

M.Phil –Chemistry [Semester – I]
Paper-I Research Methodology[50 Marks]

Hours 45

(a) Literature Search and

(b) Instrumentation method based on

1. Fluorescence and phosphorescence methods, Raman Spectra, NMR Spectra, 10 articles on recent advances [25Marks]
– Talanta, Analytical Chemistry , Chemical Education etc.
2. X-Ray Spectroscopy, Radio Chemical Methods, ORD,CD, Thermal analysis, 10 articles on recent advances- Talanta, Analytical Chemistry Chemical education etc. [20Marks]

References:-

Research Papers

1. The acronyms used in the world of spectroscopy, microscopy and diffractometry- Compilation and classification –Spectro Chemicals Acta- vol.:36,PP 5- 1989
2. Atomic absorption in clinical analysis.
Bio Chemical –vol. :13- PP -1989
3. Raman spectroscopy 20 years later – Chemical Tech. – 1990
4. Solving mysteries – using Infrared Spectrometry and chromatography – Analytical Chemistry – Vol. : 60- PP – 1988
5. Time Resolved Spectroscopy using FTIR
International Laboratory, vol. :62
6. Solid Sampling techniques in the far infrared regions
International Laboratory – 1987 June.
7. Analysis of Palladium (II) by a kinetic method and mercury (I) by volumetry Indian Journal of chemistry – vol :29,1990.
8. A new Catalytic kinetic spectrophotometry of the determination of iron – Talanta, vol. -36- PP 1107-1110
9. Polarographic adsorption analysis and tensametry, Analyst – Vol. 113 Jan. 1986.
10. Reciprocal derivative constant current stripping analysis, – Talanta – vol. 35-pp -862-867.

11. Derivative UV – Visible region absorption spectrophotometry and its analytical applications, – Talanta – Vol. :35 PP-753-761.
12. Separation of Ga, In & Tl by extraction with n-octyl aniline in CHCl₃
Talanta – Vol. :35- pp-357-360.
13. Corrosion measurements by potential step chrono amperometry
-Talanta –Vol :32-pp – 307-311.
14. Analytical Chemistry of Synthetic food antioxidants A review – Analyst
vol:112 – (July)1987.

Reference Books:

1. Spectroscopy in Inorganic Chemistry Vol :I & II --C.N.R .Rao and J.R.Ferraro.
2. Organic spectroscopy- William Kemp (ELBS)
3. Techniques of chemistry – A. Weisberger and B.W. Rossiter.

Paper-II (50 Marks)

(I) Stereo chemistry and confirmation (13 Marks)

[11 Marks]

1. Introduction – Optical and Geometrical isomerism – Polarimetry – Molecular dissymmetry – Optical isomerism due to asymmetric carbon atoms - Racemic modifications – Formation of Racemic modifications – Properties of Racemic Modifications Resolution - Resolution by mechanical separation of crystals – Resolution by formation of Diastereoisomers – second order asymmetric transformations – Bio chemical asymmetric transformation – Absolute asymmetric synthesis – Criteria of optical purity – Axial chirality – Planar chirality – Helicity
[08 Marks]
2. Configuration – Absolute configuration. – Relative configuration – Chemical inter conversion Not affecting bonds to the asymmetric atom – Chemical correlation – The method of quasi racemates – optical comparison – configuration based on asymmetric – synthesis – synthesis of optically active compounds.
[05 Marks]

References:

1. Stereo Chemistry of carbon compounds
-Ernest L.Eliel
2. Stereo Chemistry of organic compounds
-- Nasipuri

(II) Electro Chemistry – (Industrial)
(13 Marks) **[11 Hours]**

1. Organic electro synthesis – Basic principles and parameters available - the hydro

dimerization of Acrylonitrile mechanism –Monsanto process – developments from the early Monsanto process – The new Monsanto process – Mechanism – other hydro dimerization reaction – Advantages and drawbacks. [05 Marks]

2. Metals processing – Electro forming – Electro chemical machining – Electro chemical machining system – Tool design – electro chemical grinding electro chemical deburring principle – electro chemical etching . [04 Marks]

3. Water Treatment and environmental protection – Metal Iron removal and metal recovery – Hypochlorite and low tonnage chlorine electrolyzers – Electro-dialysis – Electrolytic methods of phase separation - other electrochemical processes – Electro analytical procedures. [04 Marks]

References:

1. Industrial electrochemistry --By Derek Pletcher[Chapman & Hall]
2. Organic electrochemistry – By Baiser M.M.
3. Fuel cells and their electrochemistry – By Bockris J and Srinivasan S.
[Mc Graw-Hill]

(III) Quantum Chemistry
[12 marks]

1. Orbital – Interpretation of Atomic orbital – Schrodinger's wave equation. Time dependent equation- Eigen values and Eigen functions - Normalization and orthogonality-Degeneracy – Forbidden transitions – Application of wave mechanics - particles in one and three dimensional box – The Space wave function for the electron in the Hydrogen atom.

References:

1. Valence- By C.A. Coulson [Oxford university press]
2. Quantum Chemistry – An introduction -- By Walter Kauzmann
(Academic press)

(IV) Polymer Chemistry
[12 marks]

1. Concepts of mass and Number average molecular weights. Methods of determining molecular weights – osmometry. Viscosity diffusion, gel and light scattering methods. [4 Marks]
2. Flory- Huggin theory, Entropy of mixing, polymer solutions – ideal & non ideal, viscosity of polymer solutions – crystalline and amorphous polymers, - glass transition temperature- melting point-tacticity & Crystallinity. [4 Marks]
3. Measurement of viscosity and normal stresses, Newtonian and non-Newtonian and visco- elastic fluids. Physical and chemical modification of polymers- Block & Graft polymers, High temperature polymers, polymers for biomedical application. [4 Marks]

References:

1. Polymer Chemistry – By F.Billemeier
2. Gowarikar V.R.Viswanathan N.V. and Sreedhar J.
-Polymer Science (New age international publishers)

PAPER- III- [Elective] ORGANIC CHEMISTRY
[50 marks] [25 Hours]

1. Spectroscopy methods [25marks]

1. Energy and the electromagnetic spectrum – Absorption of electromagnetic radiation by organic molecules-
Infrared spectroscopy- Molecular vibrations – factors influencing vibrational frequencies- instrumentation – sampling techniques- applications of infrared spectroscopy – Identify by finger printing- Identification of functional groups- Quantitative infrared analysis- Molar absorptivity- Attenuated Total Reflectance (ATR) and multiple internal reflectance (MIR) – Laser- Raman spectroscopy- Fourier transform infrared spectroscopy – IR spectroscopy problems.
2. NMR spectroscopy – N.M.R. phenomenon- theory of nuclear magnetic resonance- chemical shifts and its measurements- factors influencing chemical shift – correlation data for N.M.R. spectra- solvents used in N.M.R. – spin coupling- spin- spin splitting – coupling constants- factors influencing coupling constant – proton exchange reactions – simplification of complex proton N.M.R. spectra.
3. C-13 NMR Spectroscopy- Natural Abundance of ^{13}C N.M.R. spectra- resolution- multiplicity-H De coupling Noise de coupling- Deuterium coupling – NOE signal enhancement – off- resonance proton de coupling- structural applications of ^{13}C – NMR spectroscopy problems – H & ^{13}C – Electron spin resonance spectroscopy – Derivative curves – g values – Hyperfine splitting – ESR problems.

References:

1. Spectrometric identification of organic compounds – Robert M. Silverstein , G. Clayton Bassler and Torrence C. Morrill. (John Wiley and Sons)
2. Organic spectroscopy – William Kemp (ELBS).
3. Fundamentals of molecular spectroscopy
- By C.N. Banwell (McGraw – Hill 1972)
4. Introduction to molecular spectroscopy
- By G.M. Barrow (McGraw – Hill)

2. Carbohydrates [25 marks]

[20 Hours]

1. Mono saccharides – Reactions and confirmations – Ring structure of mono saccharides – Deoxy sugars – Muta rotation and mechanism of muta rotation - preparation of forms of a sugar – Glycosides – Hudson's lactone rule – Hudson's

isorotation rule – methods for determining the size of sugar rings – pyranoses and furanose structure.

2. Conformational analysis of the mono saccharides – x- ray analysis – IR spectroscopy – NMR spectroscopy – Mass spectrometry – optical rotation and ORD curves – Anomeric effect – isopropylidene derivatives of mono saccharides – some sugar derivatives – Glycosylamines – Anhydro sugars – mono saccharide esters.

References :

1. I. L. Finar – Organic chemistry, Vol.: 2, Stereo chemistry and chemistry of natural products.
2. Chemistry of carbohydrates – By Pigment and Goepp (Academic Press)
3. Newer aspects of the stereochemistry of carbohydrates – By Ferrier and Overend

Paper III – [Elective] INORGANIC CHEMISTRY {50 MARKS}

1.Co- ordination Chemistry { 25 marks }

1. Chemistry of Transition Elements – Co-ordinations chemistry of transition metal ions – stability constants of complexes and their determinations – stereochemistry of co-ordination compounds – ligands field theory – splitting of

d-orbitals in low symmetry environment – Jahn – teller effect – Metal clusters.
Spin crossover in co-ordination compounds – Interpretation of electronic spectra including charge transfer spectra, spectro- chemical series – nephelauxetic series – Tanabe Sugano diagram.

References:

1. Advanced Inorganic Chemistry-
-By Cotton & Wilkinson
2. Inorganic Chemistry – Principle, Structure and reactions
-By James Huheey
3. Introduction to Ligand field theory
-By B.N.Figgis

2. Group Theory {25 marks}

1. Molecular symmetry and the symmetry groups – symmetry elements and operations – symmetry planes and Reflections proper axes and proper rotations – Equivalent symmetry elements and equivalent atoms – the symmetry point groups – symmetry classification of molecules – classes of symmetry operations.
2. Representation of groups – the great orthogonality Theorem and its consequences – representation of cyclic groups – group theory and quantum mechanics – wave functions as bases for irreducible representations. The direct product projection operators.

References:

1. Group theory and Chemistry
-By David and Bishop
2. Introduction to Ligand field Theory
-By Carl J. Ballhausen
3. Chemical Applications of Group Theory
-By F.A. Cotton
4. Group Theory for chemists
-By George Davidsen

PAPER III – [Elective] PHYSICAL CHEMISTRY [50 MARKS]

Corrosion (25Marks)

[25 Hours]

1. Basic principles of corrosion – thermodynamics and electrode kinetic considerations – acidic, basic and neutral solutions – corrosion by oxygen – corrosion by soils – Aerobic and anaerobic micro organisms – oxidation of metals and alloys – mechanism of various growth laws – study of oxide films.

2. Corrosion by acids – oxidizing and non oxidizing acids – hydrogen cracking. Atmospheric corrosion – Modern mechanism, passivity of metal alloys. Relative merits of material of construction for industries and their selection considerations. Corrosion characteristics of non ferrous metals and alloys – stainless steels.

References :

1. An introduction to metallic corrosion --By Ulick R. Evans
2. Corrosion – Corrosion of metals and alloys–Corrosion control – Vol: 1&2
--By L.L.Shreir { George Newness Ltd. }

2. Electrochemistry {25 marks } [20 Hours]

1. The theory of electrolytic dissociation – the process of electrolytic dissociation and conductance – Electrolytic conductance of solutions – the migration of ions – Electrokinetic phenomena – structure and properties of double layer – electro osmosis – The rate of electro – osmotic flow – the pressure equation of Electro – electro stenolysis.
2. Electromotive force – Electro motive force of concentration cells – the potential difference at the liquid – liquid junction – flowing junctions. Gas electrodes – Applications of potentiometric measurements – EMF of oxidation reduction cells – polarization and electrolysis – Decomposition voltage – over voltage – Electrolytic separation of metals – polarographic analysis – The Edison accumulator – De polarization and electrolysis.

References:

1. Principles and Applications of Electrochemistry
-- By H.Jermain Creighton. { John Wiley & Sons }
2. Comprehensive Treatise of Electrochemistry
-- Vol.:1&2-By J.O.M.Bockris,Brian. F. Conway & Ernest Yeager
3. Modern aspects of electrochemistry
-- By B.E.Conway and J.O'M.Bockris [Plenum press]

**Paper : III [Elective] ANALYTICAL CHEMISTRY
[50 MARKS]**

Articles on recent advances – Talanta – analytical chemistry, chemical education etc.:

1. A titrimetric method for estimation of fluorine in organic compounds – Talanta – Vol.: 35 – PP 1261 – 1268
2. Determination of semimicro amounts of calcium in the presence of other alkaline earth metals. – Talanta – Vol:20- PP 535-541
3. Reciprocal derivative constant current stripping analysis – Talanta – vol:35 PP 861-867
4. Extreme trace analysis of the elements – methods and problems of sample treatment separation and enrichment – Talanta – (A-B) – vol:19 PP 1489-1521
5. Application of reverse pulse polarography – Talanta – Vol.:20 PP 320-335
6. Rapid and selective chelatomeric titration of aluminium in non-ferrous alloys – Talanta – Vol.: 32 PP -1119-1124
7. Polarographic procedures without removal of oxygen and other approaches to make the determinations more rapidly – Talanta – Vol.:20 PP 1139-1152
8. Thin layer Chromatography in the heavy organic industries – Talanta Vol.: 20 PP 1231-1260
9. The application of gas Chromatography to food analysis Talanta – Vol.: 26 PP 1065-1099

[Elective] : Paper – III

[50 marks]

Recent Advancements

1. Green Chemistry
2. Disconnection approach
3. Phase transfer catalysis