VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

PAPER-I

CHEMISTRY (INORGANIC)

JUNE-2002

Max. Marks: 100 (External 70 + Internal 30) Total periods: 120

SECTION – I

(Periods)

UNIT-I : PHYSICAL METHODS IN INORGANIC CHEMISTRY: (20)

Introduction, theory, instrumentation and application for structural illustration of compound, with reference to:

(i) Nuclear Magnetic Resonance Spectroscopy
(ii) Electron Spin Resonance Spectroscopy
(iii) Vibrational and Rotational Spectroscopy

UNIT-II : INORGANIC CHAINS, RINGS, CAGES & CLUSTERS: (20)

Chains:

Catenation, heterocatenation, isopolyanions, heteropolyanions.

Rings:

Borazines, phosphonitrilic compounds, heterocyclic inorganic rings, homocyclic inorganic rings.

Cages:

Non-metallic cage structures, phosphorous cage molecules, carboranes, metallocene carboranes.

Metal Clusters:

Metal-metal bonds, binuclear clusters, trinuclear clusters, octahedral clusters, octahedral clusters, metal sheets.

UNIT-III : CHEMISTRY OF NON-AQUEOUS SOLVENTS: (20)

Lewis Acid-base interaction in polar non-aqueous solvents:

(i) Introduction, characters, a coordination model, correlation of chemical reactions.

(ii) Liquid Ammonia:

Structure and physical properties, Solubility relationships, Reactions of elements of - (a) compounds of alkali and alkaline earth metals, (b) transition metal compounds.

(iii) Hydrogen fluoride:

Structure, physical properties, hydrogen fluoride as a protonating agents, hydrogen fluoride as a fluorinating agent, hydrogen fluoride as a medium for reactions.

(iv) Metal solutions in non-aqueous solvents:

Introduction, solubilities and phase diagram, dilute solutions, solutions of intermediate concentrations.

SECTION – II

UNIT-IV : CHEMISTRY OF NON-METALS: (20)

Compounds of Noble Gases:

Binary xenone fluorides, Xenone complexes, Oxyfluorides and Oxyacids, Krypton compounds.

(i) Pseudohalogens:

Cyanogen, Oxycyanogen, thiocyanogen, sellenocyanogen, azidocarbon disulphido, Azides, Polyhalogenoids.

(ii) Graphite and its compounds:

Crystal, graphite oxide, alkali metal compounds, graphite salts..

(iii) Synthetic reactions of high temperature.

UNIT-V : ORGANOMETALLIC COMPOUNDS AND HOMOGENEOUS CATALYSIS : (20)

(I) Organometallic Compounds:

Chemistry of transition metals, Synthesis, Structure and bonding, Reactions of Ferrocene like molecules, organometallic reagents in organic synthesis.

(ii) Catalysis:

Introduction, definition, classification, homogeneous catalysis by soluble metal complexes, hydrogenation of unsaturated compounds, hydroformylation, Wacker process, Zingler-Natta catalyst.

UNIT-VI : PHOTOCHEMISTRY: (20)

(i) Introduction, photochemical laws and photochemical kinetics.
(ii) Photophysical processes.
(iii) Cis-trans isomerism.
(iv) Photochemical reactions: Transition metal complexes : Cr(III) and Co(III) complexes and selection rules.

REFERENCES:

1. Text-book of Quantitative Inorganic Analysis, ELBS.
2. Principles of Instrumental Analysis, Skoog and Hart, Holt, Rinehart and Winston.
3. Instrumental Methods of Analysis, Dean and Merit, Affiliated Press.
4. Inorganic Chemistry, I. S. Butler and J. F. Harrod, Benzamine-Cumming Corp.
5. Concepts and Models of Inorganic Chemistry, B. Douglas, D. H. McDonald, J. J. Alexander, John Wiley & Sons.
6. Advance Inorganic Chemistry, F. A. Cotton and C. Willkinson, John Wiley & Sons.
7. Modern Aspects of Inorganic Chemistry, H. J. Emeleus and G. Sharpe, Routledge and Kegan Paul, 1973.
8. Inorganic Chemistry, A. Sharpe, ELBS, 2nd Edition, 1986.
9. The Chemistry of Non-aqueous Solvents, Vol. 1, 2, 3, J. J. Lagowski, Academic Press, 1967.
10. Modern Inorganic Chemistry, W. L. Jolly, McGraw-Hill Publication.
11. Instrumental Methods of Chemical Analysis, G. Chatwal and S. Anand, Himalaya Publication.
12. Organometallic Compounds, P. L. Pausan.
13. Theoretical Approach to Inorganic Chemistry, A. F. Williams, Springer-Verlag, Berlin, N.Y.
14. Molecular Spectroscopy, J. D. Craybeal, McGraw-Hill.
15. Spectroscopy of Inorganic Compounds, C.N.R. Rao and Ferrare, Academic Press.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

PAPER-II

CHEMISTRY (INORGANIC)

Max. Marks: 100 (External 70 + Internal 30) Total periods: 120

SECTION – I

(Periods)

UNIT-I : (20)

Environmental Chemistry:

Pollution : Introduction, definition, classification.

Air Pollution:

Primary pollutants, sources, concentrations effects and control, with reference to:

(i) Carbon monoxide, (ii) Nitrogen oxides, (iii) Hydrocarbons, (iv) Sulfur oxides, (v) Particulate matter.

Water Pollution:

(i) Types of water pollutions – physical, chemical, biological.
(ii) Industrial waste waters, their pollutants, and removal of (a) ammonia, (b) iron, (c) manganese, (d) soluble organic materials.
(iii) Characteristics and treatment to waste water effluents from (a) textile, (b) petroleum refineries.
(iv) Toxid metals in industrial waste waters: (a) Lead, (b) Mercury, (c) Arsenic, (d) Cadmizem, (e) Chromium.

UNIT-II : BIOINORGANIC CHEMISTRY: (20)

(i) Biochemistry of – (a) Zinc, (b) Copper, (c) Cobalt, (d) Molybdenum.
(ii) Iron storage and transport compounds: Ferritm transferrin.
(iii) Electron transport proteins: Rubredoxin – isolation, structure, substitution of metal.
(iv) Bacterial iron transport.
(v) Nature of Heme-dioxygen binding.

UNIT-III : CERAMICS, REFRACTORIES GLASS: (20)

(i) Ceramics:

Introduction, defination, sub-division, properties, basic row materials, clays, properties of clays structural, clay products.

(ii) Refractories:

Introduction, classification properties – (a) Fire bricks: Manufacture, properties and uses, (b) High arumina: Properties and uses, (c) Super refractories: Manufacture properties and uses of carborudum and graphite.

(iii) Glass:

Introduction properties, characteristics, raw materials and some special glasses.

SECTION – II

UNIT-IV : INSTRUMENTAL TECHNIQUES:

(20)

(I) Thermal Methods:

(a) Thermogravimetry: Introduction, types, factors influencing, instrumentation, applications.
(b) Thermometric titrations: Introduction, theory instrumentation, applications.

(II) Atomic Absorption:

Introduction, principle, instrumentation, evaluation and application.

(III) Solvent Extraction:

Introduction, principles, extraction techniques factors, synergistic extraction and applications.

(v) Chromatographic Techniqus:

Introduction, classification paper chromatography, Thin-layer chromatography, column chromatography, Gas chromatography, ion-exchange chromatography with reference to theory, evaluation and applications only.

UNIT-V : FERTILIZERS:
(20)

(I) Soil fertility fertilizer grades, fillers complete fertilizers, elements required in plant nutrition.
(II) Mixed fertilizers: Higher analysis fertilizers, manufacture, chemical reactions involved, Ammoniation.
(III) Micronutrients: Introduction, defination functions, sources, deficiency symptoms, application methods with special reference to – (a) copper, (b) iron, (c) boron, (d) molybdenum, (e) zinc.
(IV) Hydroponics: Introduction, defination, techniques, nutrient solutions, water physical conditions, economic possibilities.
(V) Potassic fertilizers: Sources, production, two component fertilizers, Role of fertilizers in photosynthesis and respiration.

UNIT-VI : METALLIC CORROSION AND PREVENTION: (20)

(I) Introduction, definations, corrosion damages, corrosion rate expressions.
(II) Electrochemical aspects: Electrochemical reactions, polarization, passivity.
(II) Forms of corrosion: Uniform, galvanic, pitting, selective leaching, intergranular.
(IV) Prevention: Material selection, alteration of envirionment, coatings, metallic, organic, inorganic, cathodic protection, anodic protection.

REFERENCES:

1. Water Pollution, J. E. Jajic, Marcel-Dekker.
2. Air Pollution, H. W. Parker, Prentice-Hall.
3. Environmental Chemistry, A. K. De, Wiley Eastern Ltd.
4. Environmental Pollution, Indrajeet Sethi, M.S. Sothi, Commonwealth Publication, New Delhi.
5. Industrial Chemistry, B. K. Sharma, Goel Publication, Meerut.
6. Bioinorganic Chemistry, EI-ICHIRO OCHAI, Allyn & Bacon Inco.
7. Concepts and Models of Inorganic Chemistry, B. Douglas, D. H. McDaniel, J. J. Alexander, John Wiley & Sons.
8. Advanced Inorganic Chemistry, F. A. Cotton and G. Willkinson, John Wiley & Sons.
9. Inorganic Biochemistry Vol. 2, H.Q.O. Hill Royal Society of Chem., London.
10. Text-book of Inorganic Chemistry, P. L. Sen, S. Chand Company.
11. Advanced Inorg. Chemistry, Gurudeep Raj Chatwal & Mehra, Goel Publishing House.
12. Modern Inorganic Chemistry, J. J. Lagowski, Marcel & Dekker.
13. Instrumental Methods of Chemical Analysis, G. Chatwal, S. Anand, Himalaya Publishing House, Delhi.
14. Soil Fertility and Fertilizers, S. L. Tisdale, W. L. Nelson.
15. Soils and Fertilizers, F. E. Bear, John Wiley & Sons, 1952.
16. Soiless gardening, W. F. Gericke, Prentice Hall Inc.
17. Role of Potassium in Agriculture, V. J. Kllmer, S. E. Younts & N. C. Bredy, ASA Publication, USA, 1968.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

PAPER-I

CHEMISTRY (INORGANIC)

CO-ORDINATION CHEMISTRY

Max. Marks: 100 (External 70 + Internal 30) Total periods: 120

SECTION – I

UNIT-I : (20)

(A) Theory of Metal Ligand Bonding:

- Theoretical principles of crystal field theory.
- Crystal field theory of weak and strong field – (I) octahedral, (ii) tetrahedral, (iii) tetragonal, (iv) square-planar, and (v) penta-coordinated (trigonal bipyramidal and square pyramidal) complexes.
- Drawback of crystal field theory.
- Experimental evidences in support of metal-ligand overlap.
- Adjusted Crystal Field Theory (ACFT).

(B) Molecular Orbital Theory For Complex Ions:

- Introduction
- Construction of group or symmetry orbitals of the ligands in octahedral (with and without π-bond), tetrahedral and square planar complexes.
- Molecular orbital energy level diagrams and electronic configuration of M.O.'s.

UNIT-II : ELECTRONIC SPECTRAL PROPERTIES OF COMPLEXES: (20)

- Introduction
- Theoretical aspects of spectra of complexes.
- Crystal field strength.
- Crystal Field Terminology (R.S. coupling Hund's rule and ground level).
- Determination of function (n, l, ml, S, ms) corresponding to the terms 3F, 3P, 1G, 1D and 1S obtained from d^2 system in R.S. coupling.
- Strong and weak field approximations.
- Crystal field diagram for d^1 to d^n configuration.
- Orgel and Tanabe Suzano diagrams.
- Electronic transition selection rules.
- Selection rules and d-d transition in metal complexes.
- Charge transfer transitions (spectra).
- Intensities of spectral peak.
- Oscillator strength and band width.
- Spectrochemical and Naphelauretic series.
- Crystal field and related parameter of transition metal complexes.
- Electronic spectra of lanthanides and actinides (F-electron transition).
- Correlation diagram for d^2 and d^3 configurations.

UNIT-III : MAGNETIC PROPERTIES OF COMPLESES: (20)

- Introduction
- Types of magnetic bodies
- Source of paramagnetism
- Diamagnetism and Pascal's constants
- Experimental techniques
- Magnetic susceptibility measurements experiments by Gouy and Faraday methods.
- Calculation of magnetic moment from experimental data.
- Thermal energh and magnetic property.
- Magnetic moments with different multiplate width.
- Magnetic properties of free ions.
- Ligand field, orbital contributions.
- Orbital contribution in complexes of stereochemistry other than octahedral.
- Van Vleck equation.
- Spin orbit coupling on A, E and T terms.
- Spin pairing, some aspects of spin pairing and cross over region.
- Variation of susceptibility with temperature.
- Antiferromagnetism and ferromagnetism.
- Types of antiferromagnetism.
- Exchange pathways.
- Quantitative treatment of antiferromagnetism.
- Examples of antiferromagnetic binuclear complexes.

SECTION – II

UNIT-IV : COMPLEX EQUILIBRIA: (20)

Introduction

- Stability of complexion solution, stepwise stability constants.
- Computation of stability constants from equilibria data.
- Basic principles.
- Mathematic functions and their interrelationship.
- Determination of stability constants of complex by experimental methods such as – (I) Spectroscopic method, (ii) Potentiometric method (pH-meter Irving-Rossotti method), (iii) Polarographic method.
- Factors affecting stability of complexes.
- Determination of thermodynamics functions e.g. ΔG, ΔH and ΔS.

UNIT-V : REACTION MECHANISM IN METAL COMPLEXES: (20)

- Octahedral substitution: The nature of substitution reaction, theoretical approach to substitution mechanism nucleophilic -–reactivity, nature of central atom, kinetic application of crystal field theory, substitution of Co(III) complexes, replacement of coordinated water, acid catalysis.

- Stereochemical changes in octahedral complex: molecular rearrangement in complexes – Reaction of geometrical and optical isomers – isomerization and recemization of octahedral complex – Ligand stereospecificity.

- Substitution reaction of square planar complexes:

  - Trans effect and its theories.
  - Mechanism of substitution of platinum(II) complexes.

- Electron transfer reactions (oxidation-reduction reaction) : Outer sphere and inner sphere electron transfer reaction mechanism.

- Experimental technique and interpretation of data.

UNIT-VI : STEREOCHEMISTRY OF COORDINATION COMPOUNDS: (20)

Stereochemistry of unusual co-ordination number.

REFERENCE BOOKS:

Unit-I:

1. Inorganic Chemistry (Principles of Structure and Coordination Compounds), J. E. Hathecy, Harper and Row International Series, New York (1983).
2. Coordination Compounds, S.F.A. Kettles, Nelson.
3. Advanced Inorganic Chemistry (V Edition), F. A. Cotton and G. Wilkinson, Interscience, New York (1988).
4. Theoretical Inorganic Chemistry (New Edition), M. C. Day and J. Selbin, East-West Press.
5. A Modern Inorganic Chemistry, Moeller, Wiley-Interscience.

Unit-II:

1. Inorganic Electronic Spectroscopy (2^{nd} edition), A.B.P. Lever, Elsevier, Amsterdam (1984).
2. Introduction to Ligand Field, B.N. Figgis, Interscience, New York (1966).
3. Physical Methods in Inorganic Chemistry (Both Edition), R. S. Drago, W. B. Saunders, Philadelphia (1977).
4. Introduction to Ligand Field Theory, C. G. Ballhenson, McGraw-Hill, New York (1962).

Unit-III:

1. Elements of Magnetochemistry, R. L. Datta & A. Syamal, Affiliated East-West Press Pvt. Ltd., New Delhi (1993).
2. Magnetochemistry, R. L. Karlin, Springer-Verlag, New York (1993).
3. Introduction to Magnetochemistry, A. Earnshaw, Academic Press, New York (1968).
4. Magnetism and Transition Metal Complexes, F. E. Mabbs & D. J. Machin, Chapman and Hall, London (1973).

Unit-IV:

1. Determination of Stability Constants, Rossotti and Rossotti, McGraw-Hill.
2. Chemistry of Complex Equilibria, M. T. Beek.
3. Instability Constants of Complexes Compounds, Yatisimiraskii and Vasile, Consult and Bul.
4. Chemistry of Metal Chelate Compounds, Martell and Calvin, Prentice-Hall, Inc., Eaglewood Cliffs, N. J.

Unit-V:

1. Inorganic Reaction Mechanism, Basellow and Pearson, Wiley Eastern Ltd., New Delhi (1977).
2. Kinetics and Mechanism, A. A. Frost and R. G. Pearson, Wiley, New York, 1953, 1961.
3. Inorganic Reaction Mechanism, S. K. Skyes.
4. Electron Transfer Reaction, H. Taube, Academic Press.
5. Modern Inorganic Chemistry, J. Lewis and R. G. Wilkinson, Interscience, New York.

Unit-VI:

1. Inorganic Chemistry, J. E. Huheey, Harper and Raw, New Delhi (1983).
2. A Modern Inorganic Chemistry, Moeller, Wiley Interscience.
3. Stereochemistry of Coordination Compounds.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

PAPER-III

CHEMISTRY (INORGANIC)

(CORROSION CHEMISTRY)

Max. Marks: 100 (External 70 + Internal 30) Total periods: 120

SECTION – I

UNIT-I : THEORIES OF CORROSION: (20)

Definitions, Acid, Colloidal and Peroxide theories, Thermodynamics of Corrosion reactions, Electrochemical theory, Electrode kinetics, Exchange current density, Activation, Concentration and combined polarisation, mixed electrodes – A metal in contact with a single redox system, a metal in acid solutions containing oxidizers.

UNIT-II : COMMON TYPES OF CORROSION: (20)

Localized Corrsion:

Pitting, Crevice Corrosion, Filiform Corrosion, Impingement attack, Fretting stress corrosion.

Bimetallic Corrosion:

General theory, in aqueous solution in corrosive atmospheres, protective measures.

Atmospheric Corrosion:

Classification, Composition of atmosphere, atmospheric contaminents other atmospheric variables, Electrochemistry of atmosheric corrosion, Corrosion of plastics and elastomers.

UNIT-III : PASSIVITY: (20)

Introduction, definations, theories of passivity, characteristics of passivation Flade potential, behaviour of passivators, passivation of iron by nitric acid, Anodic protection, trans passivity, passivity in alloys.

SECTION – II

UNIT-IV : OXIDATION AND TARNISH: (20)

Protective and non-protective scales, Equations of oxidation, Wagner theory of oxidation, Galvanic effects, Oxidation of – (I) Copper, (ii) Iron and Iron alloys, (iii) Oxidation resistant alloys, Catastronic oxidation.

UNIT-V : CORROSION TESTING: (20)

Classification, purposes, specimens, surface preparation, conventional methods, Electro-chemical techniques, Optical and radioactive techniques.

UNIT-VI : CORROSION PREVENTION: (20)

Material selection, Metal and alloys, metal purification, non-metallics, Alteration of Encirenment – Inhibitors, Protective coatings : Metallic coatings, Protection : Organic and inorganic cathodic and anodic protection.

REFERENCES:

1. Corrosion and Corrosion Control, H. H. Uhlig, John Wiley.
2. Corrosion Engineering, M. G. Fontana and N. D. Green, McGraw-Hill.
3. Basic Corrosion Course, NACE, NACE Publication.
4. Corrosion, Vol. 1 and 2, L. L. Sheier, Newens Butterworths.
5. Corrosion Testing Procedures, F. A. Champion.
6. Corrosion Testing Procedures, J. H. Ailor, Electrochem. Soc., Inc., Princetion.
7. Dhatvik Ksharan, Vo. 1 and 2, M. N. Desai, Univ. Granth Nirman Board, Gujarat.
8. Metallic Corrosion Passivity and Prevention, U. R. Evans, Longmans and Green.
9. Corrosion Hand-Book, H. H. Uhlig, John Wiley.
10. Corrosion Inhibitors, R. H. Hausler, NACE Publication.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

PAPER-I

CHEMISTRY (ORGANIC)

(Theoretical and Natural Organic Chemistry)

Max. Marks: 100 (External 70 + Internal 30) Total periods: 120

SECTION – I

UNIT-I : (20)

(A) NATURAL PIGMENTS:

Porphyrins:

Structure, Spectral properties and Synthesis.

Haemoglobin, Chlorophyll and Bilirubin:

(Their structure)

General and structure determination (no synthesis), Synthesis of cryptopyrrole, Phylopyrrole, Opsopyrrole and Haemopyrrole and their carboxylic acid derivatives.

(B) ALKALOIDS:

Structure of Morphine, Reserpine, Colchicine, Strychnine, L.S.D. (Analytical evidence only) and their biogenesis and physiological properties.

UNIT-II : STEROIDS: (20)

Introduction, Sterols ; Structures of cholesterol and ergosterol (No synthesis), Biosynthesis of sterols, Stereochemistry of steroids, Bile acids general and structure, Sex hormones : Androgens, Oestrogens and Gestogens, their structure and synthesis and biochemical role – Adrenocortical hormones, Partial synthesis of cortisone.

UNIT-III : VITAMINS: (20)

Introduction, Structure, Synthesis and biochemical functions of Vitamin A_1, A_2, Vitamins B_1, B_2, Biotins, Vitamin D_1, D_2 and D_3, Vitamin E – Tocopnerols, Vitamin K group, Biochemical importance of Vitamin B_{12}.

SECTION – II

UNIT-IV : ORGANIC SYNTHESIS: (20)

(a) Multistep Synthesis:

Need of protecting groups – Hydroxy protective groups – Amino protective groups – Carbonyl protective groups – Carboxylic acid protective groups – Synthetic equivalent groups – Synthetic analysis and planning – Control of stereochemistry.

(b) Introduction of functional groups by nucleophilic substitution:

- General solvent effects, Use of crown-ethers and phase transfer catalysis in organic synthesis.

- Introduction of azide group, phosphorous nucleophile and sulfur nucleophile.

REFERENCE:

Advanced Organic Chemistry by Carey and Sundberg (3rd ed.), Plenum press for (a) p.677 to 701, (b) p. 128 to 131, 136, 137 and illustrations from subsequent table.

UNIT-V : TERPENOIDS AND CAROTENOIDS: (20)

Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule.

Structure determination, stereochemistry, biosynthesis and synthesis of the following molecules:

Menthol, Farnesol, Zingiberene, Cadinene, Santonin, Phytol, Abietic acid, Squalene and Eudesmol.

UNIT-VI : OXIDATION AND REDUCTION: (20)

(a) Oxidation with Cr(VI), Mn(VII), Mn(IV), OsO_4, Peroxidic reagents – Cleavage of ethylenic d-bonds – Cleavage of glycols (with mechanism).

(b) Reduction of carbonyl and other functional groups:

Reduction of carbonyl group with $LiAlH_4$, $NaBH_4$ (with mechanism) – The Shapiro Reaction, mechanism and applications – The Birch reduction of aromatic rings
Mechanism and applications.

REFERENCE:

Advanced Organic Chemistry, Carey & Sundberg (3rd ed.), Part-B, Chapter-5, 12.

GENERAL REFERENCES:

1. Organic Chemistry, Vol. I & II (Sixth edition), I. L. Finar.
2. Chemistry of Organic Natural Products, Vol. I & II, O. P. Agrawal.
3. Organic Chemistry of Natural Products, Vol. I & II, Chatwal.
4. Chemistry of Vitamins – S. F. Dyke.
5. Protective Groups in Organic Synthesis (Second edition), Theodora W. Greene, Peter G. M. Wuts (A Wiley Interscience Publication).
6. Advanced Organic Chemistry (3rd ed.) by Carey & Sundberg (Part A & B), Plenum Press.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

PAPER-II

CHEMISTRY (ORGANIC)

(Industrial Chemicals and Industrial Analysis)

Max. Marks: 100 (External 70 + Internal 30) Total periods: 120

SECTION – I

UNIT-I : UNIT PROCESSES IN ORGANIC CHEMISTRY: (20)

(A) Nitration, Sulfonation, Halogenation, Hydroxylation, Amination and Alkylation Methods, and Industrial Chemicals derived from Benzene, Naphthalene and Anthracene using these processes.

(B) Study of few classes of dyes:

Azoic – Disperse and Reactive dyes.

UNIT-II : PETROLEUM AND POLYMERS: (20)

(A) Petroleum Industry:

Refining processes – Manufacturing of petrochemicals from C_1, C_2, C_3, C_4 cuts and aromatics (Outline and review).

(B) Polymer Industry:

Techniques of polymerization, Industrial manufacture and uses of polyolefins, PVC, polyesters, polyvinyl chloride, Polyacrylates, Elastomers, Polyethylene Terphthalate (PET).

UNIT-III : MANUFACTURE AND USES OF IMPORTANT CHEMICALS: (20)

(A) Agrochemicals:

DDT, Gammaxene, Alarin, Malathion, 2-4D, Heptachlor.

(B) Explosives:

Cellulose nitrate, Pentaerythritol tetranitrate (PETN), TNT, Trinitroglycerine and dynamite, RDX, Pentryl, Dinol.

(C) Synthetic Detergent:

Classification, preparation and uses.

(D) Chemicals used in perfumery:

Muscone, Civatone, Nitro masks, Vanillin, Diphenyl ether, Constituents of perfume.

(E) Manufacture of antibiotics, citric acid, Vit. C, Power alcohol by fermentation process.

SECTION – II

UNIT-IV : SPECTROSCOPY: (20)

(a) UV-Visible Spectrophotometry:

Review of different electronic transition, Woodward's rules for α,β-unsaturated ketones, Diene systems, Effect of solvent on absorption bands – Elementary idea of double beam automatic recording, Spectrophotometer.

(b) IR Spectrophotometry:

Spectrophotometer – Components of IR spectrophotometer – Sample handling – Calibration of wavelength – Interpretation of IR spectra using correlation charts – Study of few representative spectra, n-hexane, 2-methyl petane, n-hexyl amine, n-butyl methyl ether, butyramide, n-hexanol, acetophenone, n-butyl-acetate, ethyl benzoate, n-hexanoic acid, benzoic acid, phenol, Effect of H-bonding on absorption bands – Elementary idea about FT-IR spectrophotometer.

(c) NMR Spectroscopy:

Review of theory, Chemical shift, Reference and solvents used – Elementary idea about NMR spectrometer – Spin-spin coupling – Magnetic anisotropy – Chemical equivalence, Magnetic equivalence – Structure elucidation from NMR spectra – Study of NMR spectra of some illustrative compounds.

(d) Mass Spectrometry:

Principle of mass spectra – Parent peak – Net stable ions – Base peak – Isotope effect of arrive at correct molecular formula – Fragmentation rules – McLafferly rearrangement – Use of mass spectra to elucidate structure of organic compounds – Mass spectra of some illustrative compounds (Problems covering all above techniques).

Reference:

(1) Spectrometric Identification of Organic Compounds (4^{th} edition/5^{th} edition), Silverstein, Bassler & Morril, John Wiley & Sons.

(2) Modern Methods of Chemical Analysis (2^{nd} ed.), Pecsok, Shields, Cairns & McWilliom, John Wiley & Sons.

UNIT-V : SEPARATION TECHNIQUES: (20)

(a) Gas Chromatography:

Selection of mobile phase – Selection of stationary phase in GLC and GSC – Detectors : FID (with modifications), TCD and ECD, Their comparison, Packed column, WCOT, SCOT (advantages and disadvantages) –Temperature programming – Derivatisation in GC – Quantitative Analysis.

(b) High Performance Liquid Chromatography:

Review of components of Instrument – Criteria in selection of mobile phase – Stationary phases including bonded phase supports used in LSC and LLC – Normal phase and Reversed phase chromatography – Isocratic and Gradient Elution – Detectors : UV absorption and RI detector – Method of introducing sample.

(c) Thin-Layer Chromatography:

Selection of stationary and mobile phase – Detection techniques – Elementary idea of HPTLC.

References:

(1) Instrumental Analysis by R. D. Braun, McGraw-Hill.

(2) Modern Methods of Chemical Analysis (2^{nd} ed.), Pecsok, Shields, Cairns & McWilliom, John Wiley & Sons.

UNIT-VI : POLLUTION TESTING AND EFFLUENT TREATMENT: (20)

(A) Environmental chemistry: Introduction, Aquatic pollution – Inorganic, Organic, Pesticide, Agricultural, Industrial and Sewage, Detergents, Oil spills and Oil pollutants.

Water quality parameters – dissolved oxygen, biochemical oxygen demand. Analytical methods for measuring DO, BOD and COD. Purification and treatment of water.

(B) Chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S, O and their effect. Analytical methods for measuring air pollutants.

(C) Industrial pollution of sugar, Distillary drug, Paper and pulp and polymer industries and their analysis. Effluent treatment plants of above industries..

General References:

(1) Unit process in Organic Synthesis by P. M. Groggins.

(2) Chemical Process Industries by R. N. Shreve.

(3) Riegel's Hand-Book of Industrial Chemistry, Ed. by James A. Kent.

(4) Industrial Chemicals by Faith, Keyes, Clark.

(5) Chemicals from petroleum by Weddams.

(6) Dryden's outlines of Chemical Technology by M. Gopal Rao and Marshall.

(7) Rubber Technology by Maurice, Norton.

(8) Organic Polymer Chemistry by K. J. Saunders.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

PAPER-III

CHEMISTRY (ORGANIC)

(Dyes and Intermediates)

Max. Marks: 100 (External 70 + Internal 30) Total periods: 120

SECTION – I

UNIT-I : THEORIES OF COLOUR: (20)

(a) Colour and Chemical Constitution:

Theories of colour – Bathochromic and hypsochromic effect – Hyperchromic and Hypochromic effect – Witt's theory – Armstrong's theory – Nietzki's theory – Resonance theory – M.O. theory.

(b) Colour Science:

Subjective colour attributes – Hue, Lightness and Chroma (or saturation) – Objective colour measurements – CIE Illuminant sources, CIE standard observer, reflection spectra of object – CIE tristimulus values of colour – Chromaticity diagram and coordinates – Correlation with visual perception of colour dimetamerism – CIELAB colour and colour difference tolerance limit, shade sorting, Additive and substractive colour mixing – Kubelka-Munk theory (conceptual introduction and useful equation only – No derivation), K-M function – K-M absorption and scattering coefficient – Dye strength evaluation – Colour control system – Outline of construction and working of spectrophotometer – Conceptual introduction of computer colour matching (no theory).

REFERENCES:

(1) Instrumental colour measurement and computer aided colour matching for textiles by H.S. Shah and R. S. Gandhi, Pub. Mahajan Book Distributors, (1990), Ahmedabad.

(2) Industrial practice in colour measurements by H. S. Shah, (1998), Pub. Mahajan Publishers Pvt. Ltd., Ahmedabad.

(3) Principles of Colour Technology by Fred W. Billmeyer and Max Saltzman, John Wiley & Sons.

UNIT-II : (20)

(a) Azo dyes – General (Diazotisation, mechanism and different methods of diazotization and laws of coupling), Monoazo, bisazo dyes, azoid dyes.

(b) Classification and methods of application of dyes. Evaluation of dyes.

UNIT-III : ANTHRAQUINONE DYES: (20)

Vat dyes, acid dyes, solubilized vat dyes, mordant dyes and for cellulose Acetate.

SECTION – II

UNIT-IV : **(20)**

(a) Heterocyclic Dyes:

Pyrazolone dyes, cyanine dyes, dyes containing azine, oxazine and thiazine ring systems. Thiazole dyes.

(b) Fluorescent Whitening Agents:

Theory of fluorescence – Classification of FWA and synthesis of important member of each class.

UNIT-V : **(20)**

General nature, classification, structural variation, synthesis and application of fibres of the following classes of dyes:

(i) Reactive dyes
(ii) Cationic dyes and synthetic fibres
(iii) Triphenylmethane dyes
(iv) Dyes for non-textile uses

UNIT-VI : **(20)**

General nature, classification, structural variation, synthesis and application of fibres of the following classes of dyes:

(i) Disperse dyes
(ii) Indigo and Thio-indigoid dyes
(iii) Sulphur dyes
(iv) Pigments – Different classes of organic pigments and synthesis

REFERENCE BOOKS:

(1) The Chemistry of Synthetic Dyes, Vol. I to VII by Venkataraman, Academic Press, New York.

(2) Chemistry of Synthetic Dyes & Pigments by Lubs.

(3) Dyes and their intermediates by E. N. Abrahart.

(4) Technology of Textile Processing by V. A. Shehnai, Sevak Publications, Bombay.

(5) Unit Process in Organics Synthesis by R. H. Groggins.

(6) Chemical Process Industries by R. N. Shreve.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

PAPER-III

CHEMISTRY (ORGANIC)

(DRUGS)

Medicinal Chemistry as a Special Paper

Total Marks: 100 (External-70 + Internal-30) Total Periods: 120

General classification, structural variations, synthesis and medicinal uses of the following classes of drugs.

[**Note:** In topic 'Antibiotics' of Unit-II, discuss structural variations among penicillins and cephalosporins (beta-lactam antibiotics) and Tetrayclines (non-lactam antibiotics). In other cases of non-lactam antibiotics give structural formula and discuss medicinal importance only of antibiotics specified in syllabus].

In addition to the above structure, Activity Relationships and Mode of Action should be discussed in classes wherever it is mentioned.

As topics 'A', 'B' and 'C' of Unit-I are on 'Drug Design', pharmacokinetics and pharmaco-dynamics respectively, whatever are mentioned in the topics itself only should be discussed.

SECTION – I

(Hrs.)

UNIT-I : (20)

(A) Drug Design:

Procedure followed in drug design, concepts of prodrugs and soft drugs, Theories of drug activity : Occupation theory, rate theory, induced fit theory. Quantitative structure activity relationship. History and development of QSAR. Concepts of drug receptors. Elementary treatment of drug receptor interactions.
LD-50, ED-50.

(B) Pharmacokinetics:

Introduction of drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetics parameters in defining drug disposition and in therapeutics. Mention of uses of pharmacokinetics in drug development process (5 hrs.).

(C) Pharmacodynamics:

Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry (6 hrs.).

(Hrs.)

UNIT-II : ANTIBIOTICS: (20)

- Antibiotics that interfere with the biosynthesis of bacterial cell-wall.

(1) The β-lactam antibiotics:

(a) The Penicillin
(b) The Cephalosporins

(2) The non-lactam antibiotics:
(3) Bacitracin, Vancomycin and Cycloserine

- Antibiotics that interfere with the protein biosynthesis in micro-organisms:

(1) The non-lactam antibiotics:

(a) Macrolide antibiotics: Erythromycin
(b) Tetracyclines
(c) Lincomycin
(d) Chloramphenocol

- Structural formulae and therapeutic uses of following non-lactam antibiotics:

(a) Aminoglycoside antibiotics

(b) Non-classifiable antibiotics

Novobiocin, Nalidixic acid, Norfloxacin, Ciprofloxacin

- Structure activity relationships (SAR) among Penicillin and Tetracyclines.

- Synthesis of Penicillin V, Ampicillin, Cephalosporin, Chloramphenicol

UNIT-III :

(A) **Psychoactive Drugs – The Chemotherapy of Mind: (10 Hrs.)**

- CNS Depressants:

(1) General anaesthetics
(2) Sedatives and Hypnotics
(3) Antianxiety drugs

Mode of action of Hypnotics

- Antipsychotic Drugs:

(1) Antidepressants (2) The neuroleptics

- Synthesis of only the following:

Thiphental (pentothal), Amobarbital (Amytal), Diazepam, Chlorazepam, alprazolam, glutethimide, Nikethamide

(Hrs.)

(B) Local Anaesthetics: (6)

Synthesis of only the following drugs:

Cocaine, Procaine, Lidocaine (xylocaine), Dibucaine (Nupercaine), SAR and Mode of Action of Local anaesthetic

(C) Analgesics: (4)

Synthesis of only the following:

Meperidine (Pethidine), Ibuprofen, Meclofenamate sodium, Oxyphenbutazone, Paracetamol, Novalgin.

SECTION – II

UNIT-IV : Local Antiinfective Drugs:

(A) Antituberculosis and Antileprotic Agents: (5)

* Synthesis of only the following drugs:

Isoniazid (INH), Ethionamide, Ethambutol, DDS (Dapsone)

(B) Sulfonamides: (7)

Synthesis of only the followings:
Sulfacetamide, Sulfadiazine, Sulfamethoxine (Sufadoxine), Sulfamethoxy-Pyrazine (Sulfalene), Sulfathiazole, Succinyl sulfathiazole (Sulfasuxidine).
SAR and Mode of Action of Sulfonamides.

(C) Antimalarials: (8)

Synthesis of only the followings:

Mefloquine, Chloroquine, Primaquine, Pyrimethamine (Daraprim) SAR and Mode of Action of Antimalarial drugs.

UNIT-V :

(A) Antineoplastic Agents (Cancer Chemotherapy): (7)

Synthesis of only the following drugs:

Mechlorethamine, Cyclophosphamide, Melphalan, 6-Mercaptopyrine.

(B) Antihistamine or Antiallergenic Drugs: (6)

Synthesis of only the following drugs:

Diphenhydramine (Benadryl), Antazoline, Chlorpheniramine, Pyrilamine

(Hrs.)

(C) Diuretics: (7)

Synthesis of only the following drugs:

Acetazolamide, Chlorothiazide, Hydroflumethiazide, Furosemide, Ethacrynic acid. Classification and Structural Variation of Diuretic drugs.

UNIV-VI :

(A) Insulin and Oral Hypoglycemic Agents: (7)
(Antidiabetic agents or drugs affecting sugar metabolism)

Synthesis of only the followings:

Tolbutamide, Chlorporpamide, Glibenclamide, Phenformin.

(B) Cardiovascular Drugs: (13)

(1) Cardiotonic steroids (Digitalis)
(2) Antiarrythmic agents
(3) Antianginal drugs

Synthesis of only the followings:

Amyl nitrate, Sorbitrate, Diltiazem, Verapamil, Methyldopa, Atenolol, Oxyprenolol.

Recommended Books:

1. Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1, 2, 3, 4,5, Edited by ManFred E. Wolff (John Wiley & Sons, inc., New York).
2. Principles of Medicinal Chemistry, Vol. I & II (5/e), by S. S. Kadam, K. R. Mahadik, K. G. Bothra (Nirali Prakashan).
3. Principles of Medicinal Chemistry by William O. Foye (ed.), Lea and Febiyer, Philadelphia.
4. Wilson and Gisvold's Text-book of Organic Medicinal and Pharmaceutical Chemistry (5/e, 1982) by Robert F. Doerge (J. B. Lippincott Company, Philadelphia/Toppan Co. Ltd., Tokyo).
5. Essential of Medicinal Chemistry (2/e) by Andrejus Korolkovas (A Wiley Interscience Publication, 1988, John Wiley & Sons, Canada).
6. Medicinal Chemistry by Ashutoshkar (Wiley Eastern Ltd., 1993).
7. The Pharmaceutical Basis of Therapeutics by Goodman and Gilman (The Macmillan Co.).
8. The Organic Chemistry of Drug Synthesis, Vol. I, II & III (1980), Ed. By D. Lednicer and L. A. Mitscher (John Wiley and Sons, New York).
9. Topics in Medicinal Chemistry, Vol. I & II by Rabinowitz and Myerson (Editor) (Interscience, 1968).
10. Adhunik Sanshleshit Aushodhonu Rasayanvighyan, Dr. Anamik Shah, University Granth Nirman Board, Ahmedabad, Price Rs. 135/-.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

CHEMISTRY (PHYSICAL)

PAPER-I

Total Marks: 100 (External-70 + Internal-30) Total Periods: 120

SECTION – I

UNIT-I : STATISTICAL MECHANICS: (20)

Probability theorems in statistical thermodynamics. Phase space system- assembly and ensembles. Ensembles probability, discrete variables, ensemble averages, micro-canonical ensemble and canonical ensemble. Statistical derivation of entropy, enthalpy, free energy, heat capacity in terms of position functions. Treatment of diatomic and polyatomic molecules. Comparison of third law and statistical entropies. Grand canonical ensemble, Systems with more than one component. Quantum effects.

Potential-energy functions: hard sphere potential, square well potential, Lennard-Jones 12,4 potential. The law of corresponding state, Configurational partition function, cell model for liquids.

Recommended Books:

1. Thermodynamics for chemist by Glasstone S.
2. Thermodynamic by Grudeep Rai, Goel Publishing House, Meerut, 2nd ed.
3. Equilibrium Statistical Mechanics, by Andrews F. C., John Wiley & Sons, N.Y., 1975.
4. Introduction to Statistical Thermodynamics by Hill.
5. Statistical Thermodynamics by Gupta M. C.
6. Liquid and Their Properties by Temperley and Trevana.

UNIT-II : THERMODYNAMICS OF LIQUID SOLUTIONS: (20)

Activity and activity coefficients. Thermodynamic functions of mixing, free energy, entropy, heat, volume, viscosity and compressibility of mixing of ideal and non-ideal binary solutions. Techniques for the determination of mixing functions: excess volume, excess enthalpy and excess free energy for liquid mixtures.

Theories of solutions of non-electrolyte liquids: van Laar theory, van der Walls theory, Scatchard-Fildebrand theory, Lattice theory and elementary ideal about Progogime and Flory theories. Computation of mixing functions and corresponding parameters for pure liquids.

Recommended Books:

1. Chemical Thermodynamics by Mishra and Rastogi R. P.
2. The properties of Gases and Liquids, Reid R. C., Prausnitz J. M. and Poling B. E.
3. Molecular Theory of Solutrion by Prigogine I, North Holland, Amsterdam, 1957.
4. Liquid and liquid mixtures by Rowlinson J. S. and Swinton F. L., Butterworth, London, 1981.

UNIT-III : SOLID STATE CHEMISTRY: (20)

Imperfection in crystal, point defects, Schottky defects and Frenkal defects in ionic solids and their concentration, semiconductors; extrinsic and intrinsic semiconductor, band theory, electrical conductivity via defects, colour centres.

Specific neats of solids, Einstein theory, Debye theory, Born theory and Blackmann's lattice theory. Electronic heat capacity of metals.

Superconductivity of matter, Borndeen-Cooper-Schrieffar (BCS) theory, Effects of magnetic fields, High to super conductivity.

Recommended Books:

1. Principle of the Solid State by H. V. Keer.
2. Solid State Chemistry by N. B. Hannuy.

SECTION – II

UNIT-IV : CHEMICAL KINETICS: (20)

Rate theories based on thermodynamics, rate theories based on statistical mechanics, conventional transition-state thory, 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.

Homogeneous and heterogeneous catalysis: 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-Pronsted equation, acidity functions.

Recommended Books:

1. Chemical Kinetics by Laidler K. J. Harper and Row, 3rd Ed., 1987.
2. Chemical Kinetics and Reaction Mechanism by Williamson.

UNIT-V : SPECTROSCOPY: (20)

(a) IR and Raman Spectroscopy:

Molecular vibration, selection rules, instrumentation for IR and Raman spectroscopy, sources, detectors, monochromators, cells and sampling technique, interpretation of IR spectra. Elementary idea about FTIR.

(b) NMR and ESR Spectroscopy:

Theory and instrumentation of NMR relaxation, chemical shifts reference compounds, solvents, spin-spin coupling dimagnetic effect, magnetic anisotropy, shift reagents, interpretat-ion of H-NMR, Elementary idea about FT-NMR and C-13 NMR, Interpretation of C-13 NMR of some simple organic compounds, Interpretation and application of ESR.

Books Recommended:

1. Fundamental of molecular spectroscopy, C. N. Banwell, Tata McGraw Hill Pub. Camp.
2. Spectroscopic identification of organic compounds by Silberstein R. M., Baissler G. C.and Morrill T. C., John Wiley and Sons, N. Y., 4th Ed.
3. Modern Methods of Chemical Analysis, R. I. Ressok, L. Shields, T. Cairns and I. C.
   McWilliam, John Wiley & Sons, N.W., 2nd ed.

UNIT-VI : NUCLEAR CHEMISTRY AND BIOPHYCAL CHEMISTRY: (20)

(a) Nuclear Chemistry:

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 dosimetry, chemical dosimetry chemical effects resulting from radiation of matter, radiolysis of water and aqueous solutions, free radicals in water radiolysis.

(b) Biophycal Chemistry:

Chemical process in living systems. Metabolic and biosynthetic reactions ATP hydrolysis. Coupling reactions, phosphate transfer potential, use of free energy toi form ATP and role of ATP (glycolysis). Membranes, structure passive and active transport across membranes, transport of charged particles. Membrane potential amino acids : acid-base equilibria in amino acid and proteins. Microscopic and macroscopic dissociation constants, iso-electric point, titration of protein.

Recommended Books:

1. Nuclear Chemistry by A. H. Arnikar.
2. Nuclear Chemistry by Dash U. N., Sultan Chand and Sons, New Delhi, 1991.
3. Physical Chemistry and Its Biological Application by Brey W. S., Academic Press, N.Y., 1978.
4. Physical Chemistry With Applications to Biological Systems by Raymond C. Chang, Coller Macmillan International Ed., 1977.

Other General Recommended Books:

1. Physical Chemistry by Atkins P. W., Oxford University Press, 1980.
2. Physical Chemistry by Levine D. N., McGraw Hill, International Ed.
3. Physical Chemistry by Moelwyn-Hughes E. A., Pergamon Press, 1961.
4. Physical Chemistry by Berry, Rice and Ross.
5. Physical Chemistry by Pruton and Maron S. H.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

CHEMISTRY (PHYSICAL)

PAPER-II

Total Marks: 100 (External-70 + Internal-30) Total Periods: 120

SECTION – I

UNIT-I : (A) POLAROGRAPHY: (20)

Instrumentation factors influencing diffusion current, quantitative analysis. Derivation of Ilkovic equation for instantaneous current (with the use of Ficks laws) and also for mean diffusion current. Criterion for diffusion current. Relation between instantaneous current and mean current. Reversible polarographic wave equation – cathodic wave, anodic, wave cathodic-anodic wave. Analysis of Reversible polarographic waves. Polarographic maxima of first and second kind, their suppression. Interpretation of maxima of the first kind and of the second kind, polarity of maxima of the first kind influence of cations and anions on positive and negative maxima. Evaluation of the instability constant of the complexation.

Oscillographic polarography with controlled potential, single, sweep method – summit potential – Randles-Sevcik equation and its limitations, Multi-Sweep method. Advantages and disadvantages of oscillographic polarography.

Sinusoidal A.C. polarography, square-wave polarography, Pulse polarography (Basic principle).

(B) AMPEROMETRY:

Review of principle of Amperometry at one polarized electrode, Various amperometric titration curves, Amperometric indicators, Amperometric titrations with D.M.E. and rotating platinum microelectrode. Amperometry at dual polarized electrode – Principle and method – Dead stop end point.

UNIT-II : CHROMATOGRAPHY: (20)

(A) Gas Chromatography:

Principle of GC separation, separation of multicomponent mixtures, theoretical plates and HETP approach, Van Deemter equation. Retention time, relation between Retention time and Distribution constant, Retention factor, Selectivity factor. Column resolution, Effect of Retention and selectivity on resolution. Components of GC – carrier, gas, sample introduction system, packed column, Detectors, Argon ionization detector – TCD, FID, ECD and their sensitivity, packed column for GSC and GLC, capillary column GC, Programme-Temperature GC, Principle of qualitative and quantitative analysis – Measurement of peak area, Area normalization, internal, standard method, Kovats retention index.

(B) Liquid Chromatography:

Principle of liquid – Solid chromatography, Comparison with GC, Column chromatography, Successive Elution, Gradient Elution, Displacement Chromatography, Detectors – UV absorption, Refractive index, Voltametric and conductometric methods.

UNIT-III : PHYSICO-CHEMICAL PROPERTIES INVOLVED IN DYEING: (20)

(A) Textile Fibres:

Theory of dyeing and factors responsible for the anchoring of the dye molecules to the fibre. Thermodynamic considerations of dye adsorption, heat of dyeing adsorption isotherm, entropy kinetics of dye adsorption, factors affecting fading of dyed fibres, Dyeing of nylon, polyester and acrylic fibres.

(B) Surfactants in Solution:

Determination of CMC, Solubility of surfactants, Kraft point, Cloud point, HLB number, Aggregation number and factors affecting it, Effect of electrolytes, pH and organic material, Size and shape of micelles. Solubilization and sites of solubilization. Factors affecting solubilization – Temperatures, Nonelectrolytes and electrolytes. Micellar catalysis in aqueous solvent – Treatment of data.

SECTION – II

UNIT-IV : ION SELECTIVE ELECTRODES: (20)

Membrane potential, Principles of selectivity, Methods of evaluating selectivities separate and mixed solution method. 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 and potassium selective ion electrodes. Gas electrodes, ammonia, sulphur dioxide, oxygen and CO_2 sensing electrode, Micro ion selective electrode, enzyme electrodes. Quantitative determination – known addition method – known subtraction method.

UNIT-V : ATOMIC SPECTROSCOPY: (20)

(A) Atomic Absorption Spectroscopy (AAS):

Principles of atomic absorption, Instrument used in AAS, Radiation source – Hollow cathode, electrodeless discharge lamp, flames characteristics, flame atomizers (total consumption and premix burner), Non-flame atomizers (furnaces) monochromator and detectors, interferences in AAS, qualitative and quantitative analysis comparison with flame emission – Applications.

(B) Flame Photometry:

Principle, Instrumentation, Flame as a source of atomic, vapour-flames, atom formation steps, interferences, Limitations, Design of flame photometer, Comparison with AAS, Applications.

(C) Emission or Spectroscopy:

Origin of spectra, Instrumentation – Electrical sources – DC arc, AC arc, AC spark, analysis plasma as excitation sources – RF plasma, DC plasma, effective temperature of the plasma, Application in quantitative and qualitative.

UNIT-VI : THERMAL METHODS: (20)

Thermogravimetry – Instrument for TGA and DTG. Factors affecting TGA curves – Applications – Evolved gas detection and analysis. Differential thermal analysis – Differential scanning calorimetry – instrument, reference material, Diluents. Factors affecting DTA curves – Applications.

Thermometric titrations – Advantages – Direct-injection enthalpimetry – Applications TT and DIE.

Books Recommended:

1. Principles of polarography by Heynowaski and Kuta, Academic Press.
2. Gas chromatography by Littlewood.
3. Selective Sensitive Electrodes by Moody & Thomas.
4. Ion Selective Electrodes by Durst.
5. Surfactants by Tadros.
6. Dyeing and Chemical Technology of Textile Fibres by Trotman.
7. Chemical Analysis in Industry (in Gujarati) by M. N. Desai.
8. Gas Chromatography by Bennet, Mogere and Saffarinki.
   (Treatise on Analytical Chemistry, Ed. Kolthoff and Elving).
9. Instrumental Methods of Analysis by G. W. Ewing.
10. Modern Method of Chemical Analysis by Pecsok, Shield, Cairns, McWilliam, John Wiley and Sons..
11. Introduction to Instrumental Analysis by R. D. Brawn, McGraw-Hill Book.
12. Fundamentals of Analytical Chemistry : Skoog D. R. and West D. M. (Holt, Rinehart & Winston, New York).
13. Modern Polarographic Methods, H. Schmidt, M. Van Stackelberg (Academic Press, New York), 1963.
14. Polarography of Metal Complexes, D. R. Crow (Academic Press, New York), 1969.
15. Micelles, Theoretical and Applied Aspects, V. Moroi, Plenum.
16. Surfactant Science and Technology, Drew Myers, VCH.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

CHEMISTRY (PHYSICAL)

PAPER-III
(POLYMER)

Max. Marks: 100 (External 70 + Internal 30) Total periods: 120

SECTION – I

UNIT-I :

(a) Basics: (20)

Importance of polymers, classification, isomerism, nomenclature, internal rotation in polymer configuration and conformation, intermolecular interaction, factors determining chain flexibility, configuration and conformation of macromolecules, practical importance of chain flexibility.

(b) Polymerisation:

Bacid irregularities in step polymerisation, criterion of monomer purity, statistics of linear step polymerisation, kinetics of catalysed and non-catalysed step polymerisation, non-linear step polymerisation and Carothers equation, methods of step polymerisation (dry, wet and interfacial).

(c) Copolymerisation:

Kinetics and mechanism, reactivity ratios and their determination, Mayo-Lewis method, Fineman-Ross method, Kelen-Turdos method, prediction of copolymer composition, the QE scheme, preparation of graft and block copolymers.

(d) Phase System in Polymerisation:

Bulk, solution, suspension and emulsion polymerisation, comparison of the methods, chain transfer reactions : chain transfer constant, effect of temperature, inhibitors/retarders and autoacceleration on the rate of polymerisation, thermodynamic aspects of polymerisation.

UNIT-II : (20)

(a) Statistics of Linear Polymers:

Molecular weight distribution, average dimensions, average end-to-end distance, average radius of gyration, the completely unrestricted chain, completely rigid polymer chain.

(b) Molecular Weight Determination:

Vapour phase osmometry, membrane osmometry, theoretical expression for osmotic pressure, apparatus and experimental method, end group analysis, polymer

fractionation methods, Gel permeation chromatography : theory of separation, instrumentation and techniques, applications, hydrodynamic chromatography.

(c) Characterisation of Polymers:

Analysis and testing of polymers, spectroscopic methods, X-ray diffraction study, microscopy, thermal analysis and physical testing, pyrolysis GC.

UNIT-III : Polymer Solutions: (20)

Criteria for polymer solubility, polymer texture and solubility, dissolution and swelling of polymers and factors affecting swelling, effect of molecular weight and degree of crystallinity on dissolution, size and shape of polymer molecules in solution, thermodynamics aspects of polymer dissolution, solubility parameter theory, thermodynamics of solutions of small molecules, thermodynamics of polymer solutions, Flory-Huggins theory, Entropy of mixing. 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.

Phase Equilibria:

UCST and LCST, thermodynamics of phase equilibria, characteristic features of polyelectrolyte solutions and solutions of block and graft polymers in selective solvents, adsorption of polymers from solution vis-à-vis colloid stability.

SECTION - II

UNIT-IV : Morphological Behaviour of Polymers: (20)

Amorphous and crystalline polymers, morphology of crystalline polymers, strain induced morphology, 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, structures of polymers crystallised from melt, the fringe micelle concept, structure of spherulites, relation of spherulites to crystallites, polymer single crystals and chain folding during crystal formation, crystallizability and crystallinity, kinetics of crystallization (Avrami equation).

Supermolecular Structure of Polymers:

Methods of investigating polymer structure, structure of crystalline polymers, oriented state of polymers, structure of amorphous polymers, super domain structure in amorphous polymers.

Thermal Transitions:

Glass transition temperature, its cause and importance, relation between Tg and Tm, factors affecting glass transition temperature, effect of plasticizers, blending and copolymerisation of Tg, characteristic features of fibres, elastomers and plastics, determination of Tg by dialatometric method and DTA, DSC and thermal methods.

UNIT-V : Properties of Polymers: (20)

Physical Properties:

Different types of mechanical behaviour, elastic solids and polymers, stress, strain, modulic, generalized Hooke's law, effect of different factors on mechanical behaviour, effect of molecular weight and cross-link density, effect of crystallinity, effect of filters, effect of tacticity and effect of plasticisation, Visco-elastic behaviour, Dependence of viscosity on shear rate and stress dependence.

(a) Electric Parameters:

Electrical conductivity, electrets, static dielectric constant and dipole moment, Electrical behaviour of polar and nonpolar polymers, Temperature dependence of conductivity, Factors influencing dielectric behaviour of polymers, conducting polymers, doping of polymers, polyacetylene and polyaniline.

(B) Chemical Transformation:

Polymer degradation, Cross-linking and curing reactions, cyclization reactions, Reactions of functional groups in polymers, Polymer recycling, Biodegradation polymers.

UNIT-VI : Polymer Processing and Properties of Commercial Polymers: (20)

(a) Processing Techniques:

Extrusion, injection moulding, calandering compression moulding, spinning.

(b) Polymer Additives:

Fillers, plasticizers, antioxidants, flame retardants, UV stabilizers, curing agents; their examples, purpose and mechanism of working.

(c) Commercial polymers, Functional polymers – Fire retarding – polymers, Biochemical polymers, Ionomers,'Multiphase polymer systems', Interpenetrating network polymers.

(d) Natural polymers.

BOOKS RECOMMENDED:

1. Principles of Polymer Chemistry, P. J. Flory, Cornell Univ. Press, Ithaca.
2. Textbook of Polymer Science, J. W. Billmeyer, John Wiley & Sons.
3. Physical Chemistry of Macromolecules, C. Tanford, John Wiley & Sons.
4. Macromolecules in Solution, H. Morowitz, Interscience Publ.
5. Introducter Polymer Chemistry, Misra, Wiley Eastern & Sons.
6. Introduction to Polymer, R. J. Young, Chapman & Hall.
7. Physical Chemistry of Macromolecules, D. D. Desphande.
8. Physical Chemistry of Polymer, Tager, Mir Publishers.
9. Polymer Solutions, H. Tempa, Butterworths Scientific Pub., London.
10. Physical Methods in Macromolecular Chemistry, Vol. 2, Ed. Denzamin Canoll, Marcel Dekker Inc., New York.
11. Analysis of Polymers : An Introduction, T. R. Cromption.
12. Principles of Polymer Science : P. Bahadur & N. V. Sastry, Narosa.
13. Polymer Science – Gowarikar New Ages International.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

CHEMISTRY (ANALYTICAL)

PAPER-I
(Instrumental Methods of Analysis)

Total Marks: 100 (External-70 + Internal-30) Total Periods: 120

SECTION – I

UNIT-I : IR AND RAMAN SPECTROSCOPY: (20)

Review of the theory of IR and Raman spectroscopy selection rules – Raman scattering – Resonance Raman spectroscopy – Outline of the instrument for Raman spectroscopy – Mutual exclusion rates, Applications.

Instrument for IR spectroscopy – Sources, Detectors, monochromators – Cells and sampling techniques – Interpretation of IR spectra using correlation charts – Quantitative analysis – FT-IR spectroscopy; Instrument, Advantages.

Problems to elucidate structure from IR spectra.

Comparison of two techniques.

UNIT-II : NMR AND ESR SPECTROSCOPY: (20)

Theory of NMR – Relaxation – Chemical shifts – References and solvents – Spin-spin splitting – Magnetic Anisotropy – Instrumentation – Shift Reagents – Interpretation of simple NMR spectra – ^{13}C NMR spectra – Signal averaging, FT-NMR, Pulse FT-NMR spectroscopy. Problems to elucidate structure from NMR spectra (minimum 10). ABX, AMX, ABC, A_2B_2 Systems – NMR in medical diagnostics.

Theory of NMR – Instrumentation of ESR – Analytical applications of ESR spectroscopy – Hyperfine coupling mechanism (only qualitative).

UNIR-III : MASS SPECTROSCOPY: (20)

Instrumentation – Methods of ion production – Ion separators – Ion collection and recording – Sample handling techniques – GC-MS coupling – Resolution – Parent peak – Base peak – Metastable ions isotope effect – Molecular formula from mass spectra – Nitrogen rule, Ring rule – Fragmentation rules – Behaviour of classes of compounds – Interpretation of mass spectra – Additional applications – Problems to elucidate structure from mass spectral data.

SECTION – II

UNIT-IV :

X-RAY SPECTROSCOPY AND ATOMIC FLUORESCENCE SPECTROSCOPY AND SURFACE SPECTROSCOPY: (20)

(a) X-ray absorption – Apparatus – Source – Sample handling – Wavelength and energy dispersive device – Detector (any one). Chemical analysis by X-ray absorption – X-ray fluorescence – Apparatus for X-ray fluorescence – Applications of X-ray fluorescence.

(b) Atomic Fluorescence Spectroscopy:

Principle – Apparatus – Source – Cells – Wavelength selectors – Analysis with APS.

(c) Surface characterization by spectroscopy, Introduction – Types of surface measurements. General techniques in surface spectroscopy – Sampling surfaces – Surface contamination – Auger electron spectroscopy, Instrument and applications.

UNIT-V : ATOMIC SPECTROSCOPY: (20)

(a) Flame Emission Spectroscopy:

Flame as a source of atomic vapour – Flames Atomisation – Flame photometer – Applications and limitations comparison with AAS.

(b) 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.

(c) Atomic Absorption Spectroscopy (AAS):

Principle of AAS – Instrument – Continuous sources and line sources – Flames – Flame atomizers - Nonflame atomizers (furnaces) – Monochromator and Detector – Interference with AAS Quantitative Analysis with AAS – Applications – Numericals.

UNIT-VI : BASIC ELECTRONICS: (20)

Basic Electronics of Measurements:

Introduction – Instruments for Analysis – Data Domains – Non-electrical and electrical domains – Detectors, Transducers and Sensors – Review of electrical components, laws of electricity, Kirchoff's laws. DC current voltage and resistance measurements – AC circuits – semiconductor and semiconductor devices – Readont devices – Operational amplifiers – Their applications to various measurement devices, current and voltage control, mathematical operations servomechanisms – Digital electronics, Logic gates (Interdomain conversions).

Reference Books:

1. Principles of Instrumental Analysis (5^{th} Ed.) by Skoog, Holler, Nieman (Sanuder College Publishing) (Chapters 1, 2, 3).
2. Instrumental Methods of Chemical Analysis (5^{th} Ed.) by G. R. Ewing (McGraw Hill).

NOTES: (1) From each unit one question should be set.
(2) The marks of question and length of question should be as per the weightage of the unit.
(3) Numericals are to be taught and asked wherever necessary.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

CHEMISTRY (ANALYTICAL)

PAPER-II
(Instrumental Methods of Analysis)

Total Marks: 100 (External-70 + Internal-30) Total Periods: 120

SECTION – I

UNIT-I : POTENTIOMETRIC METHODS OF ANALYSIS: (20)

Classification of ion selective electrodes – Glass electrode – Crystalline membrane electrode – Liquid ion-exchanger electrode – Neutral carrier membrane electrode – Gas permeable membrane electrode – Biocatalytic membrane electrodes – Selectivity coefficients – Quantitative Analysis using ISE – Standard addition, Standard substraction methods – Dillution method – Double known addition methods – Ionimeter – Numericals.

UNIT-II : MODERN POLAROGRAPHIC METHODS: (20)

Electrochemical Definitions and Terminology – Faradaic and Non-Faradaic processes – Concentration profiles at microelectrode surface during electrolysis.

(A) A. C. Polarography:

Principle of Sinusoidal alternating applied potential – AC peak polarogram – Peak current equation – Characteristic of AC polarographic peak – Importance of signal to noise ratio for the sensitivity – Comparison with DC polarography.

(B) 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.

(C) 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. Instrumentation.

(D) Hydrodynamic Voltammetry:

Principle and similarity with dc polarography – Types of electrodes used – Applications of the technique in determination of rate constant of the reaction.

(E) Anodic Stripping Voltammetry:

Concentration and stripping steps – Importance of Hanging mercury drop electrode and MTFE – Sensitivity of the technique – Applications – Cathodic stripping.

(F) Cyclic Voltammetry:

Principle – Forward and reverse scan, cyclic voltamogram – Detection limits – Applications.

(G) Rapid Scan Voltammetry:

Principle – Rapid voltage scan at the end of the drop life – Peak current equation – Relation of peak current with the scanning rates – Summit potential equation – Comparison with DC polarography – Limitations.

UNIT-III : THERMAL METHODS OF ANALYSIS: (20)

Thermogravimetry – Instruments for TGA & DTG – Calibration of temperature scale – Factors affecting TGA results – Applications – Evolved gas detection and analysis.

Differential thermal analysis (DTA) – Differential scanning calorimetry (DSC) – Instrument – Reference materials – Diluents – Factors affecting DTA results – Applications.

Thermometric Titration (TT) – Advantages – Instrument – Direct Injection Enthalpimetry – Applications of TT and DIE.

SECTION – II

UNIT-IV : (20)

(a) Radio-Chemical Methods of Analysis:

Interaction of radiation with matter – Units of radioactivity – Statistic of counting – Background corrections – Neutron activation analysis – Sources of neutrons – Theory of instrumental neutron activation analysis – Experimental considerations – Isotope dilution analysis (Direct and Inverse) – Radioimmuno assay – Radiometric titrations – Radio release methods – Radiation safety – Numericals.

(b) Photo-acoustic Spectroscopy:

Principle and applications.

UNIT-V : THEORY OF CHROMATOGRAPHY, GC AND PROCESS ANALYSERS: (20)

(A) 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.

(B) Gas Chromatography:

Mobile phase and criteria for its selection – Sample introduction techniques – Stationary phases used in GSC and GLC – Supports for liquid stationary phases – Selection of columns – packed, WCOT, SCOT, FSOT – Detectors FID, TCD, FPB, ECD, TID – Their merits and demerits – Temperature programming in GC – Derivatisation in GC – Qualitative analysis from retention parameters – Quantitative analysis.

(C) Process analysers and used for moisture, oxygen determination – Process GC – non-
dispersive IR spectrophotometer to determine CD and CO_2.

UNIT-VI : LIQUID CHROMATOGRAPHY AND AUTOCANALYSERS: (20)

(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:

(i) Paper chromatography (Ascending, Descending, Radial, Two dimensional) solvent systems – Location.

(ii) Thin-layer chromatography: Preparation of plates – Adsorbants and solvent systems used – Techniques of zone detection – Elementary idea of HPTLC.

(e) Zone-Electrophoresis:

Moving boundary electrophoresis – Zone electrophoresis – Continuous flow electro-phoresis – Gel electrophoresis.

(f) Autocanalysers:

Need for autoanalyser – Instrument used in clinical laboratory.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M.Sc. PART-II

CHEMISTRY (ANALYTICAL)

PAPER-III
(Applied Analysis)

Total Marks: 100 (External-70 + Internal-30) Total Periods: 120

SECTION – I

UNIT-I : ANALYSIS OF ORES, ALLOYS AND CEMENT: (20)

(a) Ores:

General methods for the analysis of ores with special reference to the ores of iron, copper, aluminium, manganese, chromium, titanium, calcium, magnesium (for determination of trace elements, instrumental methods to be stressed).

(b) Alloys:

Analysis of brass, German-silver, bronze, stainless steel, Monels, Ferromanganese, Alloys of Al, Mg and Ti (Emphasis should be given on instrumental methods such as AAS, molecular spectrophotometry, fluorescence, emission, spectroscopy for analysis of trace elements).

(c) Cement:

Composition of cement and characterization, setting and hardening of cement, Analysis of cement for silica, calcium, magnesium, iron, sodium and potassium using ISI method.

UNIT-II : ANALYSIS OF WATER POLLUTANTS AND AIR POLLUTANTS: (20)

(a) Water:

Sources of water pollution – Sewage and industrial effluents – Analysis of water pollutants – Sampling – Preservation – Measurement of parameters such as COD, BOD, DO, TDS, suspended solids, TCC, phenols, fluoride, nitrite, sulfide, cyanides, heavy metals..

(b) Air:

Sampling – Analysis of air borne particulates using emission spectroscopy – Determination of CO, SO_2, CO_2, NO_x, H_2S, O_3 in air sample.

Non-dispersive IR spectrophotometry to determine CO and CO_2.

(c) Analysis of Soil:

Moisture, pH, Total nitrogen, phosphazous, silica, lime, magnesia, sulfur, manganese.

UNIT-III : ANALYSIS OF DRUGS AND FOOD PRODUCTS: (20)

(a) Drugs:

Analysis of sulfa-drugs, Analgesics, Antipyretics, Antimalarial, Antiallergic (Anti-histamines), Antibiotics (Emphasis should be given on the methods given in pharmacoepia), Narcotics.

(b) Clinical Chemistry:

Determination of glucose, electrolytes, urea, cholesterol, uric acid in blood serum.

(c) Food Products:

Analysis of (i) Oils and fats – Iodine value, Saponification value, RM value, (ii) reducing and non-reducing sugars, (iii) butter, honey, fruit, juices, non-alcoholic bevearages, (iv) adulteration in oil, ghee, butter.

SECTION – II

UNIT-IV : ANALYSIS OF SOAPS, DETERGENTS AND AGROCHEMICALS : (20)

(a) Soaps and Detergents:

Classification of detergents – Action of detergents – Determination of alcohol soluble materials, moisture, active constituents, silicates, phosphates, borates etc.

(b) Analysis of Moisture and Biuret in urea sample – Determination of urea nitrogen using titrimetric (ureas method) – Ammonical and nitrate nitrogen with Devarda's method –

Total phosphorous with alkalimetric ammonium molybdate method and spectrophoto-Metric method – K using flame photometry.

(c) Pesticides:

Determination of total chlorine in chloride containing pesticides, Total phosphorous in phosphorous containing pesticides – Determination of traces of pesticides using GC and HPLC – Determination of Aldrin using IR spectrophotometry.

UNIT-V : ANALYSIS OF FUELS AND POLYMERS: (20)

(a) Fuels:

Classification of coal – Proximate and ultimate – Analysis of coal and their significance – Bomb colorimeter to determine calorific value of solid and liquid-fuel – Boy's method to determine calorific value of gaseous fuel – Analysis of fuel gases using Orsat's apparatus. Octane number – Liquid fuels – Flash point – Aniline point.

(b) Polymers:

Number average and weight average molecular weights – Determination of molecular weight using osmometry, viscosity and light scattering.

Characterisation of polymers – The glassy state and determination of glass transition temperature – Crystallisation and melting – Determination of Tm – Using of IR and NMR for chemical characterization of polymer.

REFERENCES:

(1) Engineering Chemistry by Jain & Jain, Dhanpatrai pub. Co., Delhi.
(2) Text-book of Polymer Science, F. W. Billmeyer Jr., Pub. John Wiley & Co.

UNIT-VI : CALCULATIONS IN ANALYTICAL CHEMISTRY: (20)

Calculations based on titrimetry, gravimetry, spectrophotometric, potentiometric, polarographic and coulometric methods. Problems for the analysis of industrial materials, like ores, alloys, fertilizers, drugs, insecticides etc. Calculations involved in direct and back titrations and indirect analysis, Preparation of buffer solutions of definite pH.

REFERENCE BOOKS FOR ALL THREE PAPERS OF ANALYTICAL CHEMISTRY:

(1) Instrumental Analysis : G. D. Caristian and J. E. O'Reilly (Allyn & Bacon Inc., New York, 2nd edition.

(2) Instrumental Methods of Chemical Analysis : G. W. Ewing (McGraw-Hill, New York), 5th edition.

(3) Instrumental Methods of Analysis : H. R. Willard, L. L. Merrit, J. A. Dean, F. A. Settle (Van Nostrand Reinhold Co., New York), 6th edition.

(4) Modern Methods of Chemical Analysis : Pecsok, Shield & Cairns (John Wiley), 2nd 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. Shyder & J. J. Kirkland (John Wiley & Sons, New York).

(8) Treatise on Analytical Chemistry : I. M. Kohthoff & 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 (6th 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^{th} ed.) by Skoog, Holler and Nieman (Saunders College Publishings).

(20) Undergraduate Instrumental Analysis (5^{th} ed.), J. W. Robinson (Marcel Dekker Inc.).