Course name: Chemistry – II (Preparatory, 2nd semester)

Course Type	Course Code	Name of the Course	L	T	P	Credit
IC	CYP003	Chemistry-II	3	1	0	11

Course Objective
Having learned the fundamentals of Physical, Organic and Inorganic Chemistry in CYP101, in this preparatory course student will develop advanced understanding of different chemical reactions and processes. Again, this preparatory course will help them to prepare for the advanced Chemistry courses that they have to take up during their first year of B Tech course.
Learning Outcomes
• Understanding the physical principles that govern the chemical reaction kinetics. • Understanding of the chemistry behind redox reactions. • Develop an understanding of the structure and properties of solid-state materials and different surfaces. • Understanding the different chemical transformations of aliphatic and aromatic compounds. • Develop an understanding of the role of polymeric materials, carbohydrates. Lipids proteins etc. • Basic understanding of different forms of radioactivity and their use. • Develop an understanding of synthesis of metals and alloys from different naturally occurring ores. • To develop a general idea about chemical tests that is used for identification of metal ions.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Module 1: Electrochemistry** Electrochemical cells and cell reactions; Standard electrode potentials; Nernst equation and its relation to DG; Electrochemical series, EMF of galvanic cells; Faraday's laws of electrolysis; Electrolytic conductance, specific, equivalent, and molar conductivity, Kohlrausch's law; Concentration cells.	5L + 2T	Understanding of electrical cell and electrode potentials. Understanding of basic electrochemical parameters.
	Module 2: Chemical kinetics Rates of chemical reactions; Order of reactions; Rate constant; First order reactions; Temperature dependence of rate constant (Arrhenius equation).	3L + 2T	Getting the basic idea of the rate of reaction, order of reaction. Relationship between rate and temperature.

	Module 3: Solid state Classification of solids, crystalline state, seven crystal systems (cell parameters a, b, c, alpha, beta, gamma), close packed structure of solids (cubic), packing in fcc, bcc and hcp lattices; Nearest neighbors, ionic radii, simple ionic compounds, point defects.	3L + 1T	Understand identification of planes in crystal lattice. Understand the role of defects in defining the properties of solids.
	Module 4 : Surface chemistry Elementary concepts of adsorption (excluding adsorption isotherms); Colloids: types, methods of preparation and general properties; Elementary ideas of emulsions, surfactants and micelles (only definitions and examples).	3L + 1T	Basic concepts of adsorption and relationship of adsorption with different types of surfaces. Surfaces and amphiphilic molecules.
	Module 1: Characteristic and reactions of the following organic compounds Alkyl halides: Nucleophilic substitution reactions; rearrangement of alkyl carbocation, Grignard reactions, Alcohols: Dehydration and oxidation, esterification, reaction with sodium and phosphorus halides, conversion of alcohols. Phenols: Acidity of phenol, halogenation, nitration and sulphonation reactions; Reimer-Tieman reaction, Kolbe reaction etc. Ethers: Properties, preparation, and reactions of ether. Aldehydes and Ketones: Oxidation, reduction, oxime and hydrazone reaction; aldol condensation, Perkin reaction; Cannizzaro reaction; haloform reaction and nucleophilic addition reactions (Grignard addition); Carboxylic acids: formation of esters, acid chlorides and amides, ester hydrolysis. Amines: Basicity of substituted anilines and aliphatic amines, preparation from nitro compounds, reaction with nitrous acid, azo coupling reaction of diazonium salts of aromatic amines, Sandmeyer and related reactions of diazonium salts; carbylamine reaction. Haloarenes: nucleophilic aromatic substitution in haloarenes and substituted haloarenes (excluding Benzyne mechanism and Cine substitution).	8L + 2T	Basic organic transformation of molecules with variety of functional groups. Reaction mechanism of organic transformations.
	Module2: Carbohydrates Classification of mono- and di-saccharides (glucose and sucrose); Oxidation, reduction, glycoside formation.	3L + 1T	Sugars and polymers of sugars. Basic structure and reactions.
	Module3: Amino acids, peptides and polymers: General structure and physical properties of amino acids and peptides. Properties and uses of some important polymers: Natural rubber, cellulose, nylon, teflon and PVC.	3L + 1T	Structure, synthesis and properties of natural and un-natural polymeric molecules.

3	**Module1: Nuclear chemistry** Radioactivity: isotopes and isobars; Properties of alpha, beta and gamma rays; Kinetics of radioactive decay (decay series excluded), carbon dating; Stability of nuclei with respect to proton-neutron ratio; Brief discussion on fission and fusion reactions.	5L + 1T	Properties of radioactive elements, different types of radioactive emissions, use of radioactivity in chemistry and radioactive transformations.
	Module 2: Ores and minerals Commonly occurring ores and minerals of iron, copper, tin, lead, magnesium, aluminium, zinc and silver.	2L + 1T	Natural source of different metals and their chemical properties.
	Module 3: Extractive metallurgy Chemical principles and reactions only (industrial details excluded); Carbon reduction method (iron and tin); Self reduction method (copper and lead); Electrolytic reduction method (magnesium and aluminum); Cyanide process (silver and gold).	3L + 1T	Extraction of metals and alloys from different natural sources.
	Module 4: Principles of qualitative analysis Groups I to V (only Ag^{+}, Hg^{2+}, $Cu^{2+,}$ Pb^{2+}, Bi^{3+}, Fe^{3+}, Cr^{3+}, Al^{3+}, Ca^{2+}, Ba^{2+}, Zn^{2+}, Mn^{2+} and Mg^{2+}); Nitrate, halides (excluding fluoride), sulphate and sulphide.	4L + 1T	Chemical reagents and tests for qualitative analysis of cation and anions both individually and in a mixture.

Text Books:

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