Semester III: Chemistry-III (3 L-0 T-1 P)

Unit	Content	Contact Hrs
Unit I: Acid and Bases	Acid-base concepts, measure of acid and base strength, proton affinity, acidity and basicity of binary hydrogen compounds, inductive effect and strength of oxyacids, acidity of aqua ions, steric effect, proton sponge, solvation and acid base strength, non-aqueous solvents and acid base strength, levelling effect, superacids and superbases. Hard and soft acids and bases (HSAB), application of HSAB principle and symbiosis.	7
Unit II: Oxidation and reduction -I	Reduction potentials: Redox half-reactions, standard potentials and spontaneity, trends in standard potentials, the electrochemical series, Nernst equation (Influence of pH and concentration on electrode potential). Principles of redox titration and choice of redox indicators.	4
Unit III: Coordination chemistry-II	Valence bond theory (VBT), inner and outer orbital complexes, electroneutrality principle and back bonding, effects of hybridization in metal ligand bond strength and stability of complexes, choice of metal d-orbital(s) in hybridization in different coordination geometries, magnetic properties of complexes, drawback of VBT.	4
Unit IV: Aromaticity	Concepts of aromatic, anti-aromatic and non-aromatic compounds (including examples of cyclic carbocations, carbanions and heterocyclic compounds); Hückel's rule.	3
Unit V: Hydrocarbons and halogenated compounds	Methods of preparation, properties and relative reactivity of alkyl and aryl halides; Selectivity in electrophilic and nucleophilic substitution reactions (S_NAr), Preparation and reactions of diazonium salts; Benzyne mechanism.	4
Unit VI: Alcohols, phenols, thiols and related compounds	Preparation, properties and relative reactivity of 1°, 2°, and 3°-alcohols, ethers, epoxides (preparation and reactions with alcohols, ammonia derivatives and $LiAlH_4$). Thiols and sulfides; phenols (preparation, properties and reactivity; Reimer-Tiemann and Kolbe's-Schmidt Reactions)	4
Unit VII: Carbonyl compounds	Structure, reactivity and preparation; oxidations and reductions (Jones reagent, PCC and PDC, Oppenauer, Clemmensen, Wolff-Kishner, $NaBH_4$, $LiAlH_4$, MPV), Baeyer Villiger oxidation.	4

Unit VIII: Solution	Vapour pressure of solution. Ideal solutions, ideally diluted solutions and colligative properties. Raoult's law & Henry's Law. Thermodynamic derivation of colligative properties of solution (using chemical potentials) and their inter-relationships. Abnormal colligative properties.	7
Unit IX: Partial molar quantities	Fugacity, activity coefficients and concept of chemical potential: Gibbs Duhem equation and Duhem-Margules equation: their use and application, Enthalpy, free energy and entropy of mixing, excess thermodynamic functions.	8
Laboratory Course III	**Group A** (a) Acid-base titration: estimation of carbonate, bicarbonate and hydroxide. (b) Redox titration: estimation of Fe(II) using standardised $KMnO_4$ solution. (c) Determination of water of crystallisation of Mohr Salt using standardised $KMnO_4$ solution. (d) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal indicator (diphenylamine). **Group B** (a) Identification of functional groups in a given organic sample: Simple functional groups such as alcohols, phenols, amines, nitro, carbonyl and carboxylic acid groups. (b) Prepare derivatives of a given organic sample containing single functional group (i.e. alcohols, phenols, amines, nitro, carbonyl and carboxylic acid group). **Group C** (a) Determine the surface tension of a given solution at room temperature using a stalagmometer. (b) Determine the viscosity of a liquid at a given concentration at laboratory temperature, by viscometer. (c) Determine the composition of a given liquid mixture by viscosity method. (d) Study the variation of viscosity of sucrose solution with the concentration of the solute. (e) Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methylacetate. (*Students need to perform at least three experiments from Group A and C. Group B is compulsory.*)	30