



JECRCTM
UNIVERSITY
BUILD YOUR WORLD

Department of Chemistry
Course Structure and Syllabi
B. Sc. Course
(Chemistry Minor)

Session 2015-16

Names of Papers of Chemistry : B.Sc. Chemistry (Minor)

Semester I

Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total Credits
					L	P	
BCE 025A	Core-1: Basics of Chemistry	4	-		4		4
BCE 026A	Acid –Base Titrations and Radical identification (Practicals)			2		2	2

Semester II

Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total Credits
					L	P	
BCE 027A	Core-1: Periodic Trends in s- and p-Block Elements and Basics of Chemical Kinetics	4	-	-	4		4
BCE 028A	Mixture Analysis and Functional Group identification (Practicals)			2		2	2

Semester III

Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total Credits
					L	P	
BCE 029A	Core-1: Coordination Compounds, Aldehydes & Ketones and Thermodynamics	4	-		4		4
BCE 030A	Chromatographic Analysis and Calibrations (Practicals)			2		2	2

Semester IV

Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total Credits
					L	P	
BCE 031A	Core-1: Lanthanides, Actinides, Spectroscopy and Chemical Equilibrium	4	-		4		4
BCE 032A	Volumetric Analysis, Identification of Organic Compounds and Conductometric Analysis (Practicals)			2		2	2

Semester V

Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total Credits
					L	P	
BCE 033A	Core-1: Basics of Photochemistry and Electrochemistry	4	-		4		4
BCE 034A	Inorganic Preparations, Organic Mixture Separation and Adsorption Isotherms (Practicals)			2		2	2

Semester VI

Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total Credits
					L	P	
BCE 035A	Core-1: Organometallic Chemistry, Heterocyclic Compounds and Elementary Quantum Mechanics	4	-	-	4		4
BCE 036A	Inorganic and Organic Preparations and Optical Analysis (Practicals)			2		2	2

SEMESTER-I**BCE 025A: Basics of Chemistry****Unit-I**

Covalent Bond : Valence bond theory and its limitations, directional characteristic of covalent bond. Hybridisation and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory of NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2 , H_2O .

MO theory for homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Structure & Bonding

Hybridization, bond length, bond angles and bond energy, localized & delocalised chemical bond, vander - waals interaction, resonance, hyper conjugation, aromaticity, Inductive & field effect, H-bonding.

Unit-II**Stereochemistry**

Concept of isomerism. Types of isomerism. Optical isomerism - Elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, chiral & achiral molecules with two stereogenic centre, diastereomers, erythro diastereomers, resolution of enantiomers, inversion, retention. Absolute configuration, D & L and R & S systems of nomenclature.

Geometric isomerism - cis & trans-Isomerism, E & Z system of nomenclature, determination of configuration of geometrical isomers, geometrical isomerism in oximes & alicyclic compounds.

Conformational isomerism - Projection formulae (Fischer, Sawhorse, Newman & flying wedge formulae, conformational analysis of ethane & n-butane, difference between configuration and conformation.

Unit-III**Mechanism of Organic Reactions.**

Types of reagents, Electrophiles & nucleophiles. Types of organic reactions. Energy consideration, reactive intermediates-Carbocation, carbanion, free-radicals, carbenes, nitrenes, arynes. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic & stereochemistry studies).

Alkanes

Nomenclature, isomerism, methods of preparation (with special reference to wurtz reaction, Corey - house reaction. Kolbe reaction & decarboxylation of carboxylic acids), physical properties, mechanism of free radical halogenation of alkanes, reactivity & selectivity.

Unit-IV**Solid State**

Definition of space lattice, unit cell. Laws of crystallography- (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals, stoichiometric and non stoichiometric defects in solids, thermography & seven segment cell. X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of crystal structure of NaCl, and CsCl (Laue's method and powder method).

Gaseous States

Postulates of kinetic theory of gases, deviation from ideal behaviour, Vander Waals equation of state.

Unit-V**Molecular velocities**

Root means square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect).

Suggested Books

1. Selected topics in inorganic chemistry –Malik Tuli, Madan
2. Inorganic chemistry Principles of structure and reactivity-Huheey James ,E. Keiter Ellen ,A. Pearson, Edu. Delhi.
3. Stereochemistry of organic compounds-P.S. Kalsi, New age International
4. Organic chemistry Reaction and Reagents-O.P. Agarwal, Krishna Prakashan Meerut
5. Advanced Organic chemistry-Jagdamba Singh and LDS Yadav
6. Advanced Physical chemistry –Gurdeep Raj, Goel Publication
7. Essentials of physical Chemistry-Puri, Sharma, Pathania

BCE 026A: Acid –Base Titrations and Radical identification (Practicals)**INORGANIC CHEMISTRY**

1. To analyse acidic radicals of dilute H_2SO_4 and concentrated H_2SO_4 group.
2. To analyse mixture containing three acidic and three basic radicals (Group I, II and VII).
3. To analyse mixture containing three acidic and three basic radicals (Group II, III and VII).
4. To analyse mixture containing three acidic and three basic radicals (Group IV, VI and VII).
5. To analyse mixture containing three acidic and three basic radicals (Group I, II and V).

ORGANIC CHEMISTRY

1. To purify the impure sample of organic compounds by sublimation .
2. To separate the mixture (1 solid+1 liquid) by distillation .
3. To detect the elements (N and S) from the given organic compound.
4. To detect the element (halogen) from the given organic compound.
5. To purify the impure sample of organic compound by crystallization and decolourised the compound by charcoal.

PHYSICAL CHEMISTRY

1. To prepare standard 0.1 N NaOH solution using 0.1 N Oxalic acid as primary standard solution.
2. To determine strength of unknown CH_3COOH using 0.1 N NaOH as intermediate solution.
3. To determine the percentage composition of a given mixture (non interacting system) by viscosity method.

4. To determine the percentage composition of a given mixture (non interacting system) by surface tension method
5. To determine the partition coefficient of Iodine between water and carbon tetrachloride (or chloroform, carbon disulphide etc) at room temperature.

SEMESTER-II

BCE 027A: Periodic Trends in s- and p-Block Elements and Basics of Chemical Kinetics

Unit-I

Periodic trends in S-Block Elements and P- Block elements

Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies. Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16.

Compounds of P-Block Elements

Boranes, borazine, borohydrides, carbides, silicates (structural principle).

Unit-II

Alkenes : Nomenclature, isomerism, relative stabilities, methods of preparation: dehydration of alcohols, dehydrohalogenation of alkyl halides, dehalogenation of vic-dihalides, pyrolysis of quaternary ammonium hydroxides; physical properties, chemical reactions: - Catalytic hydrogenation, addition of hydrogen halides, hydroboration - oxidation oxymercuration reduction, epoxidation, ozonolysis, hydration, hydroxylation with KMnO_4 , substitution reactions at the allylic & vinylic positions, polymerization; regioselectivity in alcohol dehydration. Saytzeff & hofmann rules for elimination;

Alkynes : Nomenclature, isomerism, structure & bonding in alkynes, methods of preparation, physical properties, chemical reactions - addition of hydrogen, mechanism of electrophilic & nucleophilic addition , acidity of alkynes, hydroboration - oxidation, metal - ammonia reductions, oxidation & polymerisation.

Unit-III

Alkyl Halide

Nomenclature & classes of alkyl halides, methods of formation, chemical reaction. Mechanism of nucleophilic substitution reactions of alkyl halides, SN_2 & SN_1 reaction with energy profile diagrams.

Aryl Halides

Methods of formation of aryl halides, nuclear & side chain reactions. The addition - elimination & the elimination - addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides versus allyl, vinyl & aryl halides.

Unit-IV**Colloidal State**

Definition of colloids, classification of colloids. Solids in liquids (sols) : Properties - kinetic, optical and electrical; stability of colloids, protective action. Hardy-Schulze law, Glod number. Liquid in liquids (emulsions), types and preparation of emulsions, emulsifier, **Liquids in solids (gels)** : Classification, preparation and properties, inhibition, general application of colloids.

Unit-V**Chemical Kinetics**

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction Concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order pseudo order, half life and means life. Determination of the order of reaction – differential method, method of integration , method of half life period and isolation method. Radioactive decay as a first order phenomenon. Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometry. Theories of chemical kinetics : effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

Suggested Books

1. Selected topics in inorganic chemistry –Malik tuli, Madan.
2. Concise Inorganic Chemistry 5^{ed}- J. D. Lee
3. Kinetics and Mechanism of Chemical Transformation-J. Rajaram and J. C. Kuriacose
4. Advanced Physical Chemistry –Gurdeep Raj,Goel Publication
5. Organic Chemistry Reaction and Reagents-O.P.Agarwal,Krishna Prakashan Meerut
6. Chemical Kinetics-Laidler

BCE 028A: Mixture Analysis and Functional Group identification (Practicals)**INORGANIC CHEMISTRY**

1. To analyse mixture containing three acidic and three basic radicals including BO_3^{-3} as the interfering radical.
2. To analyse mixture containing three acidic and three basic radicals including PO_4^{-3} as the interfering radical.
3. To analyse mixture containing three acidic and three basic radicals including $\text{C}_2\text{O}_4^{-2}$ or F^- the interfering radical.
4. To analyse mixture containing three acidic and three basic radicals including $\text{C}_2\text{O}_4^{-2}$ or F^- the interfering radical.
5. To analyse mixture containing three acidic and three basic radicals .Mixture contains combination of acidic radicals. (Chloride in presence of Bromide or Iodide)
6. To analyse mixture containing three acidic and three basic radicals. Mixture contains combination of acidic radicals.(Oxalate in presence of Carbonate)

ORGANIC CHEMISTRY

1. To detect the functional group (alcoholic and phenolic) from the given organic compound.
2. To detect the functional group (Carboxylic and ester) from the given organic compound.
3. To detect the functional group (Carbonyl and Amide) from the given organic compound.
4. To detect the functional group (Amine and Aniline) from the given organic compound.
5. To detect the functional group (Carbohydrate And Nitro) from the given organic compound.

PHYSICAL CHEMISTRY

1. To determine the specific reaction rate of the hydrolysis of methyl or ethyl acetate catalysed by HCl at room temperature.
2. To determine the specific reaction rate of the hydrolysis of methyl or ethyl acetate catalysed by H₂SO₄ at room temperature and compare the relative strength of acids.
3. To determine the specific reaction rate of the hydrolysis of methyl or ethyl acetate catalysed by HCl at higher temperature (40°C) and also determine energy of activation for the reaction.
4. To study the effect of acid strength on the hydrolysis of ester.
5. To prepare colloidal solution of arsenious sulphide.

SEMESTER-III

BCE 029A: Coordination Compounds, Aldehydes & Ketones and Thermodynamics

Unit-I

Chemistry of Elements of Transition Series

Characteristic properties of d-block elements. Properties of the elements of the first transition series and their binary compounds .comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry

Unit-II

Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes. Complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Unit-III

Alcohol

Classification and nomenclature

Monohydric alcohol - nomenclature, methods of formation of reduction of aldehyde, Ketones, Carboxylic acids and ester. Hydrogen bonding, Acidic nature, Reaction of Alcohols.

Dihydric alcohol - nomenclature, method of formation, chemical reaction of vicinal glycols, oxidative cleavage [Pb(OAc)₄ and HIO₄] and pinacol - pinacolone rearrangement.

Trihydric alcohols - nomenclature and methods of formation, chemical reaction of glycerol.

Phenols

Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character. Comparative acidic strength of alcohols and phenols resonance stabilization of phenoxide ion, reaction of phenols, electrophilic aromatic substitution, acylation and carboxylation. Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben - Hoesch reaction, Lederer manasse reaction & Reimer Tiemann reaction.

Unit-IV**Aldehyde and Ketone - I**

Nomenclature and structure of the carbonyl group, Synthesis of aldehyde and Ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketone using 1,3 dithianes, synthesis of ketones from nitrites and from carboxylic acids, physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensation. Condensation with ammonia and its derivatives, Wittig reaction, Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer - Villiger oxidation of Ketones. Cannizzaro's reaction. Meerwein Ponderof Verlay reduction, Clemmensen, Wolff Kishner, LiAlH_4 and NaBH_4 reductions.

Unit-V**Thermodynamics**

Definition of thermodynamic terms : System, surroundings etc. Types of systems intensive and extensive properties. Concept of heat and work. First Law of Thermodynamics : Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law- Joule - Thomson coefficient and inversion temperature. Standard state, standard enthalpy of formation Hess's law of heat summation and its application. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

Second Law of Thermodynamics : Need for the law, different statements of the law, Carnot cycle and its efficiency. Carnot theorem. Concept of Entropy : Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, Clausius inequality, entropy as a criteria of spontaneity and equilibrium.

Third law of thermodynamics : Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions: Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as Criteria for thermodynamic equilibrium and spontaneity. Variation of G and A with P, V and T.

Suggested Books

1. Advanced Inorganic chemistry-S. K Agarwal, Keemtilal
2. Organic chemistry Reaction and Reagents-O. P. Agarwal, Krishna Prakashan Meerut
3. Advanced Organic chemistry-Jagdamba Singh and LDS Yadav
4. Reaction mechanism in Organic chemistry –S M Mukherji and S P Singh, Macmillan

5. Chemical thermodynamics-R. P. Rastogi and R.R Mishra
6. Advanced Physical chemistry –Gurdeep Raj, Goel Publication
7. Chemical thermodynamics-R. C. Srivastava, S. K. Saha and Abhay K. Jain

BCE: 030A: Chromatographic Analysis and Calibrations (Practicals)

INORGANIC CHEMISTRY

1. To calibrate fractional weights, pipettes and burettes.
2. To prepare standard solution and dilution -0.1 M to .001M solution.
3. To estimate hardness of water by EDTA.
4. To measure dissolved oxygen in water.
5. To measure Total Solid in sewage.
6. To measure chloride in water.

ORGANIC CHEMISTRY

Thin Layer Chromatography

1. To separate the mixture of Methyl Orange and Methylene Blue by using cyclohexane and ethyl acetate(8.5:1.5) as solvent system.
2. Preparation and separation of 2,4-dinitro Phenylhydrazone of acetone, 2-butanone, hexane-2-one and hexane-3-one using toluene and petroleum ether(40:60).

Paper Chromatography

3. To separate the mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid. Spray reagent –Ninhydrin.
4. To separate the mixture of D,L-alanine, glycine and L-leucine using n-butanol : acetic acid : water(4:1:5). Spray reagent- Ninhydrin.
5. To separate monosaccharides –a mixture of D –galactose and D-fructose using n-butanol : acetone: water (4:1:5) . Spray reagent –aniline hydrogen phthalate.

PHYSICAL CHEMISTRY

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
2. To determine the water equivalent of the thermos flask or calorimeter.
3. To determine the enthalpy of neutralization or heat of neutralization for a strong acid and strong base.
4. To determine heat of neutralization of a weak acid say acetic acid and hence calculate its heat of ionization or enthalpy of ionization.
5. To determine heat of neutralization of a weak base say NH_4OH and hence calculate its heat of ionization or enthalpy of ionization.

SEMESTER-IV

BCE 031A: Lanthanides, Actinides, Spectroscopy and Chemical Equilibrium

Unit-I

Chemistry of Lanthanide and Actinide Elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex

formation, Separation of Np, Pu and Am from U, Comparison between the later actinides and the later lanthanides

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2 .

Unit-II

U-V Spectra

Electromagnetic Spectrum. Absorption spectra Ultraviolet (UV) absorption Spectroscopy - absorption laws (Beer - Lambert's Law), molar absorptivity, presentation and analysis of UV spectra, types of UV spectra, types of electronic transition, effect of conjugation. Concept of Chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shift. UV spectra of conjugated enes and enones.

IR-Spectra

Molecular vibration, Hooke's Law, selection rules, intensity on deposition of IR bands, measurement of IR spectrum, finger print region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Unit-III

Carboxylic Acid

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength, preparation of carboxylic acid. Reaction of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, ester and amides, Reduction of Carboxylic acids. Mechanism of decarboxylation, method of formation and chemical reactions of unsaturated monocarboxylic acids. Decarboxylic acid, methods of formation and effect of heat and dehydrating agents haloacid, hydroxy acids - malic tartaric & citric acid.

Carboxylic Acid Derivatives

Structure and nomenclature of acid chloride, ester, amides (Urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, inter-conversion of acid derivatives by nucleophilic acyl substitution. Preparation of Carboxylic acid derivatives, Chemical reaction, Mechanism of esterification and hydrolysis (Acidic and Basic).

Unit-IV

Thermochemistry

Standard state, standard enthalpy of formation Hess's law of heat summation and its application. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

Unit-V

Chemical Equilibrium

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochore-Clapeyron equation and Clausius. Clapeyron equation, applications.

Suggested Books

1. Advanced Inorganic chemistry-S. K Agarwal, Keemtil
2. Elementry Organic spectroscopy-Y.R . Sharma
3. Elementry Organic spectroscopy-H. Kaur
- 4 . Organic Chemistry-R. T. Morrison and R. N. Boyd, Prentice Hall
5. Physical Chemistry –P W Atakins, ELBS
6. Advanced Physical chemistry –Gurdeep Raj, Goel Publication

BCE 032A: Volumetric Analysis, Identification of Organic Compounds and Conductometric Analysis (Practicals)**INORGANIC CHEMISTRY****Volumetric Analysis**

1. To determine alkali content in antacid tablet using HCl.
2. To estimate copper using thiosulphate.
3. To determine acetic acid in commercial vinegar using NaOH solution.

Synthesis

4. To prepare Tetraammine copper (II)sulphate.
5. To prepare Ni-DMG complex.

ORGANIC CHEMISTRY

1. To identify an organic compound (1) through the functional group analysis, determine its M.P and prepare its suitable derivative.
2. To identify an organic compound (2) through the functional group analysis,determine its M.P and prepare its suitable derivative.
3. To identify an organic compound (3) through the functional group analysis,determine its M.P and prepare its suitable derivative.
4. To identify an organic compound (4) through the functional group analysis,determine its M.P and prepare its suitable derivative.
5. To identify an organic compound (5) through the functional group analysis,determine its M.P and prepare its suitable derivative.

PHYSICAL CHEMISTRY

1. To determine the strength of given acid pH metrically.For this you are provided with standard NaOH solution.
2. To draw the solubility curve of phenol –water system and to determine critical solution temperature of the system and the composition of phenol-water system at C.S.T.
3. To determine the C.S.T of phenol-water system in presence of 1% NaCl solution and 1% succinic acid solution.
4. To determine the dissociation constant of a weak acid conductometrically and verify ostwalds dilution law.
5. To determine the transition temperature of the given substance by thermometric method (MnCl₂.4H₂O)

SEMESTER-V

BCE 033A: Basics of Photochemistry and Electrochemistry

Unit-I

Metal-Ligand Bonding in Transition Metal complexes

Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters. nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit-II

NMR Spectroscopy

Nuclear magnetic resonance (NMR) spectroscopy, Proton magnetic resonance (H^1 NMR) spectroscopy. Nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, area of signals. Interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.

Structure elucidation

Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopy techniques.

Unit-III

Phase Equilibrium

Statement and meaning of the terms - phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system- water, and S systems phase equilibria of two component system - solid - liquid equilibria, simple eutectic Pb-Ag systems, desilverisation of lead. solid solution - compound formation with congruent melting point (Mg-Zn) and incongruent melting point (NaCl-H₂O), (FeCl₃ - H₂O), Freezing mixtures, acetone-dry ice.

Unit-IV

Photochemistry

Introduction, difference between thermal and photochemical processes. Laws of photochemistry : Grothus-Draper law, Stark -Einstein law, Jablosnski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized Reactions

Unit-V

Electrochemistry

Electrical transport - conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its

limitations, weak and strong electrolytes. Ostwald's dilution law. Transport number, definition and determination by Hittorf method and moving boundary method.

Types of reversible electrodes - gas - metal ion, metal -metal ion, metal-insoluble salt-anion and redox electrodes, Electrode reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance. EMF of a cell and its measurements. concentration cell with and with out transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, Buffers - mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts.

Suggested Books

1. Selected topics in Inorganic Chemistry –Malik tuli, Madan
2. Elementry Organic spectroscopy-Y.R . Sharma
3. Elementry Organic Spectroscopy-H. Kaur
4. Organic Chemistry Reaction and Reagents-O.P.Agarwal,Krishna Prakashan Meerut
5. Advanced Organic Chemistry-Jagdamba singh and LDS Yadav
6. Advanced Physical Chemistry –Gurdeep Raj,Goel Publication
7. Essentials of Physical Chemistry-Puri, Sharma, Pathania
8. A Text book of Electro- Chemistry-Glasstone

BCE 034A: Inorganic Preparations, Organic Mixture Separation and Adsorption Isotherms (Practicals)

INORGANIC CHEMISTRY

1. To prepare cis-potassium-dioxalatodiaquachromate (III).
2. To prepare trans-potassium-dioxalatodiaquachromate (III).
3. To prepare sodium trioxalatoferate (III).
4. To estimate Ni as Ni-DMG in given solution.
5. To estimate Cu as CuSCN in given solution.

ORGANIC CHEMISTRY

1. To separate and identify the organic mixture containing two solid components using water and prepare their suitable derivatives.
2. To separate and identify the organic mixture containing two solid components using NaOH and prepare their suitable derivatives.
3. To separate and identify the organic mixture containing two solid components using NaOH and prepare their suitable derivatives.
4. To separate and identify the organic mixture containing two solid components using NaHCO₃ and prepare their suitable derivatives.
5. To separate and identify the organic mixture containing two solid components using NaHCO₃ and prepare their suitable derivatives

PHYSICAL CHEMISTRY

1. To determine the strength of the given acid (HCl) conductometrically using standard alkali solution.

2. To determine the strength of the given acid (CH_3COOH) conductometrically using standard alkali solution.
3. To determine the solubility and solubility product of a sparingly soluble salt conductometrically.
4. To draw spectral absorption curve for given substance ($\text{K}_2\text{Cr}_2\text{O}_7$ or KMnO_4) using spectrophotometer and determine the wavelength for maximum absorption for each of them. Also verify the Lambert Beer's Law and determine the concentration of unknown solution.
5. To investigate the adsorption of oxalic acid from aqueous solution by activated charcoal and examine validity of Freundlich and Langmuir adsorption isotherm.

SEMESTER-VI

BCE 035A: Organometallic Chemistry, Heterocyclic Compounds and Elementary Quantum Mechanics

Unit-I

Hard and Soft Acids and Bases (HSAB) :

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

Unit-II

Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds. A brief account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Unit-III

Heterocyclic Compounds

Introduction : Molecular orbital picture and aromatic characteristics of pyrrol, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six membered heterocycles. Preparation and reactions of Indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Unit-IV

Elementary quantum Mechanics

Black-body, radiation, Planck's radiation law, photoelectric effect, heat capacity of solids. Compton effect. De Broglie hypothesis Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Unit-V**Physical Properties and Molecular Structure**

Optical activity, polarization - (Calusius-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties paramagnetism, diamagnetism and ferromagnetics.

Suggested Books

1. Selected topics in inorganic chemistry –Malik tuli, Madan
2. Inorganic Chemistry Principles of structure and reactivity-Huheey James ,E. Keiter Ellen, A. Pearson, Edu. Delhi
3. Organic Chemistry Reaction and Reagents-O. P. Agarwal, Krishna Prakashan Meerut
4. Organometallic Chemistry, R.C Mehrotra
5. Reaction mechanism in Organic chemistry –S M Mukherji, and S P Singh, Macmillan
6. A Text book of Quantum Chemistry-A.K .Chandra
7. Organic chemistry –I. L. Finar

BCE 036A: Inorganic and Organic Preparations and Optical Analysis (Practicals)**INORGANIC CHEMISTRY**

1. To synthesize Hexaammine nickel (II) chloride.
2. To synthesize prussian blue.
3. To measure fluoride in the given sample by SPANDS method.
4. To separate and estimate Mg(II) and Zn(II).
5. To separate and estimate Cu(II) and Ni(II).

ORGANIC CHEMISTRY

1. (a) To prepare acetanilide from aniline (Acetylation).
(b) To prepare phenylbenzoate from phenol (Benzoylation).
2. To prepare Iodoform from ethanol and acetone. (Aliphatic Electrophilic Substitution).
3. To prepare m-dinitro benzene from nitro benzene .
4. To prepare p-nitro acetanilide from acetanilide.
5. To prepare Benzoic acid from toluene.

PHYSICAL CHEMISTRY

1. To determine the specific rotation of a given optically active compound.
2. To determine the equivalent conductance of a strong electrolyte KCl or NaCl at several concentrations and verify the applicability of Debye Huckel Onsager equation.
3. To determine the equivalent conductance of a strong electrolyte HCl at several concentrations and verify the applicability of Debye Huckel Onsager equation.
4. To study saponification of ethyl acetate conductometrically.
5. To determine the freezing point depression constant of camphor using naphthalene as solute and hence determine the molecular weight of acetanilide by Rast's method.
- 6.