SEMESTER - IV Course IV (INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY) 60hrs (4 h / w)

UNIT - I OrganometallicCompounds 8h Definitionandclassification oforganometallic compoundsonthebasisofbondtype, Conceptofhapticityof organicligands. Metalcarbonyls:18electronrule,electroncountofmononuclear, polynuclearandsubstituted metalcarbonylsof3dseries.Generalmethodsofpreparationofmonoandbinuclearcarbonylsof 3d series.P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT – II Carbohydrates 8h Occurrence,classificationandtheirbiologicalimportance,Monosaccharides: Constitutionandabsolute configurationofglucoseandfructose,epimersandanomers,mutarotation,determinationofringsiz eofglucose andfructose,Haworthprojectionsandconformationalstructures;Interconversions ofaldosesandketoses; Killiani-FischersynthesisandRuffdegradation; Disaccharides– Elementarytreatmentofmaltose, lactoseand sucrose.Polysaccharides–Elementarytreatmentof starch.

UNIT- III Amino acids and proteins 6h

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis. Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

Heterocyclic Compounds 7h Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis. 21 Properties: Acidic character of pyrrole - electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

UNIT- IV NitrogenContainingFunctionalGroups

Preparation, properties and important reactions of nitrocompounds, aminesanddiazoniumsalts.

Nitro hydrocarbons 3h

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

Amines: 11h Introduction,classification,chiralityin amines (pyramidal inversion),importanceand generalmethodsofpreparation. Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. DistinctionbetweenPrimary, secondaryandtertiaryaminesusingHinsberg’smethodandnitrousacid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimidesynthesis,HoffmannBromamidereaction,Carbylaminereaction,Mannichreaction,Hoffmann’sexhaustive methylation,Hofmann-eliminationreactionandCopeelimination. Diazonium Salts:Preparationand syntheticapplicationsofdiazoniumsaltsincludingpreparationofarenes, haloarenes, phenols,cyanoandnitrocompounds. Couplingreactionsofdiazoniumsalts (preparationofazo dyes).

UNIT- V Photochemistry 5h

Difference between thermal and photochemical processes, Laws of photochemistry- GrothusDraper's law and Stark-Einstein's law of photochemical equivalence, Quantum yieldPhotochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics 12 h

The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.

Organic Qualitative analysis 50 M

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives. Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

SEMESTER - IV

CourseV (INORGANIC &PHYSICAL CHEMISTRY) 60 hrs (4 h / w)

INORGANIC CHEMISTRY 26 h

UNIT –I Coordination Chemistry 12 h

 IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry,Jahn-Teller distortion, square planar coordination.

UNIT –II

1. InorganicReactionMechanism: 4h Introductiontoinorganicreactionmechanisms.Conceptofreaction pathways,transitionstate,intermediateand activatedcomplex. Labile and inert complexes, ligand substitution reactions - SN 1 and SN 2 ,Substitutionreactionsinsquare planar complexes,Trans-effect,theoriesoftranseffect and its applications

2. Stability of metal complexes: 2h

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

BioinorganicChemistry: 8h Metalionspresentinbiologicalsystems,classificationofelementsaccordingtotheiractioninbiolog ical system.Geochemical effectonthedistributionofmetals,Sodium/Kpump,carbonicanhydraseand carboxypeptidase. 26 Excessanddeficiencyofsometracemetals.Toxicityofmetalions(Hg,Pb,CdandAs), reasonsfortoxicity,Useof chelatingagentsinmedicine,Cisplatinasananti-cancerdrug. Ironanditsapplicationinbio-systems,Haemoglobin,Myoglobin.Storageandtransferof iron.

 PHYSICAL CHEMISTRY 34 h

UNIT-III 1 .Phase rule 6h

Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.

UNIT-IV Electrochemistry 14h

Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes,Kohlrausch's law and its applications, Definition of transport number,determination of transport number by Hittorf’s method. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conductometric titrations. Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metalmetal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations. Fuel cells- Basic concepts, examples and applications

UNIT-V ChemicalKinetics: 14 h

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).Enzyme catalysis- Specificity, 27 factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant

 SEMESTER - IV CourseV LABORATORY COURSE 30hrs (2 h / w) Practical-Course -VConductometric and Potentiometric Titrimetry 50 M

Conductometric and Potentiometric Titrimetry 50 M

1. Conductometric titration- Determination of concentration of HCl solution using standard NaOH solution.

2. Conductometric titration- Determination of concentration of CH3COOH Solution using standard NaOH solution.

3. Conductometric titration- Determination of concentration of CH3COOH and HCl in a mixture using standard NaOH solution.

4. Potentiometric titration- Determination of Fe (II) using standard K2Cr2O7 solution.

5. Determination of rate constant for acid catalyzed ester hydrolysis.