

**SARDAR PATEL UNIVERSITY  
VALLABH VIDYANAGAR**



**SYLLABUS EFFECTIVE FROM: 2017-18  
M.Sc. CHEMISTRY  
SEMESTER-I**

**PS01CCHE21: Electron spectroscopy and Magnetochemistry**

**Total Credit: 4**

Unit	Description in details	Weightage (%)
<b>Unit-1</b>	<b><i>Electron spectroscopy of transition metal complexes: I</i></b> Concept of crystal field theory(CFT), ligand field theory (LFT) and molecular orbital theory (MOT); splitting of d-orbitals in various stereochemistry; tetragonal distortion in octahedral complexes; spectrochemical series; nephelauxetic series; Electronic states and term symbols; microstates; derivation of terms for closed subshell; derivation of terms for $p^2$ , $d^2$ and $f^2$ configurations.	25%
<b>Unit-2</b>	<b><i>Electron spectroscopy of transition metal complexes: II</i></b> Correlation diagrams; Orgel diagram; Tanabe-Sugano diagram; selection rule; determination of $Dq$ and electronic parameters; interpretation of spectra.	25%
<b>Unit-3</b>	<b><i>Magnetochemistry: I</i></b> Magnetic susceptibility; sources of paramagnetism; diamagnetic susceptibility; Pascal constants and constitutive corrections; Langevin equation; Van Vleck's formula; antiferromagnetism; types of antiferromagnetism; antiferromagnetic exchange pathways; Ferromagnetism and magnetic domains; molecular field theory of ferromagnetism; magnetic sublattice, ferrimagnetism and canting.	25%
<b>Unit-4</b>	<b><i>Magnetochemistry: II</i></b> Spin-orbit coupling; Lande interval rule; quenching of orbital magnetic moment by crystal field; spin-orbit coupling on A and E terms; spin-orbit coupling on T term; Spin pairing: spin pairing in octahedral complexes; spin pairing in non-octahedral complexes; some aspects of spin pairing and cross over region. <b><i>Chemistry of lanthanides and actinides:</i></b> Term symbols, spectral and magnetic properties of the compounds of lanthanides and actinides; use of lanthanide compounds as shift reagents.	25%

**Reference books:**

- Molecular Spectroscopy, Theory and Applications,  
By: Raman Patel and Raman Patel
- Electronic absorption spectroscopy and related techniques,  
By: D.N. Sathyanarayana

- Introduction to ligand fields, By B.N. Figgis (1967)
- Introduction to Magnetochemistry,  
By: Alan Earshaw (1968)
- Elements of Magnetochemistry,  
By: Dutta and Syamal (1993)
- Modern Aspects of Inorganic Chemistry,  
By: Emeleus and Sharpe (1996)
- Advanced Inorganic Chemistry,  
By: Cotton, Wilkinson, Murillo and Bochmann (1999)
- Inorganic Chemistry,  
By: A.G.Sharpe (1981)
- Inorganic Chemistry,  
By: James E. Huheey, Eilen A. Keiter, Richard L. Keiter  
Publication: Harper Collins
- Inorganic Chemistry,  
By: Shriver and Atkins
- Inorganic Chemistry,  
By: Gary Wulfsberg
- Inorganic electronic structure and spectroscopy (2013)  
Volume I: Methodology  
Volume II: Applications and case studies  
By: Edward I. Solomon, A. B. P. Lever  
Publication: Willey
- Descriptive Inorganic Chemistry (Forth Edition)  
By Geoff Rayner- Canham, Tina Overton  
Publication: Craig Bleyer

M.Sc. CHEMISTRY  
SEMESTER-I

PS01CCHE22: Organic Chemistry-I

Total Credit: 4

Unit	Description in details	Weightage (%)
<b>Unit-1</b>	<p><b>Stereochemistry:</b>            Concept of Chirality, Chirality and Symmetry, Sawhorse, Newman and Fischer Projections, Interconversion of Projection formula, Elements of Chirality including Chiral centre, Chiral axis, Chiral plane and Helicity, CIP Nomenclature, Molecules with more than one Chiral centre, Total number of Stereoisomer in such molecules, Enantiomeric and Diastereomeric Relationship, Chirogenicity and Stereogenecity, Pseudochirality, Topicity and Prostereoisomerism, Determination of Topic relationship between Homomorphic ligands in Intact Molecules, Concept of stereoselective and stereospecific reactions, Optical Purity.</p>	25%
<b>Unit-2</b>	<p><b>Name Reaction Mechanism and their Application:</b>            Molecular Rearrangement involving Non-classical Carbocation, Wagner-Meerwein and Related Rearrangements, Wolff, Curtius, Schmidt, Lossen, Beckmann, Benzil-Benzilic acid, Favorskii, Stevensen, Sommelet-Hauser Rearrangements, Vilsmyer-Heck Reaction, Mitsunobu Reaction, Suzuki Reaction, Stobbe condensation, Fries reaction, aldol and related reactions, Knoevenagel, Dieckman, Darzen, Claisen reaction.            [ Emphasizing on Various Techniques for Determination of Mechanism]</p>	25%
<b>Unit-3</b>	<p><b>Elimination and Addition Reactions:</b>            Mechanisms and Orientation, E1, E1cb, E2 spectrum, Effects of Changes in Substrate, Base, Leaving Group and Medium on Reactivity, Hoffman and Saytzeff eliminations, Bredt's Rule, Pyrolytic Eliminations- Cope and Chugaev eliminations;            Addition reactions: Mechanisms, Orientation and Reactivity, Markonikoff and anti-Markonikoff additions, Reactions including Hydro-Halo, Hydro-Hydroxy, Hydro-Alkoxy, Dihydro, Dihydroxy, dihalo, ozonolysis            [ Emphasizing on Various Techniques for Determination of Mechanism]</p>	25%
<b>Unit-4</b>	<p><b>Aromatic substitution reactions (Electrophilic and Nucleophilic):</b>            Mono-substituted benzenes - Reactivity and Orientations, Orientation in Benzene Rings with more than One Substituent, ipso substitution, Orientation in Other Ring Systems, Mechanisms of Fridel- Craft reactions, Nitration, Sulphonation, Halogenation, Diazocoupling and Formylation. Benzyne Mechanisms for Aromatic Nucleophilic substitution reactions.</p>	25%

**Basic Text & Reference Books:-**

- Organic Reactions, Stereochemistry and Mechanism: P.S. Kalsi (New Age.)
- Principles of Organic Synthesis: R.O.C Norman & J.M. Coxon (ELBS)
- Mechanism in Organic Chemistry: Peter Sykes (Orient Longman)
- Modern Methods of Organic Synthesis: W. Carruthers (Cambridge)
- Organic Reaction Mechanism: V.K.Ahluwalia and R.K.Parashar ( Narosa )
- Organic Chemistry: Clayden, Greeves and Warren (Oxford)

M.Sc. CHEMISTRY  
SEMESTER-I  
PS01CCHE23: Topics in Physical Chemistry-I

Total Credit: 4

Unit	Description in details	Weightage (%)
<b>Unit-1</b>	<p><b>Chemical Thermodynamics :</b> Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar properties: partial molar free energy, partial molar volume and partial molar heat content and their significances. Determinations of these quantities. Concept of fugacity and determination of fugacity. Non-ideal systems : Excess functions for non-ideal solutions, Activity, activity coefficient, Debye-Huckel theory for activity coefficient of electrolytic solutions; determination of activity and activity coefficients ; ionic strength.</p>	25%
<b>Unit-2</b>	<p><b>Chemical Kinetics – I :</b> Chemical kinetics and its scope, rate of reaction, factors influencing the rate of a reaction, measurements of reaction rates, differential and integral rate laws, rate laws and equilibrium constants for elementary reactions, temperature dependence of rate constants, Arrhenius equation, concept of activation energy, reaction mechanisms and examples ;- uni-molecular reactions, bi-molecular reactions, tri-molecular reactions, nuclear decay reactions, polymerization reactions.</p>	25%
<b>Unit-3</b>	<p><b>Electrochemistry :</b> Electrochemistry of solutions, Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equation. Derivation of electro-capillary, Lippmann equations (surface excess), methods of determination. Structure of electrified interfaces, Guoy-Chapman, Stern, Graham-Devanathan-Mottwatts, Tobin, Bockris, Devanathan models. Over potentials, exchange current density, derivation of Butler-Volmer equation, Tafel plot.</p>	25%
<b>Unit-4</b>	<p><b>Surface Chemistry :</b> Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Surface films on liquids (Electro-kinetic phenomenon), catalytic activity at surface. Micelles : Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micelle concentration (CMC), factors affecting the CMC of surfactants, thermodynamics of micellization – phase separation and mass action models.</p>	25%

### **Basic Text & Reference Books:-**

- An Introduction to Chemical Thermodynamics, R. P. Rastogi and P. R. Misra, (Vikas Publishing House Pvt.Ltd.
- Thermodynamics, P. C. Rakshit, (The New Book Stall, Calcutta).
- Fundamentals of Chemical Thermodynamics, M. L. Lakhanpal, (Tata McGraw-Hill Publishing Company, New Delhi).
- Elements of Physical Chemistry, Peter Atkins, Julio De Paula, David Smith,(Oxford University Press, 6<sup>th</sup> Edition)
- Physical Chemistry, Ira N Levine (Tata McGraw-Hill Publishing Company, New Delhi, Fifth Edition).
- Micelles, Theoretical and Applied Aspects, V. Moroi, Plenum Press
- Modern Electrochemistry, Vol. I and Vol. II, J. O. M. Bockris and A. K. N. Reddy, Plenum press
- Chemical Kinetics, K. J.Laidler, Mc-Graw Hill Publisher
- Thermodynamics for Chemists, S. Glasstone, (East-West Edition, Third Edition)
- Surfactants and Interfacial Phenomena, Milton J. Rosen, (Willey Interscience, Third Edition).
- Colloid and Interface Science, Pallab Ghosh (PHI Learning Private Limited)

M.Sc. CHEMISTRY  
SEMESTER-I

PS01ECHE21: **Biophysical Chemistry**

**Total Credit: 4**

Unit	Description in details	Weightage (%)
<i>Unit-1</i>	<p><b>Cell Structure and Functions :</b> Structure of prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of plant and animal cells, biomolecules : introduction and building blocks, amino acids, peptides and proteins, structure and functions of proteins, enzymes – mechanism, Carbohydrates :structure and functions, lipids and biological membranes</p>	25%
<i>Unit-2</i>	<p><b>Nucleic Acids :</b> Purine and pyrimidine bases of nucleic acids, base pairing via H-bonding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acids (DNA), double helix model of DNA and forces responsible for holding it. Properties of DNA in solution, Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code, Chemical synthesis of mono and trinucleoside. Denaturation of DNA, RNA –types, hydrolysis, analysis and nucleic acid – protein complexes, helix coil transition</p>	25%
<i>Unit-3</i>	<p><b>Thermodynamics of Biopolymer solutions :</b> Osmotic pressure, membrane equilibrium, muscular contraction and energy generation, mechano-chemical system, chain configuration of biopolymers, statistical distribution of end – to – end and average dimensions, Cell membrane and transport of ions : Structure and functions of cell membrane, ion transport across cell membrane, passive mediated transport, active transport, irreversible thermodynamic treatment of membrane transport.</p>	25%
<i>Unit-4</i>	<p><b>Bioenergetics :</b>Overview of metabolic processes – catabolism and anabolism, ATP – the biological energy currency, Principles and ATP cycles – properties of ADP, ATP and AMP, synthesis of ATP from ADP, hydrolysis of ATP, Standard free energy change in biochemical reactions, exergonic reactions, endergonic reactions, coupled reactions and energy conservation. Working numerical based on energetic of biochemical reactions.</p>	25%

### **Basic Text & Reference Books:-**

- Lehninger Principles of Biochemistry, M. M. Cox and D. L. Nelson (W. H. Freeman and Co., New York, Firth Edition)
- Biochemistry, J. M. Berg, J. L. Tymoszko and L. Stryer (W. H. Freeman and Co., New York, Fifth Edition)
- Fundamentals of Biochemistry, D. Voet and C. W. Pratt (John Wiley & Sons, Inc., Second Edition)
- Biochemical calculations, Irwin H. Segel (John Wiley & Sons, New York, Second Edition)
- Biophysical Chemistry, M. Satake, Y. Hayashi, M. S. Sethi and S. A. Iqbal (Discovery Publishing House, New Delhi)
- Physical Chemistry : Principles and Applications in Biological Sciences, I. Tinoco Jr., K. Sauer, J. C. Wang, J. D. Puglisi (PEARSON publisher, Fourth Edition).
- Fundamentals of Biochemistry, A. C. Deb (New Central Book Agency, Kolkata)



M.Sc. CHEMISTRY  
SEMESTER-I

PS01ECHE22: Polymer Chemistry-I

Total Credit: 4

Unit	Detail Description	Weightage (%)
<i>Unit-1</i>	<p><b>Introduction:</b> Historical development in polymeric materials, Basic concepts: Oligomer, Monomer, Polymer, Polymerization and Functionality, Repeating Unit, Degree of Polymerization, Bonding in Polymers, Notation and Nomenclature of Polymers, Classification of Polymers depending on- (i) Origin (Natural, Semi-Synthetic, Synthetic); (ii) Chemical Structure (Organic Inorganic, Homochain and Heterochain); (iii) Thermal Response or the behaviour of heat or pressure (Thermoplastics and Thermosetting); (iv) Line Structure (Linear, Branched, Cross-linked, hyper branched and dendrimer); (v) Ultimate forms and Applications (Plastics, Elastomers, Fibers and Liquid Resins); (vi) Tacticity or the Stereochemistry of the Polymers (Optical Isomerism in Polymers: Isotactic, Syndiotactic, Atactic and Geometrical isomerism in Polymers); (vii) Crystallinity (Crystalline, Semi-crystalline and Amorphous) and (viii) Mode of Synthesis (Homopolymers, Copolymers, Addition, Condensation), Glass Transition Temperature (<math>T_g</math>) and Factors Influencing the Glass Transition Temperature</p> <p><b>Average Molecular Weight Concepts and Measurement of Molecular Weights (<math>\bar{M}_n</math>, <math>\bar{M}_w</math> and <math>\bar{M}_z</math>):</b> Number Average and Weight Average Molecular Weights, Molar Mass &amp; Molar Mass Distribution, Polydispersity, Method of Working out Weight Average Molecular Weight and Number Average Molecular Weight, Molecular Weight and Degree of Polymerization, Polydispersity and Molecular Weight Distribution in Polymers, Practical Significance of Polymer Molecular Weight, End Group Analysis, Freezing Point Depression (Cryoscopy), Boiling Point Elevation (Ebullioscopy), Membrane Osmometry, Vapour Phase Osmometry, Dilute Solution Viscosity, Light Scattering, Ultracentrifugation and GPC</p>	25
<i>Unit-2</i>	<p><b>Chain-Growth Polymerization:</b></p> <p>(i) <b>Chain Radical (Addition) Polymerization:</b> Free radical addition polymerization mechanism of vinyl polymerization (Generation of free radicals, initiation, propagation, termination, chain transfer inhibition of retardation, configuration of monomer units in vinyl polymer chains), Methods of Initiating Free Radical Polymerization, Kinetics of free radical addition polymerization (experimental determination of rate constants, derivations for rate expressions and expressions for kinetic chain length, degree of polymerization and average life time of a kinetic chain), Control of molecular weight by transfer, The Mayo Equation and Evaluation of the Chain Transfer Constant, Factors (Temperature, Initiator Concentration, Monomer Concentration and Pressure) determining radical polymerization and the properties of the resulting polymer, Equilibrium of Radical Polymerization</p> <p>(ii) <b>Ionic (Catalytic) Polymerization</b> - common features of two types of ionic polymerization, Mechanism of cationic</p>	25

	<p>polymerization, expressions for overall rate of polymerization and the number average degree of polymerization. Mechanism of anionic, polymerization, expressions for overall rate of polymerization and the average degree of polymerization, Living polymers.</p> <p>(iii) Coordination (Insertion) Polymerization : Ziegler – Natta Catalysis</p>	
<b>Unit-3</b>	<p><b>Step-growth Polymerization:</b> Ring – opening Polymerization (Mechanism of polymerization of cyclic ethers, cyclic amides and cyclosiloxanes), Atom transfer Polymerization, Kinetics of catalyzed and non – catalyzed polyesterification.</p> <p><b>Copolymerization:</b> Free Radical Copolymerization, Determination of Reactivity Ratio, Reactivity Ratios and Copolymerization Behaviour, Copolymer Composition at Higher Conversations, Structure and Reactivity of Monomers and Radicals, The Q-e scheme of Alfrey and Price</p>	<b>25</b>
<b>Unit-4</b>	<p><b>Techniques of Polymerization:</b> Bulk – Solution – Suspension and Emulsion polymerization, Melt Polycondensation, Solution Polycondensation, Interfacial Condensation, Solid and Gas Phase Polymerization, Salient features of different polymerization techniques, Kinetics of emulsion polymerization.</p> <p><b>Polymer solubility and solutions:</b> Introduction, General rules for polymer solubility, Thermodynamic basis of Polymer Solubility, Prediction of Solubility.</p> <p>Organometallic Polymers, Ion-containing Polymers, Additives for Polymers</p>	<b>25</b>

#### Reference Books:

- Polymer Chemistry – An Introduction by Malcom P. Stevens, Addison Wesley Publishing Co. Inc. Massachusetts.
- Polymer Chemistry by C. Carraher, Marcel Dekker Inc., New York-Basel.
- Textbook of Polymer Science by F. W. Billmeyer, Wiley – Interscience, New York
- Introduction to Polymer Chemistry by R. B. Seymour, Mc – Graw – Hill, New York
- Polymer Science by V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar, New Age International Publishers,
- Introduction to Polymer Chemistry by R. J. Young and P. A. Lovell
- Principles of Polymer Chemistry (IInd Edition) by A. Ravve
- Principles of Polymers Systems, F. Rodriguez, Hemisphere, Publishing Corporation, Washington, DC.
- Principles of Polymer Science (Second Edition) by P. Bahadur and N. V. Sastry, Narosa Publishing House, New Delhi

M.Sc. CHEMISTRY  
SEMESTER-I

PS01ECHE23: Applied and Industrial Chemistry

Total Credit: 4

Course Code: PS01ECHE23		Total Credits
Course Title : Applied and Industrial Chemistry		
Unit	Description in detail	Weightage (%)
I	<b>Unit operation and unit processes:</b> Basic concepts, characteristics, equipments and instrumentation. <b>Chemical process kinetics:</b> Types of chemical reactions, catalytic rate equation, adsorption equilibrium, factors affecting chemical process.	25%
II	<b>Principal of chemical industrial process:</b> Halogenations, Alkylation, Oxidation, Hydrogenation, Sulfonation and Nitration.	25%
III	<b>Manufacturing process (Glass, Cement, steel):</b> Introduction, Classification and types, basic raw materials, principal of manufacturing process including chemical reactions.	25%
IV	<b>Drug and Pharmaceuticals:</b> Introduction, General mode of action, concept of lead compounds and lead modification, analytical profiles of the selected drug. Development of drug. <b>Dairy products:</b> Introduction, classification and types, basic raw materials, equipments and manufacturing process and quality control parameters.	25%

**Basic Text & Reference Books:-**

- Mass Transfer operations; Robert Trebal, Mc Graw Hill Co., 3rd edition.
- Unit operations of chemical engineering, W. Mc Cabe Smith, Mc Graw Hill Co., 7th edition
- Chemical process principal Vol. I & II, Horgan Watson, Asian Pub. House, 2nd edition.
- Chemical kinetics, S. K. Jain, Vishal pub. , Jallander.
- Unit process in organic systems, Groggins, Tate, Mc Graw Hill Co., 5<sup>th</sup> edition.
- Encyclopedia of industrial chemical analysis, Foster Dee Snell, Leslie S. , Ettore, Interscience pu Wiley & Sons N.Y., 1973, Vol-1 to 20
- Ullmann's Encyclopedia of industrial chemistry, Vol.: 1 to 39, Wiley-VCH, Weinheim, 2003
- Analytical profiles of Drug substance, by Florey, Vol. : 1 to 30, Academic press N. Y. , 2005
- Basics of Industrial Chemistry, by Rajarshi Patel , Lambert Publications 2016-17

**PS01CCHE24 & PS01CCHE25 Practicals**

**Inorganic, Organic & Physical Chemistry**

❖ **INORGANIC CHEMISTRY**

**(Weightage 33.33%)**

**Total Credit : 4**

❖ **Synthesis of metal complexes, double salts and estimation by gravimetry.**

1. Hexa ammine nickel(II) chloride.
2. Ferrous ammonium sulphate.
3. Mercury tetrathiocyanatocobaltate.
4. Tris-acetylacetonato Manganese(II) chloride.
5. Potassiumtrioxalatoferrate
6. Prussian blue
7. Hexaure chromic chloride.
8. Tetra ammine copper sulphate
9. Cis – trans- bis oxalate, diaquo chromate(III)

❖ **Qualitative Analysis ( 6 + 1 Radicals)**

6 – Cation, Anion variable

1 – Rare earth element form the following:

Th, Ce, Li, Mo, Se, Te, V, Ti and Zr etc.

**References Books:**

1. Advanced Practical Inorganic Chemistry – Gurdeep Raj Goel Publishing House, Meerut.
2. Qualitative Inorganic Analysis. – A. I. Vogel, 6<sup>th</sup> Edition revised by G. Svehla ELBS – London
3. Textbook of Chemistry Analysis – A. I. Vogel
4. Qualitative Chemistry semi micro analysis – edited by P. K. Agasyan CBS Publisher-Delhi.
5. Chemistry: Inorganic Qualitative Analysis in the Laboratory, Clyde Metz, Elsevier, 2012, ISBN : 978032316104

## ❖ ORGANIC CHEMISTRY

(Weightage 33.33%)

Total Credit : 4

### ❖ List of Synthesis

1. Claisen-Schmidt Reaction:  
Benzal-acetophenone from acetophenone/ Dibenzalacetone from Benzaldehyde
2. Backmann rearrangement:  
Benzanilide from Benzophenone/Acetanilide from acetophenone
3. Diels-Alder reaction:  
9,10-dihydroanthracene- $\alpha,\beta$ -succinic anhydride from anthracene
4. Sandmeyer reaction:  
Aniline to chlorobenzene, p-nitroaniline to p-nitrochlorobenzene, Anthranilic acid to o-chlorobenzoic acid, o-toluidine to o-chlorotoluene, p-iodonitrobenzene from p-nitroaniline, m-nitrophenol from m-nitroaniline etc.
5. Fisher indole synthesis:  
1,2,3,4-Tetrahydrocarbazole from Cyclohexanone
6. Lieben haloform reaction:  
Iodoform from Acetone
7. Knorr-Quinoline synthesis:  
2-hydroxy-4-methylquinoline from Acetoacetanilide
8. Kolbe-Smith reaction:  
2,4-dihydroxybenzoic acid from resorcinol
9. Cannizarro reaction:  
Benzyl alcohol and Benzoic acid from Benzaldehyde
10. Mannich base synthesis:  
Benzyliminoethylphenylketone from acetophenone, formaldehyde and benzylamine
11. Boiling point determination of unknown liquid samples

### ❖ Estimations

1. Hydroxyl Group Estimation
2. Unsaturation Estimation
3. Phenol/ Aniline Estimation
4. Ascorbic Acid (Vitamin-C) Estimation
5. Acid + Amide / Acid + Ester Estimation

### Basic Text & Reference Books:-

Elementary Practical Organic Chemistry (part-1 to 3) By A. I. Vogel (CBS publication).

❖ **PHYSICAL CHEMISTRY**

(Weightage 33.33%)

**Total Credit : 4**

**( Physical –I)**

**Sr. No. Description in detail**

1. To determine the heat of solution of the given acid by solubility method
2. Determination of hydrolysis constant of aniline hydrochloride by distribution method
3. Determination of the critical solution temperature (CST) of the phenol/water system and to study the effect of additive on CST
4. To determine the surface tension of methyl acetate, ethyl acetate, hexane and chloroform and hence calculate the atomic parachors of C, H, Cl etc
5. To determine partial molar volume of sodium chloride in aqueous solution at room temperature

**( Physical –II)**

**Sr. No. Description in detail**

1. To determine the dissociation constants ( $k_1$  and  $k_2$ ) of a dibasic acid pH metrically
2. To find out the (a) cell constant of given conductivity cell, (b) to determine the critical micelle concentration (CMC) of an ionic surfactant
3. Determination of  $\Delta G$ ,  $\Delta H$  and  $\Delta S$  for a reaction using an electrochemical cell
4. To verify law of additivity of absorbance for a mixture of colored substances in solution using potassium permanganate and potassium dichromate solutions
5. To determine the concentration of a given solution of an optically active substance by polarimetric measurements

**Basic Text & Reference Books:-**

- Experimental Physical Chemistry by R. C. Das & B. Behera, (Tata McGraw hill Publishing Company Ltd., New Delhi)
- A Laboratory Manual of Experiments in Physical Chemistry by D. Brennan and C. F. H. Tipper, (McGraw hill Publishing Company Ltd., London)
- Systematic Experimental Physical Chemistry by S. W. Rajbhoj and T. K. Chondhekar, (Anjali Publication, Aurangabad)
- Advanced Practical Physical Chemistry by J. B. Yadav, (Goel Publishing House, Meerut)
- Experimental Physical Chemistry by G. Peter Matthews, (Clarendon Press, Oxford, London)
- Experimental Physical Chemistry by V. D. Athawale and Parul Mathur, (New Age International Publishers, New Delhi)
- Advanced Physical Chemistry Experiments by Gurtu and Gurtu, (Pragati Prakashan, Meerut)
- Advanced Physico-Chemical Experiments by J. Rose, (Sir Isaac Pitman & Sons Ltd., London)
- Experiments in Physical Chemistry by D. P. Shoemaker, C. W. Garland and J. W. Nibler, (McGraw Hill International Edition, London)