Chiralilty, R-S nomenclature, Interconversion of Fischer, Newman and Sawhorse projections, Role of metal ions in biological systems, Metalloprotein.

Polymers: Classification of polymers, thermoplastics and thermosetting polymers, polymer microstructure, polymer average molecular weight, degree of polymerization, conducting polymers, biodegradable polymers, and inorganic polymers: Properties and applications in diversified fields.

Nanoscience and Technology: Introduction to Nanoscience and technology, Synthetic methods, stabilizations, Self-Assembly, Lithography, CNTs and applications of nanomaterials.

List of Experiments:

1 To determine the surface tension of a given liquid.
2 To determine the rate constant of oxidation of iodide with hydrogen peroxide.
3 To determine the relative and absolute viscosities of a given liquid.
4 Preparation and determination of pH values of buffer solutions.
5 To determine the amount of HCl and CH_3COOH in a given mixtureconductometrically.
6 To determine the pK_{in} value of phenolphthalein indicator in aqueous solution.
7 To determine the solubility and solubility product of sparingly soluble salt by conductance measurement in aqueous solution.
8 To determination the isoelectric point of an amino acid.
9 To determine the optical rotation of cane sugar.
10 To determine the melting point of organic compounds (demonstration only).

Course Learning Outcomes: The students will be able to reflect on:

1. the fundamental idea of phase changes of liquids and solids, and their properties.
2. rate law of kinetics, concept of chemical equilibrium, applications of acid-base equilibrium in aqueous solution.
3. the concepts of thermodynamics, electrochemistry, nuclear chemistry and solid-state materials.
4. the general trends of main group elements and concepts of crystal field theory in coordination chemistry.
5. the basic idea of chirality and the role of metal ions in biological systems.
6. Laboratory techniques like volumetry, conductometry, pH-metry, potentiometry, kinetics, optical rotation, viscosity and surface tension measurement.

Text Books:

1. Atkins, P.; Paula, J. de.;Keeler, J., *Physical Chemistry*, Oxford University Press (2018), 11th ed.
2. Huheey, J.E., Keiter, E.A. and Keiter, R.L., *Inorganic Chemistry: Principles of Structure and Reactivity,*Pearson Education, (2002) 4th ed.
3. Lee, J.D., *Concise Inorganic Chemistry* Wiley, (2008) 5th ed.
4. Puri, B.R.; Sharma, L.R.; Pathania, M.S., *Principles of Physical Chemistry*, Vishal Publishing Co. (2016)48th ed.

Reference Books:

1. Sharpe, E., *Inorganic Chemistry*, Pearson Education, (2008) 3rd ed.
2. Zumdahl, S. S., *Chemistry Concepts and Applications* , Cengage Learning, (2009) 1st ed.

3. Castellan, G. W., *Physical Chemistry*, Addison-Wesley Publishing Company,(2004) 4th ed.
4. Das, A.; Das, M.,*An Introduction to Nanomaterials and Nanoscience*, CBS Publishers & Distributers Pvt. Ltd., (2017) 1st ed.
5. Ramesh, S.; Vairam S., Engineering *Chemistry*, Wiley India, (2012) 1st ed.

Evaluation Scheme:

MST	EST	Sessional (May include Quizzes/Assignments/Lab Evaluation)
25	40	35