JAYA COLLEGE OF ARTS AND SCIENCE,THIRUNINRAVUR-602024.

DEPARTMENT OF CHEMISTRY

B.Sc. CHEMISTRY

ACADEMIC YEAR 2020-2021

PROGRAMME OBJECTIVE

PO1	The B.Sc. program of Chemistry of Jaya College of Arts and Science, Thiruniravur was started in the year 2005.
PO2	A detailed knowledge of the terms, concepts, methods, principles and experimental techniques of Chemistry can be understood.
PO3	Basic concepts of chemical sciences and the tools needed for the practice of chemistry is provided in this course.
PO4	The interdisciplinary approach of the program helps the student to contribute the academic knowledge to the industrial requirements of the society.
PO5	They will be skilled in problem-solving, critical thinking, analytical reasoning and experimentations as applied to scientific problems.
PO6	They can follow and understand general lab practice guidelines and safety measures.
PO7	They can perform qualitative and quantitative chemical analysis from conventional methods to sophisticated instruments.

PROGRAMME OUTCOME

PO1	The B.Sc. program of Chemistry of Jaya College of Arts and Science, Thiruniravur was started in the year 2005.
PO2	Development of the skills in handling various chemicals, apparatus and instruments.
PO3	Application of the principles of thermodynamics and chemical kinetics in chemical reactions
PO4	Acquiring the knowledge on heterocyclic compounds and natural products.
PO5	Ability to apply the basic principles of various spectroscopic, electro and thermo analytical methods to characterize the compounds.
PO6	Industrial insights on polymers, textile dyes, fibre and medicinal chemistry
PO7	Know structure-activity relationship

COURSE STRUCTURE:

FIRST SEMESTER

Course Content	Name of the Course	Ins.Hrs	Credits	Int.Marks	Ext.Marks	Total
Part – I	Language Paper – I	6	3	25	75	100
Part - II	EnglishPaper – I	5	3	50	50	100
Part III	General Chemistry-I	6	4	25	75	100
	Allied Paper-I	6	5	25	75	100
	Major Practical-I	3	**Examination will be held in Semester II**			
Part IV	*Basic Tamil/Adv. Tamil/Non Major Elective	2	2	25	75	100
	Soft skill - I	2	4	50	50	100

SECOND SEMESTER

Course Components	Name of the Course	Ins.Hrs	Credits	Int.Marks	Ext.Marks	Total
Part – I	Language Paper – II	6	3	25	75	100
Part – II	English Paper – II	5	3	50	50	100
Part III	General Chemistry-II	6	4	25	75	100
	Allied Paper-II	6	5	25	75	100
	Major Practical-I	3	3	40	60	100
Part IV	*Basic Tamil/Adv. Tamil/Non Major Elective	2	2	25	75	100
	Soft skill - II	2	4	50	50	100

THIRD SEMESTER

Course Components	Name of the Course	Ins.Hrs	Credits	Int.Marks	Ext.Marks	Total
Part – I	Language Paper – III	6	3	25	75	100
Part - II	English Paper – III	6	3	50	50	100
Part III	General Chemistry-III	6	4	25	75	100
	Allied Paper- Physics I	6	3	25	75	100
	Major Practical-I	3	-	Examination will be held in IV semester		
	Allied Practical -I	3	-	Examination will be held in IV semester		
Part IV	Environmental Studies	-	-	25	75	100
	Soft skill - II	-	3	50	50	100

FOURTH SEMESTER

Course Components	Name of the Course	Ins.Hrs	Credits	Int.Marks	Ext.Marks	Total
Part – I	Language Paper – IV	6	3	25	75	100
Part - II	English Paper – III	6	3	50	50	100
Part III	General Chemistry-IV	6	4	25	75	100
	Allied Paper-Physics II	6	3	25	75	100
	Major Practical-II	3	3	40	60	100
	Allied Physics I &II	3	4	40	60	100
Part IV	Environmental Studies	-	2	25	75	100

	Soft skill - II	-	3	50	50	100

FIFTH SEMESTER

Course Components	Name of the Course	Ins.Hrs	Credits	Int.Marks	Ext.Marks	Total
Part III	Inorganic Chemistry I	4	4	25	75	100
	Organic Chemistry I	4	4	25	75	100
	Physical Chemistry I	4	4	25	75	100
	Pharmaceutical Chemistry	4	5	25	75	100
	Polymer Chemistry	4	5	25	75	100
	Major Practical III (Inorganic QuantitativeAnalysis Gravimetric Analysis)	3	-	Examination will be held in VI semester		
	Major Practical IV (Organic analysis and Preparation)	3	-	Examination will be held in VI semester		
	Major Practical V (Physical Chemistry)	3	-	Examination will be held in VI semester		
Part IV	Value Education	1	2	25	75	100

SIXTH SEMESTER

Course Components	Name of the Course	Ins.Hrs	Credits	Int.Marks	Ext.Marks	Total
Part III	Inorganic Chemistry II	5	5	25	75	100
	Organic Chemistry II	5	5	25	75	100
	Physical Chemistry II	5	5	25	75	100
	Analytical Chemistry	5	5	25	75	100
	Major Practical III (Gravimetric Analysis)	3	4	40	60	100
	Major Practical IV (Organic analysis and Preparation)	3	4	40	60	100
	Major Practical V (Physical Chemistry)	3	4	40	60	100

Part IV	Extension Activities	-	1			

SEMESTER – I

COURSE TITLE	CORE-I: GENERAL CHEMISTRY-I
CODE	SD21A
CO. No	Course Outcomes
CO-1	To know the fundamental concepts of atomic structure and basics of quantum mechanics
CO-2	To know the periodicity of properties of elements
CO-3	To understand the various types of chemical bonding and basics of solid state
CO-4	To learn the principles of inorganic qualitative and quantitative analysis.
CO-5	To understand the basic concepts of organic chemistry.

Syllabus

UNIT –I :Atomic Structure and Introduction to Quantum Mechanics

Rutherford's atomic model, Planck's quantum theory of radiation, Photoelectric effect, Bohr's theory of hydrogen atom - postulates, Bohr's radius, energy of electron, origin of hydrogen spectrum. Particle and wave nature of electron - de Broglie's equation, Heisenberg's uncertainty principle and Compton effect - Schrodinger wave equation (no derivation) - Significance of Ψ and Ψ2- Wave mechanical concept of atomic orbitals, - Shapes of orbitals - Quantum numbers - Zeeman effect, Pauli`s exclusion principle, Aufbau principle - Effective nuclear charge, screening effect, Slater's rules -applications and limitations. Electronic configuration of first 30 elements - extra stability of half-filled and completely filled orbitals. Hund's rule - its basis and applications.

UNIT – II : Classification of Elements and Periodicity of Properties

Classification of elements - noble gases and s, p, d and f - block elements. Modern periodic table. Position of hydrogen in the periodic table-Variation of atomic volume, atomic and ionic radii, ionization potential, electron affinity, electronegativity along periods and groups-variation of metallic characters-factors influencing the above periodic properties.

UNIT – III :Chemical Bonding andSolid State

Ionic bond - factors influencing the formation of ionic compounds - ionisation energy, electron affinity and lattice energy; inert pair effect, Fajan's rules. Covalent bond - polarity of covalent bond, percentage ionic character of covalent bond, dipole moment and molecular structures of CO_2, H_2O, NH_3 and CH_4, bond characteristics - bond length, bond angle and bond energy. Classification of solids, isotropic and anisotropic crystals, representation of planes, Miller indices, space lattice, unit cell, crystal systems. X-ray diffraction-derivation of Bragg's equation, discussion of structures of NaCl, CsCl and ZnS, determination of Avogadro's number.

UNIT – IV :

Common ion effect, solubility product, applications of the solubility product principle in qualitative analysis. Principle of elimination of interfering anions. Complexation reactions in qualitative analysis. Spot test reagents and tests with them - Cupferon, DMG, thiourea, magneson, alizarin and Nessler reagent. Volumetric analysis - Definitions - normality, molarity, molality and molefraction, primary and secondary standards, theories of acid - base, redox, complexometric, iodometric and iodimetric titrations, calculations of equivalent weights, theories of acid - base, redox, metal ion and adsorption indicators and choice of indicators.Introduction to nano science and nanotechnology – Types of nanoparticles, Techniques to synthesize nanoparticles, Physical methods – Physical vapour deposition (evaporation and sputtering) – chemical methods–reduction methods – sol–gel methods

Unit - V

Hybridization and shapes of molecules - methane, ethane, ethylene, acetylene and benzene. Electron displacement effects - inductive, electrometric, mesomeric (resonance) and hyperconjugation. Steric effect. Cleavage of bonds - homolytic and heterolytic fissions. Reactive intermediates - carbocations, carbanions and free radicals - their formation and stability.Nomenclature of organic compounds: IUPAC system of nomenclature of compounds containing upto 8 carbon atoms - mono and bifunctional compounds.

SEMESTER –II

COURSE TITLE	CORE-II: GENERAL CHEMISTRY-II
CODE	SD22A
CO. No	Course Outcomes
CO-1	To equip the learners with concepts of s block elements through comparative study.
CO-2	To equip the learners with concepts of p block elements through comparative study
CO-3	To understand the aspects of gaseous state
CO-4	To understand the aspects of liquid state, colloids and carbon nanotubes, fullerenes.
CO-5	To understand the chemistry of organic compounds like alkanes, cycloalkanes, alkenes, alkynes and the conformational analysis..

Syllabus

UNIT – I :

Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Extraction of Li from its silicate- ores. Preparation, properties and uses of NaOH,Na2CO3, KBr KClO3 alkaline earth metals: Comparative study of the elements with respect to oxides, hydroxides, sulphates, halides and carbonates. Extraction and anomalous behaviour of Be.

UNIT – II :

Boron Family[Group-IIIA]: preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. 2.2 Carbon Family (Group -IV A) : comparison of carbon with silicon. Carbon-di-sulphide – Preparation , properties , structure and uses. Percarbonates , per noncarbonates and per dicarbonates. Tin- Allotropic forms of Tin, alloys of tin, tinning, tin plating. Lead-lead accumulator (discharging and recharging), lead pigments.

UNIT – III :

Postulates of kinetic theory of gases, derivation of gas laws from the kinetic gas equation. Kinetic energy and temperature-average translational kinetic energy and its calculation. Maxwell's distribution of molecular velocities(no derivation)-mean, root mean square and most probable velocity. Collision diameter, collision number, collision frequency, mean free path. Principle of equipartition of energy. Real gases- van der Waals equation of state-derivation. Boyle temperature. Significance of critical constants.

UNIT – IV :

Some Properties of Liquids(molecular basis)-Equilibrium vapour pressure of a liquid, boiling point, heat of evaporation, heat of condensation, freezing point. Surface tension-definition, measurement of surface tension, effect of temperature on surface tension. Parachor-definition, calculation and applications. Viscosity or fluidity-definition, measurement and calculation, factors affecting viscosity.Nanoparticles of Au, Ag and TiO2 –preparation, properties and uses. Carbon nanotubes-Types- preparation, properties and uses-Fullerene – Introduction only.

UNIT – V :

Chemistry of Alkanes and Cycloalkanes : General methods of preparation and properties of alkanes and cycloalkanes ,Conformational analysis of ethane and n-butane. Baeyer's straintheory. Alkenes, Alkynes and Dienes: Preparation of alkenes (dehydrogenation, dehydrohalogenation and dehydration), preparation of alkynes(dehydrohalogenation, dehalogenation).Addition (with mechanisms) of H_2, X_2, HX, HOX, B_2H_6 and O_3 to alkenes and alkynes. Addition of HBr (peroxide effect; free radical reaction mechanism) to alkenes and alkynes. . Allylic substitution of alkenes by NBS. Dienes types, stability; preparation of- 1,3-butadiene,isoprene, and chloroprene. Reactivity: 1,2- and 1,4- additions to butadiene. Diels-Alder reaction.

COURSE TITLE	**CORE-III: MAJOR PRACTICALS – I**
CODE	**SD221**
Course Outcomes	
To understand the aspects of Volumetric analysis and inorganic preparation of salt	

Major Practical - I

1. Estimation of HCl by NaOH using a standard oxalic acidsolution
2. Estimation of Na2CO3by HCl using a standard Na2CO3solution

3. Estimation of oxalic acid by $KMnO_4$ using a standard oxalic acid.

4. Estimation of Ferrous sulphate by $KMnO_4$ using a standard Mohr's salt solution.

5. Estimation of $KMnO_4$ by sodium thiosulphate using a standard $K_2Cr_2O_7$solution

6. Estimation of iron by $K_2Cr_2O_7$ solution using a standard Ferrous sulphate solution

7. Estimation of Copper sulphate using a standard$K_2Cr_2O_7$solution.

8. Estimation of Mg(II) by EDTA solution using standard Zinc sulphate solution.

9. Estimation of Zn(II) by EDTA solution using standard Magnesium sulphate solution.

10. Estimation of total hardness of water.

The following inorganic preparations are prescribed

1. Preparation of Ferrous ammonium sulphate or Mohr's salt.

2. Preparation of potash alum or potassium aluminium sulphate.

3. Preparation of microcosmic salt.

4. Preparation of tetramminecopper(II) sulphate.

SEMESTER-III

COURSE TITLE	**CORE-IV: GENERAL CHEMISTRY-III**
CODE	**SD23A**
CO.No	**Course Outcomes**
CO-1	To understand the general characteristics of Nitrogen and Oxygen families.
CO-2	To know about the chemistry of Halogens and noble gases
CO-3	To learn the mechanism of Nucleophillic substitution and Elimination reactions.
CO-4	To know about the reaction mechanisms of aromatic and heterocycliccompounds
CO-5	To understand the basic concepts of Thermodynamics and Thermochemistry.

Syllabus

UNIT –I :CHEMISTRY OF NITROGEN ANDOXYGENFAMILIES

Group VA elements: General characteristics of Group VA elements; chemistry of H2N-NH2, NH_2OH, HN_3 and HNO_3. Chemistry of PH_3, PCl_3, PCl_5, $POCl_3$,P_2O_5 and oxyacids of phosphorous (H_3PO_3 and H3PO4).Group VIA elements: General properties of group VIA elements - Structure and allotropy of elements-chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium - Oxyacid's of sulphur (Caro's and Marshall's acids).

UNIT –II :CHEMITRY OF HALOGENS AND NOBLEGASES

Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxyacid's ($HClO_4$). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens [$(CN)_2$ and $(SCN)_2$] and basic nature of Iodine. Noble gases: Position in the periodic table. Preparation, properties and structure of XeF2, XeF4, XeF6 and XeOF4; uses of noble gases- clathrate compounds.

UNIT –III :NUCLEOPHILIC SUBSTITUTION AND ELIMINATION REACTIONS

Nucleophilic substitution : SN1, SN2 and SNi reactions-mechanisms- stereochemistry - effect of solvent, structure of substrate, nucleophilicity of the reagent [nucleophile] and nature of the leaving group. Elimination reactions: E1, E2 and E1CB reactions and mechanisms: Hofmann and Saytzeff rules. Elimination vs Substitution.

UNIT IV: BENZENE AND POLYNUCLEARAROMATICHYDROCARBONS

Aromaticity - conditions for aromaticity - resonance stabilization energy - Hückel rule with respect to benzene, naphthalene, anthracene and phenanthrene; Electrophilic substitution in benzene-general mechanism; nitration, sulphonation, halogenations, Friedel-Crafts alkylation and acylation. Orientation [directive influence] and reactivity in mono substituted benzenes. Polynuclear hydrocarbons-naphthalene, anthracene and phenanthrene-preparation, properties and uses.

UNIT V: THERMODYNAMICS-I

Terminology of thermodynamics-Thermodynamic equilibrium-nature of work and heat-First law of Thermodynamics-statement-definition of Internal Energy (E), Enthalpy (H) and Heat capacity. Relation between Cp and Cv. Calculation of W, q, dE and dH for expansion of ideal and real gases under isothermal and adiabatic condition of reversible and irreversible

processes. Joule- Thompson effect and Coefficient (μJT)-Calculation of μJT for ideal and real gases - Inversion temperature. Thermochemistry - Relation between enthalpy of reaction at constant volume (qv) and at constant pressure (qp) - Temperature dependence of heat of reaction - Kirchoffequation-Derivation and application-Enthalpy of formation and combustion - Bond energy and its calculation from thermochemical data.

SEMESTER-IV

COURSE TITLE	CORE-V: GENERAL CHEMISTRY-IV
CODE	SD24A
CO.No	Course Outcomes
CO-1	To understand the chemistry of Redox reactions
CO-2	To understand the General characteristics of d-Block elements
CO-3	To learn about the preparation and properties of Heterocyclic compounds and dyes.
CO-4	To know about the nomenclature, preparation and properties of alcohols, thiols, ethers and thioethers.

Syllabus

UNIT I: CHEMISTRY OFREDOXREACTIONS

Covalency- oxidation number- oxidation state - difference between oxidation number and valency- rules for calculating oxidation number - definition of oxidation and reduction - redox reactions and half reactions - oxidising agents and reducing agents - equivalent weights of oxidising and reducing agents - auto oxidation and induced oxidation - balancing of redox equations by oxidation number method and ion-electron method

UNIT II: CHEMISTRY OF d-BLOCKELEMENTS

Transition Elements - Electronic configuration - General periodic trend –Atomic and ionic radii, metallic character, melting and boiling points, ionisation energy, oxidation state, reactivity, colour and tendency to form complexes- Group study of Titanium, Vanadium,

Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups - galvanization, Evidences for the existence of mercurous ion as Hg_2^{2+}.

UNIT III: HETEROCYCLIC COMPOUNDS AND DYES

Nomenclature, Preparation, properties and reactions of Furan, Pyrrole, Thiophene and Pyridine. Comparative study of basicity of pyrrole and pyridine with aliphatic amines. Synthesis and reactions of Indole, Quinoline and Isoquinoline Theory of colour and constitution. Preparation and uses of: Azo dye - Bismarck brown, Triphenyl methane dye - malachite green, phthalein dye - fluorescein,anthrquinone dye- alizarin and vat dye- indigo.

UNIT IV:ALCOHOLSANDTHIOLS ,ETHERS AND THIOETHERS

Monohydric, dihydric (Ethyleneglycol)andtrihydric (Glycerol) alcohols: Nomenclature, preparation of alcohols from alkenes, alkyl halides, Grignard reagent and carbonyl compounds. Reactions of alcohols-Dehydration, oxidation, action of Grignard reagent, dehydrogenation using copper and esterification. Thiols: Nomenclature, structure, preparation and properties

UNIT5:THERMODYNAMICS-II

Second Law of Thermodynamics - Limitations of first law & Need for the second law - Different statements of the law - Carnot's cycle and efficiency of heat engine-Carnot's theorem- Concept of Entropy - Definition and physical significance of entropy - Entropy as a function of P, V and T- Entropy changes during phase changes - Entropy of mixing- Gibb's free energy (G) and Helmholtz free energy (A) - Variation of A and G with P, V and T - Gibb's Helmholtz equation and its applications - Thermodynamic equation of state - Maxwell's relations.

COURSE TITLE	**CORE-VI: MAJOR PRACTICAL – II**
CODE	**SD241**
Course Outcomes	
To understand the aspects of Semi micro qualitative analysis for inorganic salt components	

Semi-Micro Qualitative Analysis

1. Analysis of simple acid radicals: carbonate, sulphate, chloride, bromide, iodide, nitrate
2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate
3. Elimination of interfering acid radicals and Identifying the groups of basic radicals

4. Analysis of basic radicals (group-wise): Lead, copper, bismuth, cadmium, iron, aluminium, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium

5. Analysis of a mixture containing two cations and two anions (of which one is interfering type)

SEMESTER- V

COURSE TITLE	CORE-VII: INORGANIC CHEMISTRY – I
CODE	BCY-DSC07
CO.No	Course Outcomes
CO-1	Learning the unique characteristics of lanthanide and actinide series
CO-2	Learning the fundamentals of coordination chemistry and its applications in analytical chemistry
CO-3	Understanding the biologicalimportance of complexes
CO-4	Learning the theories of acids and bases

Syllabus

UNIT I: CHEMISTRY OF f-BLOCKELEMENTS

General characteristics of f-block elements - Comparative account of lanthanides and actinides - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanides and Actinides Separation by ion-Exchange and Solvent extraction methods - Lanthanide contraction- Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.

UNIT II:COORDINATION CHEMISTRY

Types of ligands, IUPAC Nomenclature, Isomerism - Ionisation, hydrate, linkage, ligand and coordination isomerism. Stereoisomerism-geometrical and optical isomerism in 4 & 6 coordinated complexes. Theories of coordination compounds - Werner and Sidgwick EAN concept , Valence Bond theory - hybridisation, geometry and magnetic properties of [Ni(CN)4]2-, [NiCl4]2-, [Fe(CN)6]4- , [Co(NH3)6]3+ and [CoF6]3-. Crystal field theory – spectrochemical series, splitting of d- orbitals in octahedral and tetrahedral complexes, low spin & high spin complexes. Explanation of colour and magnetic properties using CFT,

comparison of VBT and CFT.

UNIT- III:APPLICATIONOFCOORDINATIONCOMPOUNDS

Application of coordination compounds - Estimation of nickel using DMG and aluminium using oxine . Estimation of hardness of water using EDTA . Biologically important coordination compounds - Chlorophyll, haemoglobin, vitamin - B12 . (their structure and applications). Metal Carbonyls : Mono and Poly nuclear Carbonyls of Ni, Fe, Cr, Co and Mn- Synthesis, structures and bonding.

UNIT- IV: CHEMISTRY OFBINARYCOMPOUNDS

Classification, preparation, properties and uses of hydrides, borides, carbides and nitrides

UNIT- V: CONCEPTS OF ACIDSANDBASES

Theories of acids and bases - Arrhenius theory, Bronsted- Lowry theory - basicity of an acid and acidity of a base - relative strengths of acids and bases, Cady - Esley concept - general theory of solvent system, Lux - Flood concept - Lewis acids - bases concept in coordination chemistry - classification of Lewis acids, Usanovich concept. Concept of Hard and Soft Acids and Bases (HSAB). Types of solvents: Protic and aprotic solvents-aqueous and non-aqueous solvents-liquid ammonia and liquid HF as solvents.

COURSE TITLE	**CORE-VIII: ORGANIC CHEMISTRY – I**
CODE	**BCY-DSC08**
CO.No	**Course Outcomes**
CO-1	Understanding acidic nature of phenol and its properties
CO-2	Learning the reactions of aldehydes and ketones
CO-3	Learning the chemistry of carboxylic acids and their derivatives
CO-4	Learning the chemistry of nitro compounds and amines
CO-5	Learning the basics of green chemistry

Syllabus

UNIT-I : CHEMISTRY OF PHENOLS ANDAROMATIC ALCOHOLS

Phenols: Nomenclature, synthesis of phenol from benzene sulphonic acid, chlorobenzene and cumene - Properties - Acidity of phenols and substituted phenols (explanation on the basis of

resonance stabilization). Reactions similar to those of alcohols, ring substitution in phenol-orientation of phenolic group towards electrophiles, halogenation, nitration and sulphonation, Liebermann nitroso reaction, mechanism of Riemer-Tiemann reaction, Kolbe-Schmidt reaction and coupling with diazonium salts and condensation reactions. Alkylation and acylation of phenols. Dihydric phenols and benzyl alcohols-preparation, properties and uses.

UNIT-II: CHEMISTRY OFCARBONYLCOMPOUNDS.

Nomenclature, structure of carbonyl compounds, acidity of alpha-hydrogen atom, keto- enol Tautomerism (proof for the two forms). Mechanism of nucleophilic addition with HCN, ROH, $NaHSO_3$, ammonia (NH_2OH, $NH_2NH_2$and $C_6H_5NHNH_2$).Mechanism of Meerwein-Pondorf-Verley reduction, Clemmenson reduction, Wolf-Kishner reduction, aldol condensation, Claisen-Schmidt reaction, Cannizaro reaction, haloform reaction, Perkin and Benzoin condensation reaction - Diekmann condensation.

UNIT-III: CHEMISTRY OF CARBOXYLIC ACIDS AND THEIR DERIVATIVES

Acidity of carboxylic acids, Effect of substituents on acidity, comparison of acid strengths of halogen substituted acetic acid and substituted benzoic acid. Dicarboxylic acids: General methods of preparation - from alkyl cyanides, cyclic ketones and halo esters. Reactions - action of heat, action of PCl_5 and NH_3. Acid derivatives (Aliphatic): Synthesis and important properties of acid derivatives (acid chlorides, acid anhydrides, esters and amides). Acetoacetic and malonic esters-Preparation and synthetic applications.

UNIT-IV: CHEMISTRY OFNITROGENCOMPOUNDS

Nitrobenzene- preparation, reduction in different media, conversion of nitrobenzene to m-dinitrobenzene and TNT. Amines: Nomenclature, Basicity of amines, effect of substituents on basicity of aliphatic and aromatic amines. Preparation of primary amines by Gabriel synthesis and reduction of nitriles, secondary and tertiary amines-by the reduction of N-alkyl substituted amides. Reactions of amines-primary aliphatic and aromatic amines with nitrous acid, diazotization, coupling and carbylamine reactions.

UNIT - V: GREEN CHEMISTRY

Concept and principles of green chemistry – need of green chemistry –Atom economy reactions (substitution, elimination, hydrogenation, addition and rearrangement reaction – basic concepts only)-green solvents-types and simple applications. Green Catalysis – Heterogeneous – use of zeolites, silica, alumina, supported catalysis –bio catalysis: Enzymes,

microbes, phase transfer catalysis (miscellar / surfactant). Microwave, ultrasound and light promoted reactions (few examples for each type).

COURSE TITLE	CORE-IX: PHYSICAL CHEMISTRY – I
CODE	BCY-DSC09
CO.No	Course Outcomes
CO-1	Introduced to concepts of thermodynamics such as equilibrium constant and entropy
CO-2	Learning fundamental concepts about solutions and the basis of separation techniques suchas steam distillation and solvent extraction
CO-3	Introduced to phase rule and its application to one component and two component systems
CO-4	Introduced to colligative properties and methods of their determination
CO-5	Introduced to the concept of conductance in electrochemistry

UNIT I: THERMODYNAMICS III

Equilibrium constant and free energy change - Thermodynamic derivation of law of mass action - Equilibrium constants in terms of pressure and concentration (Kp and Kc) and their relation - Thermodynamic interpretation of Lechatelier principle (Concentration, temperature, pressure and addition of inert gases). Systems of variable composition - Partial molar quantities - Chemical potential - Variation of chemical potential with T, P and X (mole fraction) - Gibbs-Duhem equation- Duhem-Margules equation.van't Hoff reaction isotherm - van't Hoff's isochore- Clapeyron equation and Clausius- Clapeyron equation - Applications- Nernst heat theorem - Third Law of Thermodynamics - Statement of third law and concept of residual entropy - Evaluation of absolute entropy from heat capacity data- exception to third law (CO, ortho and para hydrogen).

UNIT II: SOLUTIONS

Ideal and Non-ideal solutions. Concept of activity and activity coefficients - Completely miscible liquid systems - benzene and toluene.Raoult's law and Henry's law. Deviation from Raoult's law and Henry's law. Azeotropes- HCl-water and Ethanol-water system - Partially miscible liquid systems (Upper and lower CST) - phenol-water, triethylamine-water and Nicotine-water systems. Completely immiscible liquids –principle and applications of steam distillation - Nernst Distribution Law- thermodynamic derivation, application to solvent

extraction, limitations of distribution law

UNIT III: THERMODYNAMICS OF PHASE TRANSITIONS

Definition of terms in the phase rule - Derivation and application to one component system water and sulphur - super cooling, sublimation. Two component systems - reduced phase rule - solid- liquid equilibria, simple eutectic (lead-silver), desilverisation of lead –Compound formation with congruent melting point. (Mg-Zn) and incongruent melting point (Na-K).Solid solutions - (Ag- Au) - freezing mixtures - KI-H2O system.

UNIT IV: DILUTE SOLUTIONS AND COLLIGATIVE PROPERTIES

Colligative properties - relative lowering of vapour pressure, osmosis - Law of osmotic pressure- isotonic solutions, effect of concentration and temperature on osmotic pressure - thermodynamic derivation of elevation of boiling point and depression in freezing point - determination of molecular masses using the above properties [experimental details not required]- abnormal molecular masses and van't Hoff factor - degree of association and degree of dissociation.

UNIT V: ELECTRO CHEMICAL CONDUCTANCE

Electrical transport and conductance in metal and in electrolytic solution. Specific conductance and equivalent conductance. Measurement of equivalent conductance. Using Kohlrausch'sbridge. Arrhenius theory of electrolytic dissociation and its limitations. Weak and strong electrolyte according to Arrhenius theory Ostwald's dilution laws- applications and limitation. Variation of equivalent conductance with concentration. Migration of ion-ionic mobility. Kohlrausch's law and its applications. The elementary treatment of the Debye- Hückel Onsager equation for strong electrolytes. Evidence for ionic atmosphere. Wein effect and Debye-Falkenhagen effect. Transport number - Determination by Hittorf method and moving boundary method. Application of conductance measurements- Determination of $\lambda 0$of strong electrolytes. Determination of Ka of weak acids. Determination of solubility product of a sparingly soluble salt. Conductometric titrations.

COURSE TITLE	ELECTIVE-I: PHARMACEUTICAL CHEMISTRY
CODE	BCY-DSE1A
CO.No	Course Outcomes
CO-1	Learning various terminologies in pharmacology, Types of drugs and their action
CO-2	Introduction to the concepts of Absorption of drugs, Various routes of administration and about Indian medicinal plants
CO-3	Introduced to Concepts of Anesthetics, Antipyretics, analgesics, Antibiotics and anti-inflammatory agents
CO-4	Concepts on Composition of blood, Cardiovascular drugs, vasodialators and antipsychedelic drugs
CO-5	Understanding the biological importance of vitamins, inorganic compounds and Lipid profile

UNIT I

Important terminologies used in pharmaceutical chemistry - drug pharmacology, pharmacognosy, pharmacodynamics, pharmacokinetics, antimetabolites, pharmacopeia (BP,IP,USP), National formulary, chemotherapy, vaccines, primary immunization, synergism, antagonist LD50, ED50, therapeutic index and drug dosage. Various sources of drugs, pharmacologically active constituents in plants. Classification of drugs, chemical – biological - mechanism of drug action - action at cellular sites. Drug receptors and biological responses. Mechanism of different types of drug action.

UNIT II

Absorption of drugs - factors affecting absorption of drugs, routes of administration - local, enema, oral and external, parental routes - advantages and disadvantages – Common diseases - infective diseases insect borne - air borne and water borne. Common diseases of the respiratory system and nervous system. Indian medicinal plants - tulsi, neem, keezhanelli. AIDS - symptoms and prevention.

UNIT - III

Anaesthetics - general - ether, chloroform, ethyl chloride, halothane, nitrous oxide, local - esters - cocaine, benzo cocaine, procaine, amides - lignocaine, cinchocaine. Analgesics - Narcotic and synthetic Antipyretics and anti-inflammatory agents, Antibiotics - penicillin, streptomycin, chloramphenicol, tetracycline. Antiseptics and disinfectants - phenol and its derivatives, nitrofuran derivatives.

UNIT IV

Composition of blood - blood grouping and matching. Blood pressure - systolic and diastolic - hypertensive drugs. Diabetes - causes - hyperglycaemic drugs. Cardiovascular drugs - cardiac glycosides – anti arrhythmic drugs, antianginal drugs, vasodilators, antipsychedelic drugs - antidepressants - sedatives and hypnotics.

UNIT V

Anticonvulsant agents - Barbiturates– oxazolone diones- acetyl urea derivatives - succinimides. Diagnostic agents for kidney function (aminohippuric acid) –for liver function (sulfobromophthalein).Lipid profile - HDL, LDL, cholesterol and lipid lowering drugs. Vitamins - fat soluble and water soluble - sources, biological role and deficiency conditions. Medicinal importance of inorganic compounds - compounds of aluminium - phosphorus - arsenic - mercury and Iron. Biological importance of inorganic compounds - sodium and its compounds - potassium and its compounds - copper and its compounds.

COURSE TITLE	**ELECTIVE-II:POLYMER CHEMISTRY**
CODE	**BCY-DSE2B**
CO.No	**Course Outcomes**
CO-1	Introduction to types of polymers and their properties.
CO-2	Learning the mechanism of polymerization and polymerization techniques
CO-3	Introductionto ChemistryofPolymer processing
CO-4	Introduced tochemistryof industrially important polymers
CO-5	Introduced to the concept of Polymer reactions. Properties andapplications of natural polymers and supramolecular polymes

UNIT – I :

Introduction to polymers –general characteristics of polymers in comparison with common organic compounds. Basic concept of monomers and polymers. Classification of polymers - natural and synthetic polymers. Distinction between plastics, elastomers and fibres. Types of polymers thermoplastics and thermosetting plastics. Geometrical structures of polymer molecules - microstructures - chemical structures - geometrical structures - Cross-linked polymers - stereoregular polymers. Mechanism of polymerization: chain polymerization, free radical polymerization, ionic and coordination polymerization. Polyaddition and polycondensation polymerization, ring opening and group transfer polymerization.

UNIT – II :

Molecular weight of polymers - number average, weight average and viscosity average. Determination of polymer molecular weights - Osmometry (membrane, vapour phase),Viscometry methods. Light scattering and ultra-centrifugation methods. Molecular weight and degree of polymerization - practical significance of polymer molecular weight. Glass transition temperature - transition and associated properties - factors affecting Glass transition temperature- importance - glass transition temperature of copolymers. Polymer crystallinity - crystallisability- effect of crystallinity on properties.

UNIT - III

Industrially important polymers - preparation, properties and applications. Polyethylene, polypropylene, polyamides, polyvinylchloride, polymethylmethacrylate, polyesters, polycarbonates, polyurethanes, phenol - formaldehyde, melamine - formaldehyde, polysilanes, polyaniline.

UNIT - IV

Degradation of polymers by thermal - oxidative, mechanical and photodegradation methods. Polymerisation techniques - bulk, solution, suspension, emulsion, polycondensation and interfacial polycondensation. Polymer processing - compression moulding, casting, extrusion, fibre spinning, injection moulding, thermoforming, vulcanization of elastomers.

UNIT - V

Polymer reactions - hydrolysis, Acidolysis, Aminolysis, hydrogenation, addition and substitution - cyclisation reactions - crosslinking reactions. Natural polymers - Rubber, Silk, Cellulose - structure and applications Supramolecular polymers - introduction - properties - applications.

SEMESTER- VI

COURSE TITLE	**CORE-X: INORGANIC CHEMISTRY – II**
CODE	**BCY-DSC10**
CO.No	**Course Outcomes**

CO-1	Learning the theories of metallic bonding
CO-2	Introduced to organometallic compounds
CO-3	Introduced to fundamental concepts of nuclear chemistry and radioactivity
CO-4	Learning the chemistry of clathrates, phosphazenes, silicates

Syllabus

UNIT I: METALLIC BONDING

Metallic state - Packing of atoms in metal (BCC , FCC , HCP and simple cube) - Theories of metallic bonding - Electron gas , Pauling and band theories - Semiconductors- n- type and p-type, transistors - Uses - superconductors - examples, types - structures of alloys - substitutional and interstitial solid solutions- Hume-Rotheryratio.

UNIT II: CHEMISTRY OF ORGANOMETALLIC COMPOUNDS

Introduction - Preparation, properties uses of Organomagnesium,Organozinc, Organolithium,Organocopper, Organolead, Organophosphorus and Organoboroncompounds. Preparation, properties, uses and structure of ferrocene- Preparation and uses of Ziegler-Natta catalyst.

UNIT IV: RADIOACTIVITY

Radioactive Emanations, Alpha rays, Beta rays and Gamma rays. The Disintegration theory-Group Displacement Law. Rate of disintegration and Half-life period. Radioactive disintegration series. The Gieger- Nuttal rule - Artificial radioactivity. Induced radioactivity. Nuclear fission-Atom bomb, Nuclear fusion-hydrogen bomb- Stellar energy - Hazards of radiation. Applications of Radioisotopes. Radiocarbon dating.

UNIT V: SOME SPECIAL TYPEOFCOMPOUNDS

Clathrates - examples and structures, interstitial and non-stoichiometric compounds – composition, manufacture, structure, properties and uses ofphospazenes –composition and uses of beryl, asbestos, talc, mica, zeolites and ultramarines.

COURSE TITLE	**CORE-XI:ORGANIC CHEMISTRY – II**
CODE	**BCY-DSC11**

CO.No	Course Outcomes
CO-1	Learning the chemistry of biopolymers – carbohydrates and proteins
CO-2	Understanding vitamins
CO-3	Learning the chemistry of natural products – alkaloids and terpenoids
CO-4	Learning the mechanism of various types of molecular rearrangement
CO-5	Introduced to the concepts of stereochemistry

UNIT I: CHEMISTRY OF CARBOHYDRATES

Carbohydrates –Definition and Classification of carbohydrates with examples. Mono saccharides-glucose and fructose - epimers and anomers with examples.Mechanism mutarotation, osazoneformation.Absolute configurations of glucose and fructose.Structural elucidation of glucose and fructose (including cyclic and Haworth structure).Interconversions, ascending and descending the sugar series.Disaccharide - Sucrose, Maltose - Structural elucidation. Polysaccharide - Starch and Cellulose (Elementary treatment).

UNIT II: CHEMISTRY OF PROTEINS AND VITAMINS

Amino acids - Classification, General methods of preparation and reactions, zwitter ion, isoelectric point.Peptides and proteins - Peptide linkage- Preparation of dipeptides by Bergmann's method Classification of proteins, primary structure (End group analysis - Sanger's method and Edman method) - secondary structure, tertiary structure, denaturation. Vitamins - Classification, biological importance of Vitamins. Structure of vitamin C.

UNIT III: CHEMISTRY OF ALKALOIDS AND TERPENOIDS

Chemistry of natural products - Alkaloids - Isolation, classification, general methods of elucidating structure.Structural elucidation of nicotine and piperine.Terpenes- classification , isoprene rule, special isoprene rule - isolation and structural elucidation of citral, α- terpeniol and menthol.

UNIT IV: MOLECULAR REARRANGEMENTS

Molecular rearrangements - Types of rearrangements, Mechanisms for the following rearrangements :pinacol- pinacolone, benzil- benzilic acid, benzidine, Favorskii, Claisen, Fries, Hofmann, Curtius, Schmidt and Beckmann.

Unit-V: STEREOCHEMISTRY OF ORGANIC COMPOUNDS

Stereoisomerism - definition, classification into geometric and optical isomerism. Optical isomerism - Optical activity, asymmetric centre(chirality), symmetry elements (σn, Sn and i), relative and absolute configurations, concept of enantiomerism and diastereoisomerism; Racemisation - methods of Racemisation (by substitution and tautomerism), Resolution - methods of resolution (by mechanical, seeding and biochemical),Walden inversion. Projection formulae- Fischer, flying wedge, Sawhorse and Newmann projections, notation of optical isomerism: Cahn- Ingold and Prelog rules, R and S notations for one and two chirality (stereogenic) centres, erythro and threo representations. Geometrical isomerism: cis - trans; syn- anti; E - Zdescriptors.

COURSE TITLE	**CORE-XII: PHYSICAL CHEMISTRY- II**
CODE	**BCY-DSC12**
CO.No	**Course Outcomes**
CO-1	Learning the basics of chemical kinetics
CO-2	Understanding the basics of catalysis and adsorption
CO-3	Introduced to the fundamentals of photochemistry
CO-4	Learning the basics of computational chemistry
CO-5	Learning the fundamentals of electrochemical cells

UNIT I: CHEMICAL KINETICS

Rate of reaction- Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order and molecularity, Rate laws - Rate constants - derivation of rate constants and characteristics for zero, first, second and third order (equal initial concentration) - Derivation of time for half change. Methods of determination of order of reactions - Experimental methods of determination of rate constant of a reaction - Volumetry, manometry and polarimetry. Effect of temperature on reaction rate - temperature coefficient - concept of activation energy - energy barrier - Arrhenius equation. Theories of reaction rates - Collision theory - derivation of rate constant of bimolecular gaseous reaction - Failure of collision theory. Theory of absolute reaction rates - Derivation of rate constant for a bimolecular reaction - significance of entropy and free energy of activation. Comparison of collision theory and ARRT.

UNIT II: CATALYSIS AND ADSORPTION

Catalysis - general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst - theories of homogenous and heterogenous catalysis - Kinetics of Acid - base and enzyme catalysis- Mechanism (lock and key, induced fit), Michaelis-Menton equation (no derivation) - Heterogenous catalysis Adsorption - Difference between absorption and adsorption - Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms - Freundlich and Langmuir. Adsorption isotherms and their limitations - BET theory (no derivation)

UNIT - III: PHOTOCHEMISTRY

Photo physical processes - Jablonski diagram - Laws of photo chemistry - Lambert - Beer, Grotthus- Draper and Stark –Einstein. Quantum efficiency. Fluorescence and Phosphorescence. Photo chemical reactions - rate law - Kinetics of H_2-Cl_2 and H_2-I_2 reactions, comparison between thermal and photochemical reactions.

UNIT- IV: GROUPTHEORY and COMPUTATIONAL CHEMISTRY (10 hrs)

Symmetry elements and symmetry operation symmetry operation of H2O molecule, Illustration of mathematical rules for the group using symmetry operations of H2Omolecule. Construction of multiplication table, for H2O molecule. Point group - Definition Elements (symmetry operations) of the following point groups Cn (C2, C3), Cnv (C2V, C3V) and Cnh(C2h, C3h) Introduction to computational chemistry – Optimization of structure – Z-matrix, Use of software for computing structures - eg. Avogadro

UNIT V: ELECTROCHEMICAL CELLS

Electrolytic & Galvanic cells - Reversible and irreversible cells. Conventional representation of electrochemical cells. Electromotive force of a cell and its measurement computation of E.M.F. calculation of thermodynamic quantities of cell reactions (ΔG,ΔH, ΔS and Keq).Application of Gibbs Helmholtz equation. Calculation of E.M.F. Types of reversible electrodes - Gas/metal ion- metal/metal ion; metal/insoluble salt/anion and Redox electrodes. Electrode reactions - Nernst equation - Derivation of cell E.M.F. and single electrode potential - standard hydrogen electrode - reference electrodes (Calomel electrode)- standard electrodes reduction potentials – sign convention - Electrochemical series and its significance. Concentration cell with and without transport. Liquid junction potential. Application of EMF concentration cells. Valency of ion, solubility product and activity co-efficient. Potentiometric titrations. Determination of pH using Hydrogen, quinhydrone and glass electrodes. Determination of pKa of acids by potentiometric method. Fuel cells - Corrosion - general and electrochemical theory - passivity - prevention of corrosion.

COURSE TITLE	ELECTIVE-III : ANALYTICAL CHEMISTRY
CODE	BCY-DSE3A
CO.No	Course Outcomes
CO-1	Learning terminologyof data analysis
CO-2	Understanding the basics of Separation techniques
CO-3	Principles and instrumentation ofchromatographic
CO-4	Principles and instrumentation of gravimetric, Thermal techniques computational chemistry
CO-5	Principles and instrumentation of spectroscopic and electroanalytical techniques

UNIT-I

Data Analysis - Theory of errors - idea of significant figures and its importance with examples - Precision - accuracy - methods of expressing accuracy - error analysis - minimizing errors methods of expressing precision - average deviation - standard deviation and confidence limit. Purification of solid compounds - extraction - use of immiscible solvents - Soxhlet extraction Purification of liquids - experimental techniques distillation - fractional distillation - vacuum distillation - steam distillation –tests for purity).

UNIT-II

Principles of gravimetric analysis - characteristics of precipitating agents- choice of precipitants and conditions of precipitation –specific and selective precipitants - DMG, cupferron, salicylaldehyde, ethylene diamine- use of sequestering agents - co-precipitation - post precipitation - peptization- differences- reduction of error - precipitation from homogeneous solutions - calculations in gravimetric methods - use of gravimetricfactor.Thermal analytical methods - Principle involved in thermogravimetric analysis and differential gravimetric analysis - discussion of various components with Block diagram - characteristics of TGA and DTA - factors affecting TGA and DTA curves-thermometric titrations. Chromatography Techniques - Principles - adsorption, partition and ion exchange chromatography , column chromatography - adsorbents - preparation of column - elution, recovery of substance and applications. TLC - choice of adsorbent and solvent -

preparation of chromatogram (Rf value) and applications - Paper chromatography - Solvents used - factors affecting Rfvalue- separation of amino acidmixtures.

UNIT-III

Definition of spectrum - electromagnetic radiation - quantisation of different forms of energies of molecules - translational, vibrational, rotational, vibrational and electronic energies. UV - Visible spectroscopy - absorption laws –theory- electronic spectra - types of electronic transitions - chromophores and auxochromes –absorption bands and intensity - factors governing absorption maxima and intensity – instrumentation. IR spectroscopy - vibrations of diatomicmolecules- harmonic and anharmonic oscillators, zero point energy, force constant, condition for a molecule to be IR active, selection rules - instrumentation

UNIT-IV

NMR spectroscopy - principle - equivalent and non-equivalent protons - shielded and deshielded protons, chemical shift - TMS, delta tau scales, spin-spin coupling- analysis of spectrum of ethanol - instrumentation Mass spectrometry: Basic principles of mass spectrum Instrumentation and Block diagram molecular ion peak, base peak, isotopic peak, fragmentation - Nitrogen rule - determination of molecular formulae - fragmentation and mass spectrum of simple organic compounds - alcohols and carbonyl compounds- McLafferty rearrangement.

UNIT–V

Polarography - principle - concentration polarization - dropping mercury electrode - advantages and disadvantages - migration and diffusion currents - Ilkovic equation (derivation not required) and significance - experimental assembly –electrodes - capillary - current voltage curve - oxygen wave - influence of temperature and agitation on diffusion layer - polarography as an analytical tool in quantitative and qualitative analysis . Amperometry- basic principles and uses.

COURSE TITLE	**CORE-XIII: MAJOR PRACTICAL-III**
CODE	**BCY-DSC13**
Course Outcomes	
Learning the gravimetric estimation of some anions and cations	

Gravimetric Estimation

1. Estimation of Lead as Leadchromate

2. Estimation of Barium as Barium chromate

3. Estimation of Nickel as Nickel - DMG complex.

4. Estimation of Calcium as Calciumoxalate

5. Estimation of Barium as Barium sulphate

6. Estimation of Sulphate as Bariumsulphate.

7. Estimation of Aluminium as Aluminium oxinate (for demonstration)

8. Estimation of Silver as Silver chloride (for demonstration)

COURSE TITLE	**CORE-XIV: MAJOR PRACTICAL - IV**
CODE	**BCY-DSC14**
Course Outcomes	
Learning to identify functional groups and elements present in organiccompounds; Preparation of some simple organic compounds	

ORGANIC ANALYSIS

Analysis of simple organic compounds (a) characterization functional groups (b) confirmation by preparation of solids derivatives / characteristics colour reaction.

1. Mono - functional compounds are given for analysis. In case of bi-functional compounds, students are required to report any one of the functional groups.

2. Each student is expected to do the analysis of at least 10 different organic substances. Recommended to adopt micro scale technique of organic analysis

ORGANIC PREPARATIONS

Preparation of Organic compounds involving the following chemical conversions

1. Oxidation of benzaldehyde

2. Reduction of nitrobenzene

3. Esterification of salicylic acid

4. Acetylation of aniline

5. Hydrolysis of methyl salicylate

6. Nitration of phenol

7. Bromination of acetanilide

COURSE TITLE	**CORE-XV: MAJOR PRACTICAL-V**

CODE	BCY-DSC15
Course Outcomes	
Learning determination of order of chemical reactions; potentiometric andconductometric titrations	

Physical Chemistry Experiments

1. Critical Solution Temperature
2. Effect of impurity on critical solution temperature of phenol-water system[NaCl]
3. Ras method
4. Transition temperature
5. Heat of neutralization
6. Phase diagram (Simple Eutectic)
7. Kinetics of saponification
8. Kinetics of acid catalysed ester hydrolysis
9. Kinetics of Persulphate- Iodide reaction.
10. Partition coefficient and Equilibrium constant of $KI + I2 \rightarrow KI3$
11. Determination of cell constant, specific conductance and equivalent conductance of strong electrolyte.
12. Estimation of HCl by conductometric titration .
13. Estimation of acetic acid conductometric titration.
14. Estimation of BaCl2 by conductometric titration.
15. Estimation of HCl by potentiometric titration .
16. Estimation of FAS by potentiometric titration.