

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**  
**M.Sc.-II (PHYSICAL CHEMISTRY)**  
TO COME IN FORCE FROM JUNE-2011  
**PAPER-I**

**Max. Marks: 70**

**Total Periods: 45**

**SEMESTER – III**  
**(PHYSICAL CHEMISTRY: Core Course)**

**UNIT-I: THERMODYNAMICS (15 Periods)**

Ensemble and probability, discrete property  $i$ , ensemble averages and postulates. Canonical and Micro-canonical and Grand canonical ensemble. Canonical ensemble probability distribution and partition function. Statistical derivation of entropy, free energy, heat capacity in terms of partition functions. Derivation of Sackur-Tetrode equation. Treatment of diatomic and polyatomic molecules – entropy, vibrational entropy and rotational entropy. Boltzmann distribution law.

Thermodynamic functions of mixing, free energy, entropy, heat, volume and viscosity of mixing of ideal and non-ideal binary solutions. Techniques used to determine excess functions.

**UNIT-II: BIOPHYSICAL CHEMISTRY (15 Periods)**

**Bioenergetics:** Standard free energy change in biochemical reactions (exergonic and endergonic). Formation and hydrolysis of energy rich bonds in energy rich molecule.

**Enzyme Kinetics:** Michaelis-Menten and Lineweaver-Burke plots. Enzyme inhibition reversible and irreversible inhibition, Immobilized enzymes, Techniques and methods of immobilization of enzymes, Application of immobilized enzymes.

**Biopolymer interactions:** Forces involved in biopolymer interaction, electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions, multiple equilibria and various types of binding processes in biological systems.

**Cell Membrane and Transport of ions:** Structure and functions of cell membrane, Liposomes, ion transport through cell membrane.

**UNIT-III: Electronic, Electric and Optical Behaviour of materials (15 Periods)**

Metals, Insulators and Semiconductors, Electronic structure of solid, band theory, band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping of semiconductors and conduction mechanism, the band gap. Temperature dependence of conductivity, carrier density and carrier mobility in semiconductors, synthesis and purification of semiconducting materials, single crystal growth, zone refining, fractional crystallization, semiconductor devices, rectifier transistors, optical devices, photoconductors, photovoltaic cells, solar batteries.

**Books recommended**

1. Principles of Biochemistry, Lehningers World Publishers.
2. Thermodynamics for chemist by S. Glasstone.
3. Statistical Thermodynamics by M. C. Gupta.
4. Ion Selective Electrodes

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**PAPER-I (Physical)**

**Max. Marks: 70**

**Total Periods: 45**

**(PHYSICAL CHEMISTRY: Core Course)**  
**SEMESTER – IV**

**UNIT-I: CHEMICAL KINETICS (15 Periods)**

Rate theories based on thermodynamics, rate theories based on statistical mechanics, conventional transition-state theory, statistical mechanics and chemical equilibrium, Derivation of the rate equation, Thermodynamic formulation of conventional transition-state theory, assumptions and limitation of conventional transition-state theory, Theoretical calculations of specific rate constants for bimolecular reactions.

Elementary reaction in solution; solvent effects on reaction rates, factors determining reaction rates in solution, reaction between ions, ion dipole and dipole-dipole reactions. Effect of ionic strength. Substituent and correlation effects – Hammett equation. Linear free energy relationship.

**UNIT-II: NUCLEAR CHEMISTRY (15 Periods)**

Nuclear reactions – conservation laws, types of nuclear reaction, nuclear chain reaction, condition for controlled chain reaction, principle and types of nuclear reactors (thermal and Breeder reactors).

Nuclear models, Shell model – periodicity in nuclear properties, magic numbers characteristics of the shell model, square well potential, energy levels in nuclear potential well, sequence of filling the orbits, merits of shell models.

Liquid drop model-similarities between a nucleus and a liquid drop, merits of liquid drop, calculation of nuclear binding energies, the semi-empirical mass equation, limitation of liquid drop model.

Nuclear radiations, Radiation dosimetry, units of radiation energy, dosimetry, radiolysis of water and aqueous solutions, free radicals in water radiolysis.

**UNIT-III: SURFACE CHEMISTRY & CATALYSIS (15 Periods)**

**Emulsions and Microemulsions:** Formation of emulsions and their different types and determination, Emulsifying agents and emulsion stability, inversion of emulsion, Microemulsions: Formation, type, structure, stability and applications

**Soft nanotechnology:** Complex fluids and soft condensed matter, Reverse micelles and Synthesis of nanoparticles, block copolymer aggregates in the synthesis of nanoparticles, Liquid crystals: Lyotropic and thermotropic.

**Catalysis** Characteristic and types of catalyst, Homogeneous and heterogeneous catalysis and their commercial processes, General catalytic mechanisms, equilibrium treatment, steady state treatment and activation energies for catalysed reaction. Acid-base catalysis – general acid base catalysis, mechanism of acid base catalysis, Bronsted catalysis law. Hammett-Bronsted equation, acidity functions.

**Recommended Books:**

1. Chemical Kinetics by K. J. Laidler, Harper and Row.
2. Nuclear Chemistry by A. H. Arnikar.
3. Nuclear Chemistry by Dash U. N., Sultan Chand and Sons.
4. Introduction to Soft Matter: Polymers, Colloids, Amphiphiles and Liquid Crystals by I. W. Hamley.
5. Introduction to Surface and Colloid Chemistry by P. C. Heimenz.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**  
**M.Sc. Part-II PHYSICAL CHEMISTRY**  
TO COME IN FORCE FROM JUNE-2011  
**PAPER-II**

**Max. Marks: 70**

**Total Periods: 45**

**SEMESTER-III**  
**(SPECTROSCOPY)**

**UNIT-I : IR AND RAMAN SPECTROSCOPY (15 Periods)**

Theory of IR and Raman, selection rules, IR absorption, Raman scattering, Mutual exclusion rule, complimentary techniques, Instrumentation - FTIR and Raman, Cells and sampling techniques, Resonance Raman spectroscopy, Interpretation of IR spectra using correlation charts, Advantages of FTIR spectroscopy, Mid-IR Reflection – DRS, ATR, Data processing in Near IR, Applications in structure elucidation of inorganic and organic molecules.

**UNIT-II : NMR SPECTROSCOPY (15 Periods)**

Theory of NMR, Relaxation, population of energy levels, Larmor precession, chemical shift and factors affecting it, references and solvents, Spin-spin splitting, Coupling constant, Magnetic Anisotropy, Instrumentation, Shift Reagents, Interpretation of simple NMR spectra, Signal averaging, FT-NMR, Pulse FT-NMR spectroscopy, <sup>13</sup>C NMR spectra, NMR in medical diagnostics, Double resonance technique, Multi dimensional NMR, Problems to elucidate structure from NMR spectra.

**UNIT-III : MOLECULAR MASS SPECTROSCOPY (15 Periods)**

Instrumentation, Methods of ion production (EI, CI, FI, FD, Electro Spray, MALDI), Ion separators, Ion collection and recording, Double focusing, Time of flight analyser, Quadruple-mass spectrometer, Sample handling techniques, Resolution, Parent peak, Base peak, Metastable ions isotope effect, Molecular formula from mass spectra, Nitrogen rule, Ring rule, Fragmentation rules, Behavior of classes of compounds, Interpretation of mass spectra, Additional applications, Problems to elucidate structure from mass spectral data.

**Books:** On last page.

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**PAPER-II**

**Max. Marks: 70**

**Total Periods: 45**

**SEMESTER-IV**  
**(SPECTROSCOPY)**

**UNIT-I: ATOMIC X-RAY SPECTROSCOPY (15 Periods)**

Emission of X-ray, continuum and line spectra, X-ray absorption, absorption spectra, Apparatus, Source (monochromatic X-ray), Sample handling, Wavelength and energy dispersive device, Detector, Chemical analysis by X-ray absorption, X-ray fluorescence: Theory, instrumentation and applications, X-ray diffraction: Theory, instrumentation and applications.

**UNIT-II: ATOMIC SPECTROSCOPY (15 Periods)**

**(a) Atomic Absorption Spectroscopy (AAS)**

Principle of AAS, Instrument, Continuous sources and line sources, Flames, Flame atomizers, Non flame atomizers (furnaces), Monochromator and Detector, Interference with AAS Quantitative Analysis with AAS, Applications, Numerical.

**(b) Flame Emission Spectroscopy (FES)**

Flame as a source of atomic vapour, Flame atomization, Flame photometer, Applications and limitations comparison with AAS, Interference.

**(c) Plasma and Electrical Discharge Emission**

Emission spectroscopy with plasma sources, Instrument, AES with electrical discharge, Electrodes of AES, DC- arc, spark, Laser microprobe, Salient features of the emission spectrograph, Qualitative and Quantitative analysis applications.

**UNIT-III: ESR & APPLICATION OF UV- VISIBLE (15 Periods)**

**(a)** Theory of ESR, Population of E levels, relaxation time, Larmor precession, Instrumentation of ESR, Analytical applications of ESR spectroscopy, Hyperfine coupling mechanism, Super hyperfine splitting, g factor, Fine structure in ESR spectra hyperfine splitting constant, applications of ESR in study of metal complexes.

**(b)** Application of UV- Visible, Photometric accuracy, Simultaneous determinations of two components in a mixture,  $pK_{In}$  of indicator, Photometric titrations, Determination of metal to ligand ratio, analysis of drugs by UV-VIS spectrophotometry, Quantitative analysis, Numericals.

**Books:** On last page.

## REFERENCE BOOKS:

- (1) Instrumental Analysis: G. D. Caristian and J. E. O'Reilly (Allyn & Bacon Inc., New York, 2<sup>nd</sup> edition.
- (2) Instrumental Methods of Chemical Analysis: G. W. Ewing (McGraw-Hill, New York), 5<sup>th</sup> edition.
- (3) Instrumental Methods of Analysis: H. R. Willard, L. L. Merrit, J. A. Dean, F. A. Settle (Van Nostrand Reinhold Co., New York), 6<sup>th</sup> edition.
- (4) Modern Methods of Chemical Analysis: Pecsok, Shield & Cairns (John Wiley), 2<sup>nd</sup> edition.
- (5) Introduction to Instrumental Analysis (1987), R. D. Braun (McGraw-Hill Book Company), New Delhi.
- (6) Analytical Chemistry: Principles and Techniques: Larry G. Hargis (Prentice-Hall International edition).
- (7) Introduction to Modern Liquid Chromatography: L. R. Snyder & J. J. Kirkland (John Wiley & Sons, New York).
- (8) Treatise on Analytical Chemistry: I. M. Kolthoff & P. J. Elving (John Wiley & Sons, New York).
- (9) Handbook of Analytical Chemistry: L. Meites (McGraw-Hill, New York).
- (10) Photometric and Fluorometric Methods of Analysis: F. D. Snell (John Wiley & Sons Inc., New York).
- (11) Standard Methods of Chemical Analysis: Vol. I & II (6<sup>th</sup> edition), D. Van Nostrand Co. Inc. (London).
- (12) Official Methods of Analysis: Published by Association of Official Analytical Chemists, Washington.
- (13) Instrumental Methods of Chemical Analysis: B. R. Sharma (Goel Publishing House, Meerut).
- (14) Environmental Chemistry: B. R. Sharma, H. Kaur (Goel Publishing House, Meerut).
- (15) Inorganic Quantitative Analysis: A. I. Vogel (Orient Longman).
- (16) "Polarography", J. D. Talati (In Gujarati), University Granth Nirman Board.
- (17) "Polarography": Kolthoff I. M. and Lingane J. J. (Vol. I & II) (Interscience Publishers, New York).
- (18) "Polarographic Techniques": L. Meites (Interscience Publishers, New York).
- (19) Principles of Instrumental Analysis (5<sup>th</sup> ed.) by Skoog, Holler and Nieman (Saunders College Publishings).
- (20) Undergraduate Instrumental Analysis (5<sup>th</sup> ed.), J. W. Robinson (Marcel Dekker Inc.).
- (21) Fundamentals of Molecular Spectroscopy, by Banwell.
- (22) Electronic Absorption Spectroscopy and related techniques, D.N. Sathyanarayan, (New Age International ND. 1996) Uni. Press, Hyderabad.
- (23) Introduction to Spectroscopy (3<sup>rd</sup> ed.) by Pavia Lampman Kriz, Cengage Learning Harcourt College Publishers.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**

**M.Sc. Part-II PHYSICAL CHEMISTRY**

TO COME IN FORCE FROM JUNE-2011

**PAPER-III**

**Max. Marks: 70**

**Total Periods: 45**

**SEMESTER-III**

**(ELECTROANALYTICAL TECHNIQUES)**

**UNIT-I: DC-POLAROGRAPHY**

**(15 Periods)**

Principle, Types of currents, Electro capillary maxima, Maxima suppressors, Interference of oxygen DME as electrode, Wave equation, Ilkovic equation (derivation), half wave potential, Applications, Determination of stability constants of complexes. Quantitative analysis, Numerically, Applications of DC polarography, limitations, **Amperometric titrations:** Principle, DME & RPE, curves, Biamperometric titration.

**UNIT-II: MODERN POLAROGRAPHIC METHODS**

**(15 Periods)**

Electrochemical Definitions and Terminology, Faradic and Non-Faradic processes, Concentration profiles at microelectrode surface during electrolysis:

**A.C. Polarography:** Principle of Sinusoidal alternating applied potential, A.C. peak polarogram, Peak current equation, Characteristic of AC polarographic peak, Importance of signal to noise ratio for the sensitivity, Comparison with DC polarography.

**Square-wave Polarography:** Principle of alternating rectangular wave voltage applied, Frequency of square wave applied, Problems of large condenser currents in A.C., Peak polarogram, Peak current equation, Limitations of techniques.

**Pulse Polarography:** Effect of capillary response with frequency of applied square wave potential, Principles and difference between Normal Pulse Polarography and Differential Pulse Polarography, Importance of charging and Faradaic currents.

**UNIT-III: POTENTIOMETRIC METHODS OF ANALYSIS**

**(15 Periods)**

Membrane potential, Principles of selectivity, Methods of evaluating selectivities separate and mixed solution method. Classification of ion selective electrodes, Solid state electrodes – Glass electrode effect of glass structure on selectivity function of the glass electrode. Acid error, Alkali error, Silver halide, Sulphide, Lanthanum fluoride ion selective electrodes. Liquid ion exchange electrode – Calcium selective ion electrodes. Gas electrodes, ammonia, sulphur dioxide, oxygen and CO<sub>2</sub> sensing electrode, Micro ion selective electrode, enzyme electrodes. Quantitative determination – known addition method – known subtraction method.

**Books:** On last page.

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**SEMESTER-IV  
(SEPARATION TECHNIQUES)**

**UNIT-I: SOLVENT EXTRACTION**

**(15 Periods)**

Review of distribution law, Distribution coefficient, Distribution ratio, Equations for the solute dissociating or associating in one phase, Successive extractions, Extraction of metal ion with chelating agent with necessary equation, Multiple extractions, Craig pseudo counter current extractions, Apparatus for Craig extractions, Continuous counter current extractions, Extraction involving association of ion pairs, Elementary idea of extraction with crown ethers, Cryptans, Use of organic reagents, Numericals.

**UNIT-II: THEORY OF CHROMATOGRAPHY: PROCESS ANALYSERS**

**(15 Periods)**

**Theory of Chromatography:** Methods of elution, Ideal and non-ideal chromatography, Plate theory, Rate theory, Reasons for broadening of lands, Van Deemter equation and significance of terms involved, Optimum velocity, Resolution, Methods to improve resolution, GLC, Supports for liquid stationary phases, Selection of columns, FSOT, Selective Detectors- FPB, TID, Temperature programming in GC, Derivatisation in GC, Qualitative analysis from retention parameters, Quantitative analysis, Headspace Analysis, Thermal Desorption.

**UNIT-III: LIQUID CHROMATOGRAPHY:**

**(15 Periods)**

**(a) Liquid Chromatography:**

Principle of HPLC, Instrument and significance of each component, Pumps, Guard column, Stationary phases (solid, liquid), Bonded phase supports, Detectors UV absorption, Fluorescence detector, RI detectors, electrochemical detectors, Normal phase and Reversed phase.

**(b) Ion-exchange Chromatography:**

Resins used, Principle of exchange, Factors affecting the exchange, Capacity of resin and its determination, Techniques, IEC with eluent suppressor columns, Applications.

**(c) Gel-permeation Chromatography:**

Principle, Types of gels, Theoretical principles, Techniques and applications.

**(d) Plane Chromatography: Paper and TLC:** Two dimensional, solvent systems, Location, HPTLC and applications.

**Books:** On last page.

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**SEMESTER – III**  
**(POLYMER CHEMISTRY – Special paper 1)**

**UNIT-I: REVIEW and CHEMISTRY OF POLYMERIZATION (15 Periods)**

**(a) Basics:**

Importance of polymers, Historical development of polymer science, Detailed classification, Nomenclature, Polymers versus small mol wt substances, Advantages and disadvantages of polymers, Isomerisms and tacticity, Intermolecular forces in polymers, Industrial Scenario, Common synthetic polymeric materials used as plastics, fibres, elastomers and adhesives, Polymer Waste Disposal and Remedies, Natural polymers (brief idea on polysaccharides, polyamides, polynucleotides, polyterpenes, poly hydroxyalkanoates), Industrially useful natural polymers, Biodegradable polymers

**(b) Polymerization:**

Review of distinguishing features of the two techniques, Catalysts for free radical, anionic and cationic and Ziegler Natta chain polymerization, Living polymerization and its implications, Introduction on controlled radical polymerisation, Phase techniques in chain polymerization (bulk, solution, suspension, emulsion polymerization), Chain transfer reactions, Thermodynamic aspects of polymerization, Step polymerisation, Kinetics of catalysed and non-catalysed step polymerisation, Extent of conversion and DP, Methods of step polymerisation (dry, wet and interfacial), Criterion of monomer purity.

**(c) Copolymerization** - Kinetics of copolymerization, reactivity ratios and their determination, Mayo-Lewis method, Fineman-Ross method, Prediction of copolymer composition, Ideal, alternate & azeotropic copolymerization, Preparation of graft and block copolymers. Commercially important copolymers: their synthesis and applications.

**UNIT-I I: SYNTHETIC POLYMERIC MATERIALS (15 Periods)**

**(a) Synthesis and Applications of some industrially important common polymers**

*Addition polymers* (polyolefins and polydienes, vinyl polymers, acrylic polymers), *Condensation polymers* (terylene and unsaturated polyesters,, nylons and aramides, polyimides and Polybenzimidazoles, polyethers, epoxies, polyurethanes, formaldehyde (PF,UF and MF) resins, Alkyd resins, polycarbonates, silicones, polysulphones.

**(b) Chemical transformation in polymers:** Polymer degradation: Thermal, mechanochemical, oxidative & photo degradation, Cross-linking and curing reactions, Cyclization reactions, some important polymer reactions: Hydrolysis, acidolysis, aminolysis, hydrogenation, addition & substitution reactions.

### UNIT-III: IDENTIFICATION/CHARACTERIZATION

(15 Periods)

**(a) Analysis and testing of polymers:** Physical testing, Spectroscopic methods (IR, NMR), Chromatographic Methods (GC, HPLC) for identification/analysis/characterisation of polymers, Microstructure of polymers.

**(b) Characterisation of amorphous and crystalline polymers:** Thermal stability and thermal transitions in polymers, Melting versus glass transition, Glass transition temperature, its cause and importance, Relation between  $T_g$  and  $T_m$ , Factors affecting glass transition temperature: Chain flexibility, effect of plasticizers, blending and copolymerization of  $T_g$ , Determination of glass transition method by dilatometry, Thermal methods of analysis (DTA, TGA, DSC) in polymers. Crystalline polymers, Fringe micelle model, Factors affecting polymer crystallinity, Degree of crystallinity in polymers and its determination, X-ray diffraction pattern of polymers, Helical structure, Crystallization of polymers, Spherulites and crystallites, Polymer single crystals, Chain folding during crystal formation, Crystallizability and crystallinity, Effect of crystallinity on properties of polymer.

**(c) Mol wt of polymers:** The concept of mol wt average in polymers, Different mol wt averages and their significance, Molecular weight distribution and polydispersity index, Methods to determine number mol. wt. (dilute solution viscosity, vapor phase osmometry, membrane osmometry, and end group analysis, light scattering method for mol wt determination), Polymer fractionation methods, Gel permeation chromatography: Theory of separation, instrumentation and technique. Effect of molecular weight on the properties of polymers.

### BOOKS RECOMMENDED:

- Principles of Polymer Science : P. Bahadur & N. V. Sastry, Narosa.
- Polymer Science – Gowarikar et al New Ages International
- Seymour/Carraher's Polymer Chemistry Charles E. Carraher Jr Marcel Dekker
- Textbook of Polymer Science, J. W. Billmeyer, John Wiley & Sons.
- Physical Chemistry of Macromolecules, C. Tanford, John Wiley & Sons.
- Macromolecules in Solution, H. Morowitz, Interscience Publ.
- Introduction to Polymer, R. J. Young, Chapman & Hall.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**  
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**Total Periods: 45**

**SEMESTER – IV**  
**(POLYMER CHEMISTRY – Special paper 2)**

**UNIT-I: POLYMER SOLUTION BEHAVIOUR (15 Periods)**

Criteria for polymer solubility, Polymer texture and solubility, Dissolution and swelling of polymers. Factors affecting swelling and dissolution, Effect of molecular weight and degree of crystallinity on dissolution, Size and shape of polymer molecules in solution, Thermodynamics aspects of polymer dissolution, cohesive energy density, Solubility parameter and its uses and determination. Thermodynamics of polymer solutions, Enthalpy of mixing, Entropy of mixing. Flory-Huggins theory, Excluded volume effect and Flory interaction parameter and determination. Unperturbed dimensions of polymer coil, Good/poor/theta and nonsolvents, Viscosity of polymer solutions and the size of polymer coil, Effect of mol.wt. on viscosity, determination of intrinsic viscosity in theta conditions.

Concentrated polymer solutions and physical gelation, Newtonian & Non-Newtonian solutions; Bingham plastics, pseudoplastics & dilatants materials under shearing force.

Phase equilibria and phase separations in polymer solutions and their technological applications, Adsorption of polymers from solution vis-à-vis colloid stability

**UNIT-II: POLYMER PROPERTIES and PROCESSING (15 Periods)**

**(a) Fibres, elastomers , plastics, and adhesives:** Types, characteristic features and different types of mechanical/thermal/elastic/electrical behavior, Stress-strain curves, Effect of different factors on mechanical behavior, Effect of molecular weight and cross-link density, Effect of crystallinity, Effect of fillers, Effect of tacticity and effect of plasticization, Electrical behavior of polar and non-polar polymers, Viscoelasticity- Kelvin model and Voigt-Maxwell model, Properties of rubbers on cold drawing, Stretched and Vulcanized.

**(b) Polymer additives:** Antioxidants, Thermal stabilizers, UV stabilizers, Antistats, Colorants (organic dyes and pigments, inorganic pigments), Flame retardants, Curing agents, Blowing agents, Impact modifiers, Lubricants, Plasticizers, Preservatives, Processing aids, Fillers. Reinforcement: Their function and examples

**(c) Processing methods:** Extrusion, injection moulding, thermoforming, calendaring, compression moulding, blow molding, processing of elastomers and fibres.

### **UNIT-III: SPECIALIZED POLYMERS**

**(15 Periods)**

Conducting polymers, Ionomers and Polyelectrolytes, Telechelic polymers, Interpenetrating network polymers, Dendrimers, Block copolymers, Graft copolymers, Thermoplastic elastomers, Polyblends, Thermally stable polymers, High performance polymers, Inorganic polymers, Stimuli responsive polymers, Polymer composites and nanocomposites, Biomedical polymers, Liquid Crystalline Polymers, Polymer hydrogels and Natural polymers.

### **BOOKS RECOMMENDED:**

- Principles of Polymer Science : P. Bahadur & N. V. Sastry, Narosa.
- Polymer Science – Gowariker et al New Ages International
- Seymour/Carraher's Polymer Chemistry Charles E. Carraher Jr Marcel Dekker
- Textbook of Polymer Science, J. W. Billmeyer, John Wiley & Sons.
- Physical Chemistry of Macromolecules, C. Tanford, John Wiley & Sons.
- Macromolecules in Solution, H. Morowitz, Interscience Publ.
- Introduction to Polymer, R. J. Young, Chapman & Hall.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**  
**M.Sc. (REGULAR) SEMESTER-III**  
**TO COME IN FORCE FROM JUNE-2011 (REVISED IN B O S Dated 18-01-2011)**  
**PRACTICALS IN PHYSICAL CHEMISTRY**

**Max. Marks: 200 (EX-140 + INT-60)**

**Note:**

*First two days in practical classes will be on general instructions about the laboratory practices:*

*Students should know about the material safety data sheets (MSDS), handling of reagents, safety and measures in the laboratory Information provided on the labels of reagent bottles, Catalogues of chemical and glassware manufacturing companies.*

*Students must be aware of analytical balances, technique of weighing, cleansing and calibration of glass ware, making solutions in different concentration units and their calibration. Laboratory note book and recording of data, error in data and its treatment. Report writing and presentation.*

*Students are also expected to know fullest use of a scientific calculator. Computer should be used in experiments involving extensive calculations and graphs*

FULL	PRACTICAL AIM
1	Determination of the primary salt effect on the kinetics of ionic reactions (Persulphate-iodide reaction).
2	Determination of CMC of surfactant by conductance method and calculate thermodynamic parameters for micellization
3	Determine the effect of salts on the cloud point of nonionic surfactant.
4	Preparation of simple colloids and determination flocculation value for different salts.
5	Determination of constants of Mark-Houwink equation by viscosity method
6	Synthesis of Phenol Formaldehyde Resin
7	Synthesis of Thiokol rubber
8	To determine the $\text{Ca}^{+2}$ , $\text{Mg}^{+2}$ and $\text{Fe}^{+2}$ content in a sample of dolomite ore.
HALF	
9	Determination of dissociation constant of a dibasic acid pH-metrically
10	Study the ratio of complex formation formed by titration of $\text{Zn}^{2+}$ with potassium ferrocyanide potentiometrically.
11	Electrogravimetric determination of copper from solution
12	Equivalence conductance of solutions of strong electrolytes and weak electrolytes. Application of Kohlrausch's law. Onsager constant.
13	To determine the COD value using KHP by conventional method.
14	$[\text{K}_a]$ of weak organic acid [benzoic acid] conductometrically.

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**  
**M.Sc. (REGULAR) SEMESTER- IV**  
**TO COME IN FORCE FROM JUNE-2011 (REVISED IN B O S Dated 18-01-2011)**  
**PRACTICALS IN PHYSICAL CHEMISTRY**

**Max. Marks: 200 (EX-140 + INT-60)**

**Note:**

*First two days in practical classes will be on general instructions about the laboratory practices:*

*Students should know about the material safety data sheets (MSDS), handling of reagents, safety and measures in the laboratory Information provided on the labels of reagent bottles, Catalogues of chemical and glassware manufacturing companies.*

*Students must be aware of analytical balances, technique of weighing, cleansing and calibration of glass ware, making solutions in different concentration units and their calibration. Laboratory note book and recording of data, error in data and its treatment. Report writing and presentation.*

*Students are also expected to know fullest use of a scientific calculator. Computer should be used in experiments involving extensive calculations and graphs*

<b>FULL</b>	<b>PRACTICAL AIM</b>
1	Determination of the primary salt effect on the kinetics of ionic reactions (Persulphate-iodide reaction) by isolation method.
2	To calculate the surface area of adsorbed molecule in a monolayer, CMC, efficiency, effectiveness from surface tension measurements of aqueous solutions of surfactant.
3	Determinations of pK value of acid-base Methyl red indicator by spectrophotometry.
4	Determination of $R_f$ value of amino acid in the given mixture by technique of ascending paper chromatography and identify amino acids by their $R_f$ values.
5	To carryout fractionation of a polydispersed polymer by viscosity method
6	Grafting of acrylamide on PVA.
7	Ion exchange separation of $Fe^{+3}$ and $Co^{+2}$ and determination of $Fe^{+3}$ spectrophotometrically.
8	To determine the %purity of aspirin sample and analgin tablet
<b>HALF</b>	
9	Determination of rate constant, order of reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.
10	Spectrophotometric determination of - Cobalt and Chromium.
11	Photometric titration of iron-EDTA.
12	Determination of dissociation constant of a polybasic acid pH-metrically
13	To determine the degree of hydrolysis and hydrolysis constant for the hydrolysis of aniline hydrochloride by conductance method.
14	Determination of $Ca^{+2}$ and $Cu^{+2}$ in a mixture using EDTA titration spectrophotometrically.

### **Books Suggested for Practicals:**

- 1] Findley's Practical Physical Chemistry, B. P. Levitt, Longman.
- 2] Practical Physical Chemistry, A. M. James and F. E. Prichard, Longman.
- 3] Experimental Physical Chemistry, R. C. Das and B. Behra, Tata McGraw Hill.
- 4] Advanced Physical Chemistry Experiments, Gurtu-Gurtu, Pragati Prakashan.
- 5] Experimental Physical Chemistry, V. D. Athawale and Parul Mathur, New Age Int
- 6] Advanced Practical Physical Chemistry, J. B. Yadav, Goel Pub. House.
- 7] Experiments in Physical Chemistry, Dr. D. V. Jahagirdar.
- 8] Systematic Experimental Physical Chemistry, Dr. T. K. Chondhekar & S. W. Rajbhoj.
- 9] Experiments in Physical Chemistry, D. P. Shoemaker.