Teaching Objectives & Learning Outcomes in B.Sc. Chemistry(H)

SEMESTER – I

CH-101 : Section A : INORGANIC CHEMISTRY 25 Marks; 30 Hours

Unit 1 : Atomic Structure 6 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Idea of de Broglie Matter waves, Heisenberg uncertainty principle, atomic orbital's, Schrodinger wave equation;
- explain quantum numbers, radial and angular wave functions, and probability distribution curves;
- draw on plain surfaces the shapes of s, p, d, orbital's;
- state Aufbau and Pauli exclusion principles, Hund's multiplicity rule;
- write Electronic configurations of the elements;
- calculate effective nuclear charge;

Unit 2 : Periodic Classification of Elements 6 Marks

Objective& outcomes s of this unit : After studying this unit, you will be able to

- understand Electronic configuration of the elements;
- define atomic and ionic radii, ionization energy, electron affinity, and electronegativity;
- explain methods of determination or evaluation of the above;
- state the trends in periodic table and applications in predicting and explaining the chemical behavior;

Unit 3 : Chemical Bonding 8 Marks

Objectives& outcomes of this unit : After studying this unit, you will be able to

- understand and explain Covalent bond – Valence Bond theory and its limitations, directional characteristics of covalent bond;
- define various types of hybridization;
- draw shapes of simple inorganic molecules and ions;
- explain Valence shell electron pair repulsion theory (VSEPRT) to define the shapes of NH_3, H_30^+, SF_4, CIF_3, ICI_2, Molecular orbital theory;
- appreciate homonuclear and heteronuclear diatomic molecules multicenter bonding in electron deficient molecules, bond strength and bond energy;
- calculate percentage ionic character from dipole moment and electronegativity difference;

Unit 4 : Theory of quantitative and qualitative analysis 5 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand and explain quantitative and qualitative analysis;
- understand about Strength of acid and bases, pH, common ion effect, solubility of precipitates, solubility product;
- define Principles of oxidimetry and reductimetry, iodimetry and iodometry;
- appreciate Gravimetric analysis – its principles, precipitation, coprecipitation, postprecipitation, theory of washing;
- explain Error in quantitative analysis;

CH 101: SECTION – B : ORGANIC CHEMISTRY 25 Marks : 30 Hours

Unit 1: Structure and Bonding 5 Marks

Objectives& outcomes of this unit : After studying this unit you will be able to

- define hybridization;
- explain the types of hybridization like sp, sp^2 and sp^3 in certain atoms;
- define and show bond lengths, bond angles and bond energy;
- differentiate between localized and delocalized chemical bonds;
- explain and differentiate about the van der Waal's interactions;
- appreciate inclusion compounds, clatherates, charge transfer complexes and their structures;
- understand the different electron displacement effects like resonance, hyperconjugation, inductive and field effects and explain the influence of these effects on the structure and reactivity of organic compounds;

Unit 2: Mechanism of organic reactions 6 Marks

Objectives& outcomes of this unit : After studying this unit you will be able to

- Understand and draw curved arrow notation, electron movement with arrows, half – headed and double – headed arrows;
- Appreciate and show homolytic and heterolytic bond breaking;
- Define and explain types of reagents – electrophiles and nucleophiles with examples;
- Explain the types of organic reactions with energy considerations, if any;
- Understand different reactive intermediates – carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples) and Assigning formal charges on intermediates and other ionic species;
- Know the methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetically controlled and thermodynamically controlled reactions and stereochemical studies);

Unit 3 : Cycloalkanes 5 Marks

Objectives& outcomes of this unit : After studying this unit you will be able to

- Understand about structures and nomenclature of monocyclic, bicyclic, tricyclic, cycloalkanes;
- Explain Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane);
- Explain the theory of strainless rings. The case of cyclopropane ring: banana bonds;

Unit 4 : Alkenes Cycloalkenes, Dienes and Alkynes 9 Marks

Objectives& outcomes of this unit : After studying this unit you will be able to

- Understand the different reactions for preparation of alcohols, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration;
- State and explain the Saytzeff rule, Hofmann elimination;
- Appreciate the physical properties and relative stabilities of alkenes;
- Write the chemical reactions of alkenes – mechanisms involved in hydrogenation, electrophilic and free radical additions;
- Explain Markownikoff's rule(with example);
- Understand the reactions of alkenes like hydroboration – oxidation, oxymercuration – reduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$,Polymerization of alkenes;
- Appreciate substitution at the allylic and vinylic position of alkenes;
- Know the nomenclature and classification of dienes: isolated, conjugated and cumulated dienes;
- Draw the structure of allenes and butadiene;
- Write different methods of formation & polymerization of dienes;
- Appreciate chemical reactions 1,2- and 1,4- additions, Diels – Alder reaction;
- Describe the Methods of formation, Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization, etc with examples;

SEMESTER – I (CH-101)

SECTION C : PHYSICAL CHEMISTRY 25 Marks : 30 Hours

Unit 1 : Gaseous State – I 6Marks

Objectives& outcomes of this unit : After studying this unit, you will be able to

- understand Kinetic molecular model of a gas, and its postulates ;
- derive of the kinetic gas equation;

- appreciate explain collision frequency; collision diameter; mean free path, including their temperature and pressure dependence;
- understand Barometric distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy,
- explain the law of equipartition of energy;

Unit 2 : Gaseous State – II **6Marks**

Objectives& outcomes of this unit : After studying this unit, you will be able to

- understand Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure and temperature for different gases, Causes of deviation from ideal behavior;
- explain van der Waals equation of state, its derivation and application in explaining real gas behavior;
- mention of other equations of state (Berthelot, Dieterici);
- define Boyle temperature Continuity of states, critical state
- appreciate relation between critical constants and van der Waals constants;
- explain the law of corresponding states;

Unit 3 : Liquid state **5Marks**

Objectives& outcomes of this unit : After studying this unit, you will be able to

- appreciate Nature of the liquid state, intermolecular forces;
- understand the Qualitative treatment of the structure of the liquid state and physical properties of liquids;
- explain vapour pressure, surface tension and coefficient of viscosity, and their determination;
- appreciate the Effect of addition of various solutes on surface tension and viscosity;
- explain the Temperature variation of viscosity and surface tension of liquids;

Unit 4 : Solid state **8Marks**

Objectives& outcomes of this unit : After studying this unit, you will be able to

- appreciate the nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices;
- understand the elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices;
- explain X-ray diffraction, Bragg’s law, a simple account of rotating crystal method and powder pattern method ;

CH-101P: INORGANIC CHEMISTRY PRACTICAL 25 Marks: 45 Hours

Outcomes& outcomes of this unit : After studying this unit, you will be able to

- Appreciate Semimicro analysis of inorganic mixtures containing four radicals/ions;
- Understand analysis of compounds containing Silver,lead, mercury,bismuth, copper, cadmium, arsenic, manganese, cobalt, aluminium iron, nickel, calcium, strontium, barium, magnesium, sodium, potassium, ammonium, chloride, bromide, iodide, fluoride, sulphate, sulphite, thiosulphate, chromate, phosphate, nitrate, nitrite, borate, arsenite and arsenate;

Understand what is quantitative analysis and Iodometry and dichromatometry.

SEMESTER – II

CH- 202 : Section A: INORGANIC CHEMISTRY 25 Marks: 30 Hours

Unit 1 : Acids and Bases 6 Marks

Objectives& outcomes of this unit : After studying this unit, you will be able to

- understand and explain Arrhenius concept, Bronsted-Lowry theory, electronic theory, Lux- flood theory, solvent system theory, Lewis theory of acids and bases;

Unit 2 : Oxidation and Reduction 6 Marks

Objectives& outcomes of this unit : After studying this unit, you will be able to

- define Oxidation and Reduction reactions;
- understand and explain Electronic concept of oxidation number, concept of oxidation-reduction, oxidation- reduction potentials;
- state the factors influencing redox potential;

Unit 3 : Non – aqueous solvents 6Marsks

Objectives& outcomes of this unit : After studying this unit, you will be able to

- understand non-aqueous solvent;
- classify solvents (protic, aprotic, amphiprotic);
- appreciate qualities of ionizing solvents;
- understand the study of reactions in liquid ammonia, liquid hydrogen fluoride and liquid sulphur dioxide;

Unit 4 : Chemistry of s- block elements **7Marks**

Objectives& outcomes of this unit : After studying this unit, you will be able to

- understand Comparative studies of s-Block elements;
- explain diagonal relationships;
- state salient features of hydrides;
- appreciate solvation and complexation tendencies including their function in biosystems;

SEMESTER – II

CH- 202 **Section B: ORGANIC CHEMISTRY** **25 Marks: 30 Hours**

Unit 1 : Stereochemistry of organic compounds **10 Marks**

Objectives/Outcomes of this unit : After studying this unit you will be able to

- Appreciate Concept of isomerism;
- define the elementsof symmetry, molecularchirality, enantiomers, propertiesof enantiomers, stereogeniccentre;
- discuss optical activity, chiral andachiral molecules with two stereogenic centres
- draw the structures of diastereomers, threo– and erythro– diastereomers,meso–compounds;
- describe the important methods of preparation of these classes of compounds;
- correlate relative and absolute configuration;
- State sequence rules;
- understand D and L and R and S systems of nomenclature, Geometrical isomerism, E and Z system of nomenclature, geometrical isomerism in oximes and alicyclic compounds;
- discuss Conformation isomerism–conformational analysis of ethane and n-butane; conformations of cyclohexane derivatives;
- Draw Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.
- Differentiate between configuration and conformation;

Unit 2 : Arenes and aromaticity **7 Marks**

Objectives/outcomes of this unit : After studying this unit you will be able to

- understand and correlate the Structure of benzene : molecular formula and Kekule structure;
- appreciate Stability and carbon- carbon bond lengths of benzene ;
- draw resonance structure, Molecular Orbital picture ;
- define the Arornaticity : the Huckel rule, draw structures of aromatic ions ;
- discuss Aromatic electrophilic substitution–general pattern of the mechanism, role of σ- and π-complexes;
- read and draw energy profile diagram;

- describe the Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel – Crafts reaction;
- Differentiate between activating and deactivating substituents, orientation and ortho/para ratio;

Unit 3 : Alkyl halides and aryl halides **4 Marks**

Objective/outcomes of this unit : After studying this unit you will be able to

- understand the Mechanisms of nucleophilic substitution reaction of alkyl halides. S_N2 and S_N1 reaction with energy profile diagrams;
- describe the reactions involved in the preparation of haloarenes and understand various reactions that they undergo;
- correlate the structures of haloalkanes and haloarenes with various types of reactions like nuclear and side chain reactions;
- appreciate and explain the addition–elimination and the elimination–addition mechanisms of nucleophilic aromatic substitution reactions:

Unit 4 : Alcohols **4 Marks**

Objectives& outcomes of this unit : After studying this unit you will be able to

- understand the Synthesis of dihydric alcohols from carbonyl compounds;
- name vicinal glycols in the IUPAC system of nomenclature:
- describe the reactions involved in the preparation of vicinal glycols and understand various reactions that vicinal glycols undergo such as oxidative cleavage with $[Pb(OAc)_4$ and $[HIO_4]$;
- name Trihydric alcohols by IUPAC system:
- understand the various chemical reactions including nitration, reaction with $KHSO_4$, etc.

SEMESTER – II (CH- 202)

Section C: **PHYSICAL CHEMISTRY** 25 Marks: 30 Hours

Unit 1 : Solutions **6 Marks**

Objectives& outcomes of this unit : After studying this unit, you will be able to

- understand solutions and mixtures, miscible and immiscible liquids, types of solutions;
- explain Raoults law and Henry's laws, ideal and nonideal solutions, deviations from ideal behavior, vapour pressure of liquids and liquid mixtures;
- appreciate separation of completely miscible binary liquids solutions by distillation;
- state azeotropic mixtures, solubility of partially miscible liquids (phenol – water, TEA – water and nicotine – water systems);
- explain the critical solution temperature, Nernst's distribution law and its limitations;

Unit 2 : Dilute Solutions **6 Marks**

Objectives& outcomes of this unit : After studying this unit, you will be able to

- understand Dilute solutions;
- explain Colligative properties – lowering of vapour pressure;
- derive Clapeyron–Clausius equation,Thermodynamic derivation using chemical potential to derive relations between the four colligative properties (i)relative lowering of vapour pressure, (ii)elevation of boiling point,(iii)Depression of freezing point, (iv)osmotic pressure and amount of solute
- appreciate Applications in calculating molar masses of normal, dissociated and associated solutes in solution;

Unit 3: Colloids and Surface Chemistry **6 Marks**

Objectives of this unit : After studying this unit, you will be able to

- understand Colloidal state and colloidal systems, characteristics of true solutions, colloidal solutions and suspensions;
- classify colloidal solutions;
- explain preparation and purification of colloidal solutions;
- state the properties of colloidal solutions, Tyndal effect, Brownian motion;
- describe Adsorption- Physisorption and chemisorptions, Freundlich adsorption isotherm, Langmuir adsorption isotherm;

Unit 4 : Thermodynamics – 1 **7 Marks**

Objectives& outcomes of this unit : After studying this unit, you will be able to

- define thermodynamics, Intensive and extensive variables; state and path functions; isolated, closed and open systems, Zeroth law, First law of thermodynamics;
- understand Concept of heat(q), work(w), internal energy(U);
- explain enthalpy(H), relation between heat capacities;
- perform calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions;
- appreciate Joule-Thomson effect and relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature;

CH-202P ORGANIC CHEMISTRY PRACTICAL Marks 25 : 45 Hours

Objectives/outcomes of this unit : After studying this unit, you will be able to

perform

- understand Determination of melting points of compounds like Naphthalene, Benzoic acid, Urea, Succinic acid, trans – Cinnamic acid, cis – Cinnamic acid, Salicylic acid, Acetanilide, m- Dinitrobenzene, p- Dichlorobenzene, Aspirin,etc;
- understand Determination of boiling point of compounds like Ethanol, Cyclohexane, Toluene, Benzene ;
- appreciate Mixed melting point determination of Urea-Cinnamic acid mixture using of various compositions
- appreciate Distillation: Simple distillation of ethanol-water mixture using water condenser
- Distillation of nitrobenzene and aniline using air condenser Crystallisation: Concept of induction of crystallisation, Benzoic acid from water;
- Decolourisation and crystallization using charcoal, Decolourisation of brown sugar(sucrose) with animal charcoal using gravity filtration

SEMESTER – III

CH-303 : Section A: INORGANIC CHEMISTRY 25 Marks: 30 Hours

Unit 1 : Metallurgy 6 Marks

Objectives& outcomes of this unit : After studying this unit, you will be able to

- understand and explain Minerals and Ores, general principles of metallurgy;
- appreciate the extraction of Li, K, Be, Sn, Sb, Bi, Cr and Mn;

Unit 2 : Chemistry of p-block elements 6Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand p-block elements, Comparative studies, diagonal relationships, salient features of hydrides, oxides, oxyacids and halides, basic properties of halogens,;
- explain interhalogens and polyhalogens;
- appreciate Applications of p-block elements (Si, Ge, Se);

Unit 3 : General properties of d-block elements 6Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand the general properties of d-block elements, definition, position in periodic table;
- state the characteristic properties of d-block elements;
- appreciate occurrence and abundance, variable oxidation states;

Unit 4: Coordination Chemistry 7 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define coordination chemistry;
- understand Werner's co-ordination theory and its experimental verification;
- understand the types of ligands;

- name coordination compounds by IUPAC system;
- define and calculate coordination number central atom or ion;
- appreciate stereochemistry of coordination compounds and isomerism of coordination compounds;

SEMESTER – III

CH-303: SECTION – B: ORGANIC CHEMISTRY 25 Marks: 30 Hours

Unit 1 : Phenols 5 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand the Acidic character of phenols;
- appreciate the Comparative acidic strengths of alcohols and phenols;
- draw the resonating structures of phenoxide ion;
- describe the reactions of phenols –electrophilic aromatic sub stitution, acylation and carboxylation:
- explain the Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben – Hoesch reaction and Reimer –Tiemann reaction;

Unit 2 : Ethers and epoxides 5 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand ethers, different methods for preparation of ethers;
- appreciate the physical properties of ethers;
- explain the chemical reactions of ethers specially cleavage and autoxidation, Ziesel's method, etc.
- know the synthetic methods of epoxides;
- describe the reactions such as acid and base catalysed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides;

Unit 3: Aldehydes and ketones 8 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3, -dithianes, synthesis of ketones from nitriles and from carboxylic acids;
- appreciate the physical properties of ethers;
- write and explain the Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives. Witting reaction, Mannich reaction Oxidation of aldehydes, Baeyer – Villiger oxidation of Ketones. Cannizzaro reaction, etc;

- know further the MPV reaction, Clemmensen reduction, Wolff – Kishner reduction, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones;
- have an introduction to α, β- unsaturated aldehydes and ketones;

Unit 4 : Organic compounds of Nitrogen **7 Marks**

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand about nitroalkanes and nitroarenes and their preparation;
- appreciate the Chemical reactions of nitroalkanes, Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media, Picric acid;
- draw the structure of amines and name them by IUPAC system of nomenclature;
- appreciate the physical properties, Stereochemistry of amines;
- explain about separation of a mixture of primary, secondary and tertiary amines, Structural features effecting basicity of amines;
- write and explain the Preparation of alkyl and aryl amines (reduction of nitrocompounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction;

SEMESTER – III (CH-303)

SECTION C : PHYSICAL CHEMISTRY 25 Marks: 30 Hours

Unit 1 : Thermochemistry **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define Heats of reactions: standard states; enthalpy of formation of molecules, and ions and enthalpy of combustion and understand its applications;
- understand and perform calculation of bond energy, bond dissociation energy and resonance energy from thermo chemical data, effect of temperature (Kirchoffs equations);

Unit2 : Thermodynamics-II **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Carnot cycle and its efficiency, concept of entropy, thermodynamic scale of temperature;
- define the second law of thermodyamics;
- perform Calculation of entropy change for reversible and irreversible processes ;
- appreciate Free Energy Functions;
- derive Gibbs and Helmholtz equation;

Unit3 : Chemical equilibrium **7 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Criteria of thermodynamic equilibrium, chemical equilibria in ideal gases, concept of fugacity;
- perform Thermodynamic derivation o f relation between Gibbs free energy of reaction;
- appreciate Equilibrium constants and their quantitative dependence on temperature, pressure and concentration;
- explain Free energy of mixing and spontaneity;
- perform thermodynamic derivation of relations between the various equilibrium constants Kp, Kc and Kx.
- state Le Chatelier principle;

Unit 4 : Chemical Kinetics – I **6Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define Orde rand molecularity of a reaction;
- explain rate laws in terms of the advancement of a reaction;
- derive differential and integrated form of rate expressions up to second order reactions ;
- explain Zero order reactions and examples -half life period with examples;
- understand effect of temperature on the rate of reactions - Arrehenius equation and concept of energy of activation;
- appreciate Experimental methods of the determination of rate laws;

CH-303P PHYSICAL CHEMISTRY PRACTICAL 25 Marks : 45 Hours

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Surface tension measurements Determine the surface tension by (i) drop number (ii) drop-weight method;
- perform Viscosity measurement Viscosity measurement of given liquids using Ostwald's viscometer, Study the effect of variation of viscosity of an aqueous solution with the concentration of solute;
- perform pH measurements, Measurement of pH of different solutions using pH-meter. Preparation of buffer solutions,

SEMESTER –IV

CH-404 Section A: INORGANIC CHEMISTRY 25 Marks: 30 Hours

Unit 1 : Chemistry of Lanthanides **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define lanthanides;
- understand Position of lanthanides in the periodic table,;
- state general properties of lanthanides, oxidation states, ionic radii ;
- explain lanthanide contraction, consequences of lanthanide contraction;
- draw electronic structure;
- appreciate complex formation, uses of lanthanides and their compounds;

Unit 2 : Chemistry of Actinides **6Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define actinides;
- understand Position of actinides in the periodic table, general properties of actinides;
- explain identification and nuclear synthesis of trans-uranium elements;
- appreciate separation of Np, Pu and Am from U;
- note down similarities between the later actinides and later lanthanides;

Unit 3 : Chemistry of noble gases **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define noble gases;
- understand the Position of noble gases in the periodic table;
- state the principles of isolation, chemical properties;
- explain bonding and stereochemistry of xenon compounds;
- appreciate uses of noble gases;

Unit 4 Hard and soft acids and bases **7 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define hard and soft acids and bases;
- explain Classification of acids and bases as hard and soft;
- understand Pearson's concept of acids and bases;
- appreciate acid–base strength and hardness and softness;
- explain Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness;

SEMESTER –IV

CH-404 **Section B: ORGANIC CHEMISTRY** **25 Marks: 30 Hours**

Unit 1 : Carboxylic acids **6 Marks**

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand Acidity of carboxylic acids, effects of substituents on acid strength, Reactions of carboxylic acids;
- appreciate the Hell-Volhard-Zelinsky reaction, Synthesis of acid chlorides, esters and amides;
- explain the Reduction reaction of carboxylic acids, Mechanism of decarboxylation;
- know about Hydroxy acids: malic, tartaric and citric acids;

Unit 2 : Carboxylic acid derivatives 6 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand acyl derivatives and relative stability of acyl derivatives and Physical properties of acyl derivatives;
- write the inter-conversion of acid derivatives by nucleophilic acyl substitution;
- appreciate the Preparation of carboxylic acid derivatives, chemical reactions;
- explain and write the Mechanisms of esterification and hydrolysis both in acidic and basic conditions.

Unit3 : Organometallic compounds 6 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand about Organomagnesium compounds, how to prepare Grignard reagents;
- draw the structure of Organomagnesium compounds;
- appreciate and write the various chemical reactions of Organomagnesium compounds;
- write the inter-conversion of acid derivatives by nucleophilic acyl substitution;
- appreciate the organozinc and organolithium compounds, their preparations and chemical reactions;

Unit 4 : Polymers 7 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- define Natural and synthetic Polymers and distinction between them;
- explain the mechanism of polymerization;
- distinguish condensation and addition polymers;
- appreciate Synthetic plastics, thermosetting and thermoplastic and the difference between the two;
- understand the some polymers like Urea – formaldehyde, phenol – formaldehyde plastics. Teflon, polystyrene and polyurethanes;
- describe the natural and synthetic rubbers, synthetic fibres, acrylics, nylon–6 and nylon–66, terylene;
- appreciate the elementary idea of fibre making, blended fibres;

SEMESTER –IV (CH-404)

Section C : PHYSICAL CHEMISTRY 25 Marks: 30 Hours

Unit 1 : Catalysis 6 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define Types of catalyst;
- understand specificity and selectivity of catalysts, mechanisms of catalyzed reaction at solid surfaces; effect of particle size and efficiency of the catalysts;
- Explain Enzyme catalysis, Michaelis-Menten mechanism, acid–base catalysis;
- appreciate Theory of catalysis – adsorption and intermediate compound formation;

Unit 2 : Ionic equilibria – I 7 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define Electrolytes and non – electrolytes, strong, moderate and weak electrolytes;
- understand ionization and ionization constant, factors affecting degree of ionization, ionic product of water;
- Perform Calculation of pH of dilute solutions of weak acids and bases;
- Explain common ion effect; dissociation constants of mono– and di– protic acids. Salt hydrolysis and pH for different salts;
- appreciate Buffer solutions, buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body;
- derive Henderson equation and state its applications;

Unit 3 : Ionic equilibria – II 6 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- explain Solubility and solubility product of sparingly soluble salts–applications of solubility product principle;
- explain Qualitative treatment of acid–base titration curves;
- understand Theory of acid – base indicators; selection of indicators and their limitations;

Unit 4 : Phase equilibria I 6 Marks

Objectives/outcomes of this unit : After studying this unit, you will be able to

- define Phases, components and degrees of freedom;
- explain Gibbs Phase Rule (no derivation) for non–reactive and reactive systems;
- state Application to one component systems–water, carbon dioxide and sulphur with applications;

CH-404P ANALYTICAL CHEMISTRY PRACTICAL 25 Marks : 45 Hours

Objectives/outcomes of this unit : After studying this unit, you will be able to

- determine Hardness of water using EDTA, estimate nickel using DMG
- estimate calcium content in chalk as calcium oxalate by permanganometry;
- estimate reducing sugar by titration with standard Fehlings solution/Benidict's solution
- determine the equivalent weight of the given acid sample by direct titration method with alkali;
- determine the Saponification value of the given fat or oil sample
- estimate protein in the given sample by Folin Lowry method / biuret method
- estimate a reducing sugar by colorimetric method;
- determine the concentration of a given sample by using Lambert – Beer's law;
- determine the amount of iodine from a given sample (salt) by titration method;

SEMESTER – V

CH-505 INORGANIC CHEMISTRY 67 Marks: 90 Hours

Unit 1 : Nuclear Chemistry and Radioactivity 7 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand and explain nuclear chemistry and radioactivity;
- understand the discovery of radioactivity, nature of radiations, separation of isotopes, binding energy, mass defect, half–life, group displacement law, artificial transmutation, artificial radioactivity
- define Nuclear binding energy and packing fraction;
- explain thermonuclear reactions, radioactive tracer techniques and their applications;

Unit 2 : Chemistry of compounds of non – transition elements 8 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Comparative studies of s– and p– block elements;
- understand Preparation and properties of bleaching powder, Portland cement and borazole ;
- appreciate Study of Solid CO_2 and carbonaceous fuel (solid, liquid and gaseous);
- explain Oxides and oxyacids of phosphorous, oxides and hydrides of halogens, Chemical reactivity of Chalcogens (halides, oxyacids and peroxyacids of sulphur);

Unit 3 : Chemistry of second and third transition element series 11 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand the General characteristics, comparative treatment with their 3d-analogues (ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry) of second and third transition element series;
- explain Vertical group and horizontal group relationship of 3d, 4d and 5d elements, oxides and halides of scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper and zinc gouts;
- appreciate the Role of transition elements in biology;

Unit 4 : Alloy and intermetallic compounds **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define Alloy and intermetallic compounds;
- understand Effect of alloying, types of alloys, rules for the formation of alloys;
- appreciate intermetallic compounds;

Unit 5 : UV-visible spectroscopy **9 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand about ultraviolet and visible radiation;
- understand the Fundamental laws of photochemistry (Lambert-Beer's law), molar absorptivity, energy levels of electron transition of n $\longrightarrow$ π* and π $\longrightarrow$ π* , presentation of electronic spectra;
- appreciate application to characterization of groups like conjugated dienes, carbonyls and α, β- unsaturated carbonyl compounds, and inorganic compounds;
- understand the Elementary ideas on instrumentation and sample handling;

Unit 6 : Infrared Spectroscopy **9 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand infrared radiation, Unit of frequency;
- define wavelength and wavenumber, molecular vibrations - fundamental, overtone, combination tone;
- explain Fermi resonance, stretching and bending;
- appreciate Factors influencing vibrational frequencies (elementary treatment only), application to characterization of groups like C=N, C=O, C=C, COOR, N-H and $CONH_2$;
- understand the Elementary ideas on instrumentation and sample handling;

Unit 7: Thermodynamic and kinetic aspects of metal complexes **5 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand a brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes;

Unit 8: Environmental Chemistry 12 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Environmental segment, atmosphere, composition of atmosphere, atmospheric structure, reactions in atmosphere, oxidation of sulphur dioxide, photochemical smog, oxidation of organic compounds, radionuclides in environment
- appreciate water pollution, nature of pollutants, treatment of water. Toxic chemicals in environment, biochemical effects of mercury, cadmium, lead and pesticides, control and treatment of the above trace elements, solid waste pollution, treatment and disposal.

SEMESTER – V

CH-506 : ORGANIC CHEMISTRY 67 Marks; 90 Hours

Unit 1 : Carbohydrates 11 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- define carbohydrates;
- appreciate their classification and nomenclature, Monosaccharides, mechanism of osazone formation;
- explain about the constitution of glucose and fructose, chain lengthening and chain shortening of aldoses;
- appreciate Configuration of monosaccharides. Formation of glycosides, ethers and esters;
- understand Determination of ring size of monosaccharides. Cyclic structure of D(+)-glucose and Mechanism of mutarotation;
- draw the Structures of ribose and deoxyribose;
- have an introductary idea of disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination;

Unit 2 : Amino acids, Peptides and Proteins 7 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- define Amino acids, Peptides and Proteins;
- appreciate Classification, structure and stereochemistry of amino acids;
- explain about the Acid-base behaviour, isoelectric point and electrophoresis;
- appreciate Preparation and reactions of -amino acids;
- understand Classification of proteins, Peptide structure determination;
- distinguish Classical Levels of protein structure;
- describe Protein denaturation/renaturation;

Unit 3 : Nucleic acids 5 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- define Nucleic acids;
- appreciate Constituents of nucleic acids-ribonucleosides and ribonucleotides;
- explain about the Acid-base behaviour, isoelectric point and electrophoresis;
- appreciate the double helical structure of DNA;

Unit 4 : Fats, Oils, detergents 6 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand about Fats, Oils, detergents;
- appreciate Natural fats, edible and industrial oils of vegetables origin, common fatty acids, glycerides, hydrogenation of unsaturated oils;
- describe Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates;

Unit 5 : Pericyclic reactions 9 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand Pericyclic reactions;
- appreciate Definition and classification of electrocyclic reactions (thermal and photo chemical) involving 4 and 6 π- electrons and corresponding cyclo reversion reaction;
- explain cycloaddition reactions, FMO approach, Diels-Alder Reaction,
- write photochemical [2+2] reactions

Unit 6 : Synthetic dyes 5 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- understand Synthetic dyes, Colour and constitution (electronic concept);
- Classify dyes Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo;

Unit 7 : Steroids 7Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- Appreciate steroids ;
- Know about Occurrence, nomenclature, basic skeleton;
- Understand about Diel's hydrocarbon and stereochemistry;
- Write about Isolation, structure determination and synthesis of Cholesterol, Estrone. Biosynthesis of steroids;

Unit 8 : Terpenoids **5 Marks**

Objectives & outcomes of this unit : After studying this unit you will be able to

- Appreciate terpenoids ;
- Know about Occurrence, isolation, classification of terpenes and chemical composition ;
- explain about general methods of determining structure - Isoprene rule;
- Write about synthesis and structure of citral and limonene;

Unit 9 : Alkaloids **6 Marks**

Objectives & outcomes of this unit : After studying this unit you will be able to

- define Alkaloids;
- Know about extraction and general methods of determining structure, isolation;
- draw structure nicotine;
- appreciate the synthesis of nicotine, atrophine and coc aine;

Unit 10 : Enzymes **6 Marks**

Objectives & outcomes of this unit : After studying this unit you will be able to

- define Enzymes;
- state Enzymes as biocatalyst;
- understand chemical nature, general characteristics and nomenclature of enzyme activity;
- appreciate the Active sites of enzymes
- know about Vitamines (B complex group) and elements in enzyme function;

SEMESTER – V

CH – 507 **PHYSICAL CHEMISTRY** **66 Marks; 90 Hours**

Unit 1 : Mathematics for Chemists **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- explain Uncertainty in measurement: types of uncertainties, combining uncertainties
- understand Statistical treatment of uncertainties. Mean, standard deviation, relative error;
- Explain Data reduction and the propagation of errors;
- appreciate Graphical and numerical data reduction, method of least squares (regression);

Unit 2 : Atomic structure **6 marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Bohr treatment of atomic structure and spectra of hydrogen like atoms;

- explain limitations of Bohr model. Black body radiation;
- appreciate Planck's theory - photo electric effect - Compton effect
- explain Dual nature of matter, de Broglie's relationship, some simple examples

Unit 3 : Quantum Chemistry – I **8 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define Black-body radiation, Planck's radiation law;
- explain photoelectric effect, Bohr's model of hydrogen atom (no derivation and its defects),
- understand De Broglie hypothesis Heisenberg's uncertainty principle;
- Explain Quantum mechanical operators – momentum, position, energy;
- appreciate(Hamiltonian) operators, postulates of quantum mechanics. Expectation values of dynamical variables ;

Unit 4 : Photochemistry **6Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define Grotthus-Drapers and Lambert Beer's Laws, Stark-Einstien's laws of photochemical equivalence, Quantum yield;
- explain Photolysis of ammonia, decomposition of Hydrogen iodide and Hydrogen chlorine reactions;
- Explain Phothsynthesis. Phosophorescence, Fluorescence, Chemiluminescence and photosensitization with examples;

Unit 5 : Energetics **8 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- derive Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.;
- explain Systems of variable compositions, Partial molar quantities, dependence of thermodynamic parameters on composition;
- understand Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases, Nernst heat theorem;
- state Third Law of thermodynamics;
- Perform calculation of absolute entropy of molecules;

Unit 6 : Specific heats of solids **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- state The law of Dulong and Petit, atomic and molar heat capacities, Kopp's law;
- perform classical derivation of heat capacity;
- understand quantum theory of specific heats;
- Derive Einstein equation of heat capacity of solids, Debye's equation ;

- appreciate Debye's T law and characteristic temperatures of solids;

Unit 7 : Statistical Thermodynamics – I **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Purpose of statistical thermodynamics, probability of distribution, law of multiplication of probabilities, law of addition of probabilities;
- Explain Sterling approximation, concept of ensembles, canonical ensemble, microcanonical ensemble and grandcanonical ensemble;

Unit 8 : Interaction of molecules with electromagnetic radiations **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define Electromagnetic radiation, wave length, wave number and frequency with their units;
- explain the electromagnetic spectrum with wave lengths and frequency, absorption of electromagnetic radiation by molecules;
- understand elementary idea of different spectroscopic techniques and the information obtainable from each;

Unit 9 : Macromolecules **6 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Classification of polymers - natural and synthetic - rubber, cellulose, starch, wool, silk ;
- appreciate synthetic rubber, polyalkenes, acrylics, polyamides, polyesters, PVC polyurethane starting materials and uses ;
- salculate Number average molecular weight and weight average molecular weight;
- state Special properties of polymers;

Unit 10 : Conductance **9 Marks**

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define conductance;
- explain Metallic and electrolytic conductors - specific, equivalent and molar conductance
- understand measurement of conductance - variation of Conductance with dilution for strong and weak electrolytes(qualitative explanation) - Transport number and its determination by Hittorffs and moving boundary method;
- Explain effect of temperature and concentration - ionic mobility and ionic conductance - Kohlrausch's law and its applications - salt hydrolysis and pH of a salt solution, buffer action and explanation;

CH - 508P INORGANIC AND PHYSICAL CHEMISTRY PRACTICAL

100 Marks (Inorganic: 67 marks:Physical: 33 marks)135 Hours Inorganic Laboratory:

Objectives & outcomes of this unit : After studying this unit, you will be able to

- Prepare of Inorganic complexes such as sodium tris(oxalato)ferrate(III), Nickel Dimethylglyoxime, copper tetraammine complex, cis and trans-bis(oxalato)diaquachromiate
- estimate of two constituents from a binary mixture (one volumetrically and one gravimetrically e.g. Iron and calcium, iron and copper, iron and manganese, copper and zinc, silver and copper, calcium and barium, calcium and lead, calcium and magnesium, copper and chloride, copper and sulphate, etc;
- understand Semimicro analyses of five radicals containing at least one rare element Perform the following potentiometric/pH-metric titrations:

SEMESTER VI

CH-609 INORGANIC CHEMISTRY 67 marks: 90 Hours

Unit 1 : Bonding in coordination compounds 14 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define coordination compounds;
- understand and explain Theory of co-ordination bond, Effective atomic number rule, Valence bond theory and its limitations;
- understand Crystal field theory. Splitting of d-orbitals in different stereochemistries octahedral, tetrahedral and square planner complexes;
- appreciate Factors that influence complex formation, stability constants;

Unit 2 : Magnetic properties of transition metal complexes 8 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand and explain magnetism;
- understand Types of magnetic behaviour,
- explain the methods of determining magnetic susceptibility, spin only, formula, L-S coupling ;
- appreciate applications of magnetic moment data in 3d transition metal complexes;

Unit 3: Inorganic polymers 7 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define inorganic polymers;
- understand and explain Silicates and their classifications and structures, , phophazenes as inorganic polymers;
- explain structure and bonding in triphosphazenes, zeolites and molecular sieves;

Unit 4 : Thermoanalytical methods 9 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Thermogravimitric (TGA) and Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) - Basic principles, Instrumentation;
- state the Factors affecting to thermoanalytical techniques;
- appreciate Application in soils, organic and inorganic compounds, analytical chemistry;

Unit 5 : Organometallic Chemistry 9 Marks

Objectives& outcomes of this unit : After studying this unit, you will be able to

- define organometallic compounds;
- name and classify
- understand and explain organometallic compounds;
- explain 18 electron rule, counting of electrons in compounds;
- appreciate bonding and structure of CO, NO and N2 compounds;

Unit 6 : Bioinorganic Chemistry 9 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- define Bioinorganic Chemistry;
- understand Essential and non essential trace elements in biological processes;
- explain metalloporphyrins with special reference to haemoglobin and myoglobin;
- appreciate Biological role of alkali and alkaline earth metal ions with special reference to Na^+, K^+ and Ca^{2+}, nitrogen fixation, chlorophyll;

Unit 7 : Inorganic rings and cages 5Marks

Objectives of this unit : After studying this unit, you will be able to

- understand and explain Inorganic rings and cages, Boron hydrides, diborane and higher boranes, borazine, tetrasulphur, tetranitride;
- appreciate synthesis, structure and their properties;

Unit 8 : Non-stoichiometric compounds 6 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Radius ratio rules, classification of ionic structures, layer structures, lattice energy, Born-Harber cycle;
- explain non-stoichiometric defects and stoichiometric defects, semiconductor and transistors, photovoltaic cells;

SEMESTER – VI

CH - 609 **ORGANIC CHEMISTRY** **Marks: 90 Hours**

Unit 1 : Organosulphur compounds 5 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- name thiols, thiothers, sulphonic acids and sulphonamides according to IUPAC system of nomenclature.
- appreciate the functional groups of thiols, thiothers, sulphonic acids and sulphonamides
- draw the structures of thiols, thiothers, sulphonic acids and sulphonamides.
- describe the important methods of preparation of these classes of compounds;
- correlate physical properties of thiols, thiothers, sulphonic acids and sulphonamides with their structures;
- discuss chemical reactions of the thiols, thioethers, sulphonic acids, sulphonamides on the basis of their functional groups
- explain the mechanism of a few selected reactions

Unit 2 : Elimination reactions 7 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- explain Elimination Reaction, α-elimination, β-elimination;
- appreciate the E2, E1 and E1 cb mechanisms, orientation effects in Elimination Reactions, stereochemistry of E2 Reactions;
- note down the difference between elimination Vs substitution;
- give factors affecting the elimination and substitution reactions;

Unit 3 : Organic synthesis via enolates 7 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- appreciate enolates, Acidity of α-hydrogens;
- draw the mechanisms involved in alkylation of diethyl malonate and ethyl acetoacetate;
- describe Synthesis of ethyl acetoacetate: the Claisen condensation Keto-enol tautomerism of ethyl acetoacetate ;
- explain the mechanism of a few selected reactions like Alkylation of 1, 3-dithianes, Alkylation and acylation of enamines;

Unit 4 : Heterocyclic compounds 10 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- appreciate Heterocyclic compounds ;

- appreciate the introductory ideas of Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine;
- understand the methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution;
- explain Mechanism of nucleophilic substitution reactions in pyridine derivatives;
- bring out the points of differences in the basicity of pyridine, piperidine and pyrrole;
- have introductory idea of condensed five and six-membered heterocycles;
- Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis
- explain Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline;

Unit 5 : Medicinal chemistry **7 Marks**

Objectives & outcomes of this unit : After studying this unit you will be able to

- appreciate introductory idea of medicinal chemistry, Drugs and antibiotics;
- appreciate the synthesis and structure of; Sulphadrugs – Sulphadiazine, sulphaguanidine, Analgesics - aspirin, phenacetin,
  Antimalarials - Plasmoquin, chloroquine,
  Antibiotics – chloramphenicol;

Unit 6 : Chromatography **5 Marks**

Objectives & outcomes of this unit : After studying this unit you will be able to

- appreciate Principles and application of chromatography- column, thin layer, paper, preparatory thin layer, gas chromatography;
- understand the elementary ideas of instrumentation of gas chromatography;

Unit 7 : Mass spectroscopy **7 Marks**

Objectives & outcomes of this unit : After studying this unit you will be able to

- appreciate ideas of mass spectroscopy;
- understand the Basic principle, basic compounds of double focusing instruments, molecular ions, fragmentation of molecular ions;
- State the basic rules of fragmentation, fragmentation by -bond rupture in alkanes, bond rupture near functional groups ;
- have study of the nature of fragmentation and presentation of mass spectra of 2-methylpentane, cyclohexane;

Unit 8 : Nuclear Magnetic Resonance Spectroscopy **8 Marks**

Objectives & outcomes of this unit : After studying this unit you will be able to

- appreciate ideas of Nuclear Magnetic Resonance Spectroscopy;

- understand Qualitative and conceptual treatment of the nmr phenomenon, precessional frequency, energy trasition, theory of reasonance;
- explain chemical shift, magnetically nonequivalent protons, shielding and deshielding, spin coupling, analysis of AX type spectra like, (trans-cinnamic acid, 1, 1, 2-trichloro ethane, ethyl bromide;
- state elementary ideas on instrumentation and sample handling;

Unit 9 : Electron Paramagnetic Resonance Spectroscopy 5 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- appreciate ideas of Electron Paramagnetic Resonance Spectroscopy;
- understand Qualitative and conceptual treatment of the nmr phenomenon, precessional frequency, energy trasition, theory of reasonance;
- explain Elementary principle of epr;
- determine g values hyperfine splitting, epr spectra of C_6H_6(.) and $CH_3CHOCH\ 2CH_3$, and their analysis;

Unit 10 : Green Chemistry 5 Marks

Objectives & outcomes of this unit : After studying this unit you will be able to

- appreciate ideas of green chemistry;
- understand the Principles and applications of green chemistry;
- know Introduction,advantages and disadvantages of green chemistry;
- explain Applications in organic synthesis, principles of ultrasound and microwave assisted organic reactions, , reactions in ionic liquids;

SEMESTER – VI

CH -610 PHYSICAL CHEMISTRY Marks; 90 Hours

Unit 1 : Computer Applications in Chemistry 6 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Introduction to computers and its application in chemistry: - introduction to computers - characteristics of a computer - types of computers - block diagram of a digital computer;
- explain Algorithm, Flow chart, Applications of computer in chemistry (only selected programs);
- appreciate determination of molarity, normality and molality of solutions - calculation of pH;

Unit 2 : Quantum Chemistry – II 7 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Schrodinger wave equation in Cartesian co-ordinates) and its importance;
- explain wave function and its physical interpretations, Schrodinger equation for a free particle moving in one dimensional box and its solutions;
- appreciate probability distribution of electrons - radial probability distribution curves;

Unit 3 : Spectroscopy 8 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- explain Rotational spectra of diatomic molecules;
- understand Rigid rotor, moment of inertia, energy levels, selection rules, nature of spectrum, determination of bond length
- explain Effect of isotopic substitution on the rotational spectra;
- explain Vibrational spectra of diatomic molecules;
- appreciate Harmonic oscillator, energy levels, selection rules, nature of spectrum, determination of force constant;
- explain Anharmonic oscillator, energy levels, selection rules, nature of spectrum, fundamental band, overtones;
- understand Raman Spectroscopy: Raman Effect, Raman scattering-Stokes lines and Anti-Stokes' lines. Raman shift;

Unit 4 : Symmetry and Point groups 6Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- explain Symmetry operations - products of symmetry operations of various point groups with examples;
- create group multiplication table (C_{2v}, C_{3v});

Unit 5 : Electrochemistry I 6 Marks

Objectives of this unit : After studying this unit, you will be able to

- understand Chemical cells, reversible and irreversible cells with examples;
- appreciate Electromotive force of a cell and its measurement;
- explain Nernst equation; Standard electrode potential and its application to different kinds of half-cells;
- explain EMF in determination of (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone- hydroquinone, glass electrodes;

Unit 6 : Electrochemistry II 7 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand about Concentration cells with and without transference, liquid junction potential, decomposition potential, electrolytic polarization, overvoltage;
- explain determination of activity coefficients and transference numbers;
- appreciate Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation
- understand Theory of strong electrolytes - Debye - Huckel - Onsager theory (without detailed treatment) - verification of Onsager equation -- Wein effect and Debye - Falkenhangen effect;
- calculate ionic strength - activity and activity coefficients of strong electrolytes and the limiting equation;

Unit 7 : Statistical Thermodynamics – II 6 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Basic postulates of Maxwell-Boltzmann distribution law;
- derive of Boltzmann distribution law, Maxwell-Boltzmann distribution law of velocities;
- explain Partition function and its physical significances, types of partition functions (derivation not included);

Unit 8 : Surface Active Agents 6 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Hydrophillic and hydrophobic groups, amphiphiles;
- classify of surfactants, surfactants in solution, micelles and micelles formation;

Unit 9 : Chemical kinetics II 8 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- understand Collision theory and transition state theory of reaction rates, Lindemann mechanism;
- explain Steady state approximation and reaction mechanism, Kinetics of complex reactions;
- state and show (i) Opposing reactions (ii) parallel reactions , (iii) consecutive reactions and (iv) chain reactions;

Unit 10 : Phase equilibria II 7 Marks

Objectives & outcomes of this unit : After studying this unit, you will be able to

- appreciate Phase equilibria of two component system : solid -liquid equilibria, simple eutectic - Bi, Cd, Pb-Ag systems;

- explain desilverisation of lead., Solid solutions : compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl. H_2O), ($FeCl_3$-H_2O) and $CuSO_4$-H_2O system. Freezing mixtures, acetone dry ice;

CH - 611P ORGANIC AND PHYSICAL CHEMISTRY PRACTICAL

100 Marks (Organic : 67, Physical : 33)

Objectives & outcomes of this unit : After studying this unit, you will be able to

- Identifi of Organic Compounds; Detection of extra elements(N,S and halogens) and functional groups – phenolic, carboxylic, carbonyl, esters, amines, nitro, anilide, alcohol, halogen derivative of hydrocarbons and hydrochloride in simple organic compounds;
- perform certain organic reactions such as Acetylation of salicylic acid, aniline, glucose and hydroquinone. Benzoylation of aniline and phenol Aliphatic electrophilic substitution; Preparation of iodoform from ethanol and acetone Aromatic electrophilic substitution Preparation of m-dinitrobenzene, p-nitroacetanilide. Halogenation: Preparation of p-bromoacetanilide, 2, 4, 6-tribromophenol (d)Diazotisation/ coupling : Preparation of methyl orange and methyl red.;
- perform Oxidation: Preparation of benzene from toluene;
- Reduction: Preparation of aniline from nitrobenzene
- to study changes in conductance in the following systems: strong acid-strong base, weak acid-strong base and mixture of strong acid and weak acid-strong base;
- to study the kinetics of the following reactions Acid hydrolysis of methyl acetate with hydrochloric acid, volumetrically or conductometrically, Saponification of ethyl acetate;
- verify Lambert-Beer's Law;
- to Determine of PK (indicator) for phenolphthalein or methyl red;
- to study the formation of a complex between ferric and thiocyanate (or salicylate) ion

Program/Course outcome:

After completing the BSc Chemistry(H), the chemistry graduate go for different fields. He/She can appear different service examinations that can be done by a graduate.

1. One can go for undergoing MSc Chemistry(Organic, Inorganic, Physical, Analytical,etc)
2. Different Certificate Courses:

Analytical Chemist
Lab Manager (Analytical Chemistry)
Research associate Analytical Chemistry.
Teacher analytical Chemistry.
Senior Process Analytical Scientist.