

**BHAGWANT UNIVERSITY**  
**Sikar Road, Ajmer**  
**Rajasthan**



**Syllabus**

**Institute of Life Sciences & Applied Sciences**  
**M. Sc.**  
**(Chemistry)**

### M. Sc. Previous Examination

SUB. CODE	PAPER	TEACHING PERIOD			External Marks	Internal Marks		G. Total
		L	T	P		Mid Terms carrying 15 marks	Assignments /Seminar /Presentation /Group Discussion-15	
	THEORY							
01MSC07101	Paper-I: Inorganic chemistry	3	1	0	70		30	100
01MSC07102	Paper-II: Organic Chemistry	3	1	0	70		30	100
01MSC07103	Paper-III: Physical Chemistry	3	1	0	70		30	100
01MSC07104	Paper-IV: Spectroscopy, Diffraction methods &Pharmaceutical-I	3	1	0	70		30	100
LABORATORY								
01MSC07201	Inorganic Chemistry	0	0	2	50		50	100
01MSC07202	Organic Chemistry	0	0	2	50		50	100
01MSC07203	Physical Chemistry	0	0	2	50		50	100
01MSC07204	Seminar	0	0	2	50		50	100
	TOTAL	12	4	8	480		320	800

### M.Sc. Final Examination

SUB. CODE	PAPER	TEACHING PERIOD			External Marks	Mid Terms carrying 15 marks	Assignments /Seminar Presentation /Group Discussion 15 Marks	G. Total
		L	T	P				
THEORY		L	T	P	0			
02AMC101	Paper-I: Spectroscopy,And photochemistry,	3	1	0	70	30	100	
02 AMC 102	Paper-II: Environment &Chemistry of life	3	1	0	70	30	100	
02 AMC 103	Paper III : Organic Synthesis	3	1	0	70	30	100	
02 AMC 104	Paper: IV - Heterocyclic , Pharmaceuticals –ii, Natural product	3	1	0	70	30	100	
LABORATORY								
02 AMC 201	Inorganic Chemistry	0	0	2	50	50	100	
02 AMC 202	Organic Chemistry	0	0	2	50	50	100	
02 AMC 203	Physical Chemistry	0	0	2	50	50	100	
02 AMC 204	Seminar	0	0	2	50	50	100	
	TOTAL	12	4	8	480	320	800	

## M.Sc. PREVIOUS

### PAPER I- INORGANIC CHEMISTRY

**Paper Code- 01MSC07101**

**Max. Marks- 100**

**External -70 Marks**

**Internal - 30 Marks**

#### **Unit I**

##### **(a) Stereochemistry and Bonding in Main Group Compounds**

VSEPR, Walsh diagrams (tri-and penta-atomic molecules), Bent rule and energetics of hybridization, some simple reaction of covalently bonded molecules.

##### **(b) Metal-Ligand Equilibria in Solution**

Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH-metry and spectrophotometry.

#### **Unit II**

##### **(a) Metal-Ligand Bonding**

Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes,  $\pi$ -bonding and molecular orbital theory.

##### **(b) Metal Clusters**

Higher boranes, carboranes, metalloboranes and metallocarboranes. Metal carbonyl and halide clusters, compounds with metal-metal multiple bonds.

#### **Unit III**

##### **Reaction Mechanism of Transition Metal Complexes**

Energy profile of reaction, reactivity of metal complexes, inert and labile complexes, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, reactions without metal

ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer-sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

#### **Unit IV**

##### **Electronic Spectra and Magnetic Properties of Transition Metal Complexes**

Spectroscopic ground state, correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d1-d9 states), charge transfer spectra, anomalous magnetic moments, magnetic exchange coupling and spin crossover.

#### **Unit V**

##### **Metal $\pi$ -Complexes**

Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reaction of metal carbonyls; preparation, bonding structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand.

##### **Books Suggested**

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.

2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Chemistry of the Elements, N.N. Greenwood and A. Earnshaw, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetochemistry, R.L. Carlin, Springer Verlag.
6. Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.
7. Reaction mechanism, Basalo Pearson, Academic Press

## PAPER II- ORGANIC CHEMISTRY

**Paper Code- 01MSC07102**

**Max. Marks- 100**

**External -70 Marks**

**Internal - 30 Marks**

### Unit I

#### (a) Nature of Bonding in Organic Molecules

Delocalized chemical bonding-conjugation, cross conjugation, resonance, hyperconjugation, bonding in fullerenes, tautomerism. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckel's rule, energy level of  $\pi$ -molecular orbitals, annulenes, anti aromaticity, homo-aromaticity, PMO approach.

#### (b) Reaction Mechanism: Structure and Reactivity

Types of mechanisms, types of reactions, hammond's postulate, curtin- Hammett principle. Generation, structure, stability and reactivity of carbocations, carbonanions, free radicals, carbenes and nitrenes. Effect of structure on reactivity-resonance and field effects, steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft equation.

#### (c) Aliphatic Nucleophilic Substitution

The SN<sub>2</sub>, SN<sub>1</sub>, mixed SN<sub>1</sub> and SN<sub>2</sub> and SET mechanism

#### (d) Aromatic Nucleophilic Substitution

The ArSN<sub>1</sub>ArSN<sub>2</sub>, benzyne and SRN<sub>1</sub> mechanism. Reactivity-effect of substrate structure, leaving group and attacking nucleophile. The von Richter, Sommelet-Hauser, and smiles rearrangements.

### Unit-II

#### (a) Aliphatic Electrophilic Substitution

Bimolecular mechanism-SE<sub>2</sub> and SE<sub>i</sub>. The SE<sub>1</sub> mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity.

#### (b) Aromatic Electrophilic Substitution

The arenium ion mechanism, orientation and reactivity. The ortho/para ratio, ipso attack, orientation in other ring system. Diazonium coupling, Vismier reaction, Gattermann-koch reaction.

### Unit III

#### (a) Free Radical Reactions

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvent on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by

diazonium salts. Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

(b) Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain.

#### **UNIT-IV**

##### **(a) Addition to Carbon-Hetero multiple Bonds**

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Wittig reaction. Mechanism of condensation reactions involving enolates- Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

##### **(b) Addition to Carbon-Carbon Multiple Bonds**

Mechanism and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio- and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Hydroboration. Michael reaction. Sharpless asymmetric epoxidation.

#### **Unit V**

##### **(a) Stereochemistry**

Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, stereospecific and stereoselective synthesis. Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

##### **(b) Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD)**

Definition, deduction of absolute configuration, octant rule for ketones

##### **(c) Pericyclic Reactions**

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach.  $4n$ ,  $4n+2$  and allyl systems. Cycloadditions- antarafacial and suprafacial additions,  $4n$ ,  $4n+2$  systems,  $2+2$  addition of ketenes, 1,3, dipolar cycloaddition and cheletropic reactions. Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3- and 5,5- sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements. Ene reaction.

#### **Books Suggested**

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum.
3. A guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold Cornell University Press.
5. Organic Chemistry, T.R. Morrison and R.N. Boyd, Prentice- Hall
6. Modern Organic Reactions, H.O. House, Benjamin.
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional.
8. Pericyclic Reactions S.M. Mukherji, Macmillan, India
9. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.

10. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
11. Stereochemistry of Organic Compounds, P.S. New Age International.
12. Quantum chemistry by Zimmerman Academic Press.

### **PAPER III- PHYSICAL CHEMISTRY**

**Paper Code-** 01MSC07103

**Max. Marks-** 100

**External -70 Marks**

**Internal - 30 Marks**

#### **Unit I**

##### **(a) Quantum Chemistry**

Schrödinger equation to some model systems viz., harmonic oscillator, the rigid rotor, the hydrogen atom. Applications of variation method and perturbation theory to the Helium atom.

##### **(b) Molecular Orbital Theory**

Huckel theory of conjugated systems, bond order and charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical, cyclobutadiene etc.

#### **Unit II**

##### **(a) Electrochemistry**

Electrochemistry of solutions, Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode., methods of determination. Semiconductor interfaces-theory of double layer at semiconductor, electrolyte, structure of double layer interfaces. Effect of light at semiconductor solution interface. Over potentials, exchange current density, Biochemistry- threshold membrane phenomena, Nernst-Planck equation, electrocardiography. Polarography theory, Ilkovic equation; half wave potential and its significance. Introduction to corrosion - forms of corrosion

#### **Unit III**

##### **Thermodynamics**

**(a) Thermodynamics** Concept of fugacity and determination of fugacity. Non-ideal systems: Excess functions for non-ideal solutions: Activity, activity coefficient, Debye-Huckel theory for activity coefficient for electrolytic solution; determination of activity and activity coefficient; ionic strength. Application of phase rule to three component system – acetic acid + chloroform + water

##### **(b) Statistical Thermodynamics**

Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulate of ensemble and averaging., corresponding distribution laws (using Lagrange's method of undetermined multipliers.) Partition functions- translational, rotational, vibrational and electronic partition functions, calculation of thermodynamic properties in terms of partition functions. Applications of partition functions. Chemical equilibria and equilibrium constant in terms of partition functions - Bose-Einstein statistics-distribution law and application to helium in brief.

#### **Unit IV**

##### **A. Chemical Dynamics**

Collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, ,methods of determining mechanism,), photochemical (hydrogen-

bromine reaction), acid base catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, flash photolysis, dynamics of unimolecular reactions (Lindemann-Hinshelwood and Rice-Ramsperger-Kassel-Marcus[RRKM] theories of unimolecular reactions).

### **Unit V**

#### **Surface Chemistry**

##### **(a) Adsorption**

Pressure difference across curved surface (Laplace equation), vapour pressure of droplets (kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation without derivation), catalytic activity at surfaces.

##### **(b) Micelles**

Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solubilization, micro emulsion, reverse micelles.

##### **(c) Macromolecules**

Electrically conducting, fire resistant, liquid crystal polymers, general mechanism and kinetics of polymerization.

#### **Books Suggested**

1. Physical Chemistry, P.W. Atkins, ELBS
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Coulson's Valence, R. McWeeny, ELBS
5. Chemical Kinetics, K.J. Laidler, Macgraw-Hill.
6. Kinetics and Mechanism of Chemical transformations, J. Rajaraman and J. Kuriacoose, McMillan.
7. Micelles, Theoretical and Applied Aspects, V. Moroi, Plenum
8. Modern Electrochemistry Vol.I and Vol. II J.O.M. Bockris and A.K.N. Reddy, Plenum
9. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
10. Phase Rule by Bowden.
11. Phase Rule by Y.K. Gupta.

## **PAPER IV- SPECTROSCOPY, DIFFRACTION**

**Paper Code- 01MSC07104**

**Max. Marks- 100**

**External -70 Marks**

**Internal - 30 Marks**

### **Unit I**

#### **(a) Symmetry and Group Theory in Chemistry**

Symmetry elements and symmetry operation, definitions of group, subgroup, relation between orders of a finite group and its subgroup Conjugacy relation and classes.

Point symmetry group

#### **(b) Raman Spectroscopy**



Classical and quantum theories of Raman effect. Pure rotational ,vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle. Resonance Raman spectroscopy, coherent anti Stokes Raman .

## **Unit-II**

### **X-ray Diffraction**

Bragg condition, Miller indices, Laue methods, Bragg method, Debye- Scherrer method of X-ray structural analysis of crystal, index reflections,. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules..

## **Unit III**

**(a) Molecular spectroscopy:** energy levels, molecular orbitals, vibrational transitions, vibration progression and geometry of the excited states, Franck- Condon Principle, electronic spectra of polyatomic molecules, Emission spectra, internal conversion, spectra of transition metal complexes, charge- transfer spectra.

### **(b) Photoelectron Spectroscopy**

Basic principles; photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules, chemical information from ESCA. Auger electron spectroscopy-basic idea.

Photoacoustic Spectroscopy :Basic principle of photoacoustic spectroscopy (PAS), PAS-gases and condensed systems, chemical and surface applications.

## **Unit-IV**

### **Electron Spin Resonance Spectroscopy**

Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and McConnell relationship, measurement techniques, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron) including biological systems .

### **Electron Diffraction**

Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules, Low energy electron diffraction and structure of surfaces.

## **.Unit-V**

### **Pharmaceutical –I**

Introduction,classification,synthesis and use of the following-

#### **1.General Anesthetics**

Ethyl Chloride, Cyclopropane, Methoxyflurane, Thiopental sodium, Methohexital sodium.

#### **2.Local Anaesthetics**

Mepivacain Hydrochloride, Phenacaine Hydrochloride, Benzamine Hydrochloride,

#### **3. Sedative and Hypnotics**

Baarbiturates and Non Barbiturates

#### **4. Antipyretic and Analgesic**

Paracetamol, Phenacetin, Aspirin, Aminophenazone, Mefenamic.

#### **5. Cardiovascular Drugs**

Hydralazine, Methyl dopa, Diazoxide.

#### **6. Diuretics**

Chloromerodrin Hg , Chlorothiazide, Benzthiazide, Ethoxzolamide, Disulfamide.

### Books Suggested

1. Modern Spectroscopy, J.M. John Wiley.
2. Applied Electron Spectroscopy for chemical Analysis Ed. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Chemical Applications of Group Theory, F.A. Cotton
6. Introduction to Molecular Spectroscopy, R. Chang, McGraw Hill.
7. Basic Principles of Spectroscopy, R. Chang, McGraw Hill.
8. Theory and Applications of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBH-Oxford.
9. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
10. Introduction to Magnetic Resonance, A. Carrington and A.D. Carrington and A.D. MacLachlan, Harper & Row.
11. Medicinal chemistry by Ashutosh Kar

## PRACTICALS

### Inorganic Chemistry

**Paper Code-** 01MSC07201

**Max. Marks-** 100

**External -**50 Marks

**Internal -** 50 Marks

**A.** Separation and determination of two metal ions Cu-Ni, Ni-Mg, Cu-Fe etc. involving volumetric and gravimetric methods.

**B.** Preparations

- (1)  $\text{TlO}(\text{C}_9\text{H}_8\text{NO})_2 \cdot 2\text{H}_2\text{O}$
- (2)  $\text{cis-K}[\text{Cr}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2]$
- (3)  $\text{Na}[\text{Cr}(\text{NH}_3)_2(\text{SCN})_4]$
- (4)  $\text{Mn}(\text{acac})_3$
- (5)  $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$
- (6) Prussian Blue, Turnbull's Blue.
- (7)  $\text{Co}(\text{NH}_3)_6[\text{Co}(\text{NO}_2)_6]$
- (8)  $\text{cis-}[\text{Co}(\text{trien})(\text{NO}_2)_2]\text{Cl} \cdot \text{H}_2\text{O}$
- (9)  $[\text{Co}(\text{Py})_2\text{Cl}_2]$
- (10)  $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$
- (11)  $\text{Ni}(\text{DMG})_2$
- (12)  $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$

## Organic Chemistry

**Paper Code-** 01MSC07202

**Max. Marks-** 100

**External -50 Marks**

**Internal - 50 Marks**

### A. Qualitative Analysis

Separation, purification identification of compounds of binary mixture(two solids)

Organic Synthesis

- (i) Acetylation: Acetylation of cholesterol and separation of cholesteryl acetate by column chromatography.
- (ii) Oxidation: Adipic acid by chromic acid oxidation of cyclohexanol.
- (iii) Aldol condensation: Dibenzal acetone from benzaldehyde.
- (iv) Sandmeyer reaction:p- chlorotoluene from p-toluidine
- (v) Cannizzaro reaction:4-Chlorobenzaldehyde as substrate.
- (vi) Friedel Crafts Reaction:  $\alpha$ -Benzoyl propionic acid from succinic anhydride and benzene.
- (vii) Aromatic electrophilic substitutions: Synthesis of p-nitroaniline and pbromoaniline.

**OR**

### B. Quantitative Analysis

- (i) Estimation of amines/phenols using bromide solution/or acetylation method.
- (ii) Determination of Iodine values of an oil sample.
- (iii) Determination of Acid values of an oil sample.
- (iv) Determination of saponification values of an oil sample
- (v) Determination of DO for a water sample.
- (vi) Determination of COD for a water sample.
- (vii) Determination of BOD for a water sample.

## Physical Chemistry

**Paper Code-** 01MSC07203

**Max. Marks-** 100

**External -50 Marks**

**Internal - 50 Marks**

1. Determination of congruent composition and temperature of a binary system (e.g. diphenylamine-benzophenone system).
2. To construct the phase diagram for three component system(e.g., chloroform-acetic acid-water).
3. Determination of the effect of (a) Change of temperature (b) Change of concentration of reactants and catalyst and (c) Ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions.
4. Determination of the velocity constant of hydrolysis of an ester/ionic reaction in micellar media.
5. Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction.

6. Determination of the primary salt effect on the kinetics of ionic reactions and testing of the Bronsted relationship (iodine ion is oxidised by persulphate ion)
7. Oscillatory reaction.
8. Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.
9. Determination of solubility and solubility product of sparingly soluble salts (e.g.,  $\text{PbSO}_4$ ,  $\text{BaSO}_4$ ) conductometrically.
10. Determination of the strength of strong and weak acids in a given mixture conductometrically.
11. To study the effect of solvent on the conductance of  $\text{AgNO}_3$ / acetic acid and to determine the degree of dissociation and equilibrium constant in different solvents and in their mixture (DMSO, DMF, dioxane, acetone, water) and to test the validity of Debye-Huckel-Onsager theory.
12. Determination of strengths of halides in a mixture potentiometrically.
13. Determination of the strengths of strong and weak acids in a given mixture using a potentiometer/pH meter.
14. Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometrically.
15. Acid-base titration in a non-aqueous media using a pH meter
16. Determination of activity and activity coefficient of electrolytes.
17. Determination of the dissociation constant of acetic acid in DMSO, DMF, acetone and dioxane by titrating it with KOH.
18. Determination of the dissociation constant of monobasic/dibasic acid.
19. Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.
20. Enzyme kinetics-inversion of sucrose

### Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly, Prentice Hall.
3. Experiments and Techniques in Organic Chemistry, D. Pastp, C. Johnson and M. Miller, Prentice Hall.
4. Macroscale and Microscale Organic Experiments, K.L. Williamson, D. C. Heath.
5. Systematic Qualitative Organic Analysis, H. Mideleton, Adward Arnold.
6. Handbook of Organic Analysis-Qualitative and Quantitative, H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
9. Findley's Practical Physical Chemistry, B.P. Levitt, longman.
10. Experiments Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.

### Seminar

**Paper Code-** 01MSC07204

**Max. Marks-** 100

Seminar includes the power point presentation on any one topic of theory.

## M. Sc. FINAL

### PAPER I. SPECTROSCOPY AND PHOTOCHEMISTRY

**Paper code:** 02MSC07101

**Max.Marks- 100**

**Theory -70 Marks**

**Internal - 30 Marks**

#### **Unit I**

##### **(a) Application of spectroscopy**

UV-Visible, IR,  $^1\text{H}$  NMR,  $^{13}\text{C}$  NMR, MASS-interpretation of common organic compounds.

#### **Unit-II**

##### **(a) Mossbauer Spectroscopy**

Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of  $\text{Fe}^{+2}$  and  $\text{Fe}^{+3}$  compounds including those of intermediate spin, (2)  $\text{Sn}^{+4}$  compounds- nature of M-L bond, (3) detection of oxidation state and inequivalent MB atoms.

##### **(b) Mass Spectrometry**

Introduction, ion production- EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak, Mc Lafferty rearrangement. Nitrogen rule. High resolution mass spectrometry.

Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

#### **Unit III**

##### **Electronic Properties and Band Theory**

Metals, insulators and semiconductors, electronic structure of solids band theory, band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties- Optical reflectance, photoconduction-photoelectric effects. Magnetic Properties- Classification of materials: quantum theory of paramagnetic

#### **Unit-IV**

##### **(a.) Photochemical Reactions**

Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

##### **(b.) Determination of Reaction Mechanism**

Classification, rate constants, and life times of reactive energy state-determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions-photo-dissociation, gas-phase photolysis.

#### **Unit-V**

##### **(a)Photochemistry of Alkenes**

Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5- dienes.

##### **(b) Photochemistry of Carbonyl Compounds**

Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic,  $\alpha,\beta$ -unsaturated and  $\alpha,\gamma$ -unsaturated compounds. Cyclohexadienones. Intermolecular cycloaddition reactions-dimerisations and oxetane formation.

**(c) Photochemistry of aromatic Compounds**

Isomerisations, additions and substitutions.

**Books Suggested**

1. Physical Methods for Chemistry, R.S. Drago, Saunders Company.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Craddock, ELBS
3. Infrared and Raman Spectra: Inorganic and Coordination Compounds, K. Nakamoto, Wiley.
4. Progress in Inorganic Chemistry vol. 8, ed., F.A. Cotton, vol. 15, ed. S.J. Lippard, Wiley.
5. Transition Metal Chemistry ed. R.L. Carlin vol. 3, Dekker.
6. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Horwood.
8. Practical NMR Spectroscopy, M.L. Martin, J.J. Delpuech and G.J. Martin, Heyden.
9. Spectrometric identification of Organic Compounds, R.M. Silverstein, G.C. Bassler and T.C. Morrill, John Wiley.
10. Introduction to NMR Spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Application of Spectroscopy of organic Compounds, J.R. Dyer, Prentice Hall.
12. Spectroscopic Methods in Organic Chemistry, D.H. Williams, I. Fleming, Tata McGraw Hill.
13. Fundamentals of Photochemistry, K.K. Rohtagi-Mukherji, Wiley-Eastern
14. Essentials of Molecular Photochemistry, A. Gilbert and J. Baggott, Blackwell Scientific Publication.
15. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
16. Introductory Photochemistry, A. Cox and T. Camp, McGraw Hill.
17. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
18. Organic Photochemistry, J. Coxon and B. Halton, Cambridge University Press.
19. Solid State Chemistry and its Applications, A.R. West, Plenum.
20. Principles of the Solid State, H.V. Keer, Wiley Eastern.
21. Solid State Chemistry, N.B. Hannay.
22. Solid State Chemistry, D.K. Chakrabarty, New Age International.

**PAPER II : ENVIRONMENT AND CHEMISTRY OF LIFE**

**Paper code:** 02MSC07102

**Max. Marks- 100**

**Theory -70 Marks**

**Internal - 30 Marks**

**Unit I**

**a. Air**

Chemical composition of atmosphere ions and radicals and their formation chemical and photochemical reactions in atmosphere. Green house effect, acid rain, ozone hole phenomenon, thermal inversion.

Source and toxic effects of Pb, Cd, Hg, As, Cr, Ni and Mn.

### **b. Air Pollution**

Classification of air pollutants- sources, effects and control of CO, SO<sub>2</sub>, NO, HC as gaseous pollutants, suspended particulate matter aerosols, photochemical air pollution.

### **Unit-II**

#### **(a) Water**

Water quality parameters and their analysis, purification and treatment of waste water.

#### **(b) Water Pollution**

Sources of water pollution- solid waste, industrial, agricultural, oil, radioactive waste, thermal pollution classification of water pollutants- basis, effects and controls. sampling of water pollutants.

#### **(c) Soil and Soil Pollution**

Brief introduction of pedagogy of soils, definition, components of soil, fertility management of soils, soil sediment analysis-physical and chemical parameters. Soil pollution- sources, detrimental effects and control.

### **Unit III**

#### **(a) Metal Ions in Biological Systems**

Definition and classification of metals

(b) Na<sup>+</sup>/K<sup>+</sup> Pump Role of bulk and trace metals ions in biological processes.

#### **(c) Bioenergetics**

Standards free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

#### **(d) Cell Membrane and Transport of Ions**

Ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

### **Unit IV**

#### **(a) Enzymes**

Introduction and historical perspective, chemical and biological catalysis,. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, . Enzyme kinetics, Michaelis Menten kinetics and Michaelis constant, reversible and irreversible inhibition.

#### **(b) Mechanism of Enzyme Action**

Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, Example of some typical enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A.

### **Unit V**

#### **Co-Enzyme Chemistry**

Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD<sup>+</sup>, NADP<sup>+</sup>, FMN, FAD, lipoic acid, vitamin B<sub>12</sub>. Mechanisms of reactions catalyzed by the above cofactors., syrups from corn starch, enzymes as targets for drug design, recombinant DNA technology.

### **Books Suggested**

1. Environmental Chemistry, S.E. Mannahan, Lewis Publishers.
2. Environmental Chemistry, Sharma & Kaur, Krishna Publishers.
3. Environmental Chemistry, A.K. De, Wiley Eastern.
4. Environmental Pollution Analysis, S.M. Khopkar, Wiley Eastern.
5. Standard Method of Chemical Analysis, F.J. Welcher Vol.III Van Nostrand Reinhold Co.
6. Element Annalysis of Airborne Particles, Ed. S. Landsbergeer and M. Creatchman, Gordon and Breach Science Publication.
7. Environmental Chemistry, C. Baird, W.H. Freeman.
8. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
9. Bioinorganic Chemistry, I Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
10. Inorganic Biochemistry vols I and II G.L. Eichhorn, Elsevier.
11. Progress in Inorganic Chemistry, Vols 18 and 38 ed. J.J. Luippard, Wiley.
12. Bioorganic Chemistry: A chemical Approach to Enzyme Action, Heeermann Dugas and C. Penny, Springerverlag.
13. Understanding Enzymes, Trevor Palmer, Prentice Hall.
14. Enzyme Chemistry: Impact and Applications, Ed. Collin J Suckling, Chapman and Hall.
15. Fundamental of Enzymology, N.C. Price and L. Stevens, Oxford University Press.
16. Immbilized Enzymes: An introduction and Application in Biotechnology, Michael D. Trevan, John Wiley.
17. Enzymatic Reaction Mechanisms, C. Walsh, W.H. Freeman.
18. Enzyme Structure and Mechanism, A Fersht, W.H. Freeman.
19. Biochemistry: The Chemical reactions of Living Cells, D.E. Metzler, Academic Press.
20. Enzyme Mechanisms Ed. M.I. Page and A. Williams, Royal Society of Chemistry.
21. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
22. Biochemistry, L. Stryer, W.H. Freeman
23. Biochemistry, J. David Rawn, Neil Patterson.
24. Biochemistry, Voet and Voet, John Wiley.
25. Outline of Biochemistry, E.E. Conn and P.K. Stumpf, John Wiley.
26. Bioorganic Chemistry: A chemical Approach to Enzyme Action, H. Dugas and C. Penny, Springer Verlag.
27. Macromolecules: Structure and Function, F. Wold, Prentice Hall.

### **PAPER: III ORGANIC SYNTHESIS**

**Paper code:** 02MSC07103

**Max.Marks- 100**

**Theory -70 Marks**

**Internal - 30 Marks**

#### **Unit I**

##### **(a) Oxidation**

Introduction, Different oxidative processes. Hydrocarbons- alkenes, aromatic rings, saturated C-H groups (activated and inactivated). Alcohols, diols, aldehydes, ketones, ketals and carboxylic acids. Amines, hydrazines and sulphides.



### **(b) Reduction**

Introduction. Different reductive processes. Hydrocarbons- alkanes, alkenes, alkynes and aromatic rings.

Carbonyl compounds- aldehydes, ketones, acids and their derivatives. Epoxides. Nitro, azo and

### **(c) Rearrangements**

General mechanistic considerations- nature of migration migratory aptitude, memory effects. A detailed study of the following rearrangements Pinacol-pinacolone, Wagner-Meerwein, Demjanov, Benzil-Benzilic acid, Favorskii, Arndt-Eistert synthesis, Beckmann, Hofmann, Curtius, Schemidt, Baeyer-Villiger, Shapiro reaction.

## **Unit II**

### **(a) Six-Membered Heterocycles with one Heteroatom**

Synthesis and reactions of quinolinium and benzopyrylium salts, coumarins and chromones.

### **(b) Benzo-Fused Five-membered Heterocycles**

Synthesis and reactions including medicinal applications of benzopyrroles, benzofurans and benzothiophenes. Meso-Ionic heterocycles

### **(c) Seven- and Large-membered Heterocycles**

Synthesis and reactions of azepines, oxepines, thiepinines, diazepines thiazepines.

### **(d) Six-Membered Heterocycles with Two or More heteroatoms**

Synthesis and reactions of tetrazines and thiazines.

## **Unit III**

### **Terpenoids and Carotenoids**

Classification, nomenclature, occurrence, isolation, general methods of structure determination, Structure determination, stereochemistry, synthesis of the following representative molecules: Citral, Geraniol,  $\alpha$ -Terpineol, Menthol, Farnesol, , Santonin, Phytol, Abietic acid and  $\beta$ -Carotene.

### **Alkaloids**

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, Structure, Stereochemistry, synthesis and biosynthesis of the following: Ephedrine, Nicotine, Atropine, Quinine and Morphine.

## **Unit IV**

### **Prostaglandins**

Occurrence, Nomenclature, Classification, biogenesis and physiological effects. Synthesis of PGE<sub>2</sub> and PGF<sub>2</sub> $\alpha$ .

### **Pyrethroids and Rotenones**

Synthesis and reactions of Pyrethroids and Rotenones. (For structure elucidation, emphasis is to be placed on the use of spectral parameters wherever possible.)

## **Unit-V**

### **Steroids**

Occurrence, nomenclature, basic skeleton, Isolation, structure determination and synthesis of Cholesterol, Bile acids, androsterone, estosterone, Estrone, Progesterone, Aldosterone.

### **Plant Pigment**

Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Quercetin, Myricetin, Diadzein, Butein, Cyanidin, Hirsutidin.

### **Porphyrins**

Structure and synthesis of Haemoglobin and Chlorophyll.

### **Book Suggested**

1. Modern Synthetic Reactions, H.O. House, W.A. Benjamin.
2. Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge Univ. Press.
3. Advanced Organic Chemistry, Reactions Mechanisms and Structure, J. March, John Wiley.
4. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional.
5. Advanced Organic Chemistry Part B, F.A. Carey and R.J. Sundberg, Plenum Press.
6. Rodd's Chemistry of carbon Compounds, Ed.S. Coffey, Elsevier.
7. Designing Organic Synthesis, S.Warren, Wiley.
8. Organic Synthesis – Concept, methods and starting Materials, J. Fuhrhop and G. Penzillin, Verlage VCH.
9. Some Modern Methods of Organic Synthesis. W.E. Carruthers, Cambridge Univ. Press.
10. Modern Synthesis Reactions, H.O. House, W.A.A. Benjamin,
11. Advanced organic Chemistry: Reactions, Mechanisms and Structure, J. March, Wiley
12. Principles of Organic Synthesis, R. Norman and J.M. Coxon, Blackie Academic & Professional.
13. Advanced Organic Chemistry Part B, F.A. Carey and R.J. Sundberg, Plenum Press.

### **PAPER: IV -HETEROCYCLIC, PHARMACEUTICALS –II, NATURAL PRODUCT**

**Paper code:** 02MSC07106

**Max. Marks- 100**

**Theory -70 Marks**

**Internal - 30 Marks**

#### **Unit I**

Introduction, classification, synthesis and use of the following-

**Non Steroidal Anti-inflammatory Drug** Iodomethacin, Ibuprofen, Naproxen.

**Sulphonamide** Sulfanilamide, Sulfapyridine, Sulfadiazine,

Sulfamethizole, Sulfacetamide, Sulfafurazole,

Sulfaguanidine, Succinylphthiazole, Mefenide, Dapsone.

**Antimalarial** Chloroquine, Phosphate, Santoquine, Pamaquine, Pentaquine phosphate, Hydroquine Sulphate, Primethamine.

**Antibiotics** Penicillins, Ampicillin, Chloramphenicol, Tetracyclin.

**Antimycobacterial Drugs** Ofloxacin, Ciprofloxacin Hydrochloride.

**Antineoplastic Agent** Melphalan, Cyclophosphamide, Busulfan, Carmustine, Pipobroman.

**Antipsychotics Drugs** Deserpidine, Pipradrol, Chloropramazine, Haloperidol.

#### **Unit II**

**Six-Membered Heterocycles with one Heteroatom**

Synthesis and reactions of quinolizinium and benzopyrylium salts, coumarins and chromones.

#### **Benzo-Fused Five-membered Heterocycles**

Synthesis and reactions including medicinal applications of benzopyrroles, benzofurans and benzothiophenes. Meso-Ionic heterocycles

#### **Seven-and Large-membered Heterocycles**

Synthesis and reactions of azepines, oxepines, thiepinines, diazepines thiazepines.

#### **Six-Membered Heterocycles with Two or More heteroatoms**

Synthesis and reactions of tetrazines and thiazines.

### **Unit-III**

#### **Terpenoids and Carotenoids**

Classification, nomenclature, occurrence, isolation, general methods of structure determination, Structure determination, stereochemistry, synthesis of the following representative molecules: Citral, Geraniol,  $\alpha$ -Terpineol, Menthol, Farnesol, , Santonin, Phytol, Abietic acid and  $\beta$ -Carotene.

#### **Alkaloids**

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, Structure, Stereochemistry, synthesis and biosynthesis of the following: Ephedrine, Nicotine, Atropine, Quinine and Morphine.

### **Unit IV**

#### **Prostaglandins**

Occurrence, Nomenclature, Classification, biogenesis and physiological effects. Synthesis of PGE<sub>2</sub> and PGF<sub>2</sub> $\alpha$ .

#### **Pyrethroids and Rotenones**

Synthesis and reactions of Pyrethroids and Rotenones. (For structure elucidation, emphasis is to be placed on the use of spectral parameters wherever possible.)

### **Unit-V**

#### **Steroids**

Occurrence, nomenclature, basic skeleton, Isolation, structure determination and synthesis of Cholesterol, Bile acids, androsterone, estosterone, Estrone, Progesterone, Aldosterone.

#### **Plant Pigment**

Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Quercetin, Myricetin, Diadzein, Butein, Cyanidin, Hirsutidin.

#### **Porphyryns**

Structure and synthesis of Haemoglobin and Chlorophyll.

### **Books Suggested**

1. Heterocyclic Chemistry Vol.1-3, R. R. Gupta, M. Kumar and V. Gupta, Springer Verlag.
2. The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.
3. Heterocyclic Chemistry, J. A. Joule, K. Mills and G.F. Smith, Chapman and Hall.
4. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical.
5. Contemporary Heterocyclic Chemistry, G.R. Newkome and W.W. Paudler, Wiley-Inter Science.
6. An introduction to the Heterocyclic Compounds, R.M. Acheson, John Wiley.
7. Comprehensive Heterocyclic Chemistry, A.R. Katritzky and C.W. Reeds, eds. Pergamon Press.
8. Natural Products: Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthorpe and J.B. Harborne, Longman, Essex.

9. Organic Chemistry, Vol 2, I.L. Finar, ELBS.
10. Stereoselective Synthesis: A practical Approach, M. nogradi, VCH.
11. Rodd's Chemistry of Carbon Compounds, Ed. S. Coffey, Elsevier.
12. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A.Marston, Harwood Academic Publishers.
13. Introduction to Flavonoids, B.A. Bohm, Harwood Academic Publishers.
14. New Trends in Natural Products Chemistry, Atta-ur-Rahman and M.I. Choudhary, Harwood Academic Publishers.
15. Insecticides of Natural Origin, Sukhdev, Harwood Academic Publishers.

## PRACTICALS

### Inorganic Chemistry

**Paper Code- 02MSC07201**

**Max. Marks- 100**

**External -50 Marks**

**Internal - 50 Marks**

#### **A. Spectrophotometric Determination (Any Three)**

- a. Manganese/Chromium/ Vanadium in steel sample
- b. Nickel/molybdenum/tungston/ vanadium/uranium by extractive spectrophotometric method.
- c. Fluoride/ nitrite/ phosphate
- d. Iron-phenanthroline complex: Job's Method of continuous variations.
- e. Zirconium-Alizarin Red-S complex: Mole-ratio method.
- f. Copper-Ethylene diamine complex: Slope-ratio method.

**OR**

#### **B. Flame Photometric Determinations(Any Three)**

- a. Sodium and potassium when present together
- b. Lithium/ calcium/barium/ strontium
- c. Cadmium and magnesium in tap water
- d. Sulphate
- e. Phosphate
- f. Silver

**OR**

#### **C. Chromatographic Separations (Any Three)**

- a. Cadmium and Zinc
- b. Zinc and Magnesium
- c. Thin-layer chromatography-separation of nickel, manganese, cobalt and zinc. Determination of R<sub>f</sub> values.
- d. Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of R<sub>f</sub> values.

## Organic Chemistry

Paper Code: 02MSC07202

**Max. Marks- 100**

**External -50 Marks**

**Internal - 50 Marks**

### Qualitative Analysis

**A.** Separation, purification and identification of the components of mixture of three organic compounds (three solids or two liquids and one solid, two solids and one liquid) using TLC for checking the purity of the separated compounds, chemical analysis.

### **B. Multi-Step Synthesis of Organic Compounds (any four)**

The exercise should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

(i) Photochemical reaction

Benzophenone → benzpinacol → benzpinacolone

(ii) Beckmann rearrangement: benzanilide from benzene

Benzene → Benzophenone → Benzophenone oxime → Benzanilide

(iii) Benzilic acid rearrangement : Benzilic acid from benzoin

Benzoin → Benzil → Benzilic acid

(iv) Synthesis of heterocyclic compounds

Skraup synthesis: preparation of quinoline from aniline Fisher-Indole

synthesis : Preparation of 2- phenylindole from phenylhydrazine.

(v) Enzymatic synthesis

enzymatic reduction: Reduction of ethyl acetoacetate using Baker's yeast to yield enantiomeric excess of S(+) ethyl-3-hydroxybutanoate and determine its optical purity.

(vi) Biosynthesis of ethanol from sucrose

(vii) Synthesis using microwaves

Alkylation of diethyl malonate with benzyl chloride.

(viii) Synthesis using phase transfer catalyst

(ix) Alkylation of diethyl malonate or ethyl acetoacetate with an alkyl halide

**OR**

### **C. Extraction of Organic Compounds from Natural Source (Any Five)**

1. Isolation of caffeine from tea leaves.

2. Isolation of casein from milk (the students are required to try some typical colour reactions of proteins)

3. Isolation of lactose from milk (purity of sugar should be checked by TLC and PC and R<sub>f</sub> value reported.)

4. Isolation of nicotine dipicrate from tobacco.

5. Isolation of cinchonine from cinchona bark.

6. Isolation of piperine from black pepper.

7. Isolation of lycopene from tomatoes.

8. Isolation of  $\beta$ -carotene from carrots.

9. Isolation of oleic acid from olive oil (involving the preparation of complex with urea and separation of linoleic acid.

10. Isolation of eugenol from cloves.

11. Isolation of (+) limonene from citrus rinds.

### **D. Spectroscopy**

Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR)

**OR**

**I. Spectrophotometric (UV/VIS) Estimations ( Any Three)**

1. Amino acids
2. Proteins
3. Carbohydrates
4. Cholesterol
5. Ascorbic acid
6. Aspirin
7. Caffeine

**Physical Chemistry**

**Paper Code: 02MSC07203**

**Max. Marks- 100**

**External -50 Marks**

**Internal - 50 Marks**

Determination of partial molar volume of solute (e.g. KCl) and solvent in a binary mixture.

2. Determination of the temperature dependence of the solubility of a compound in two solvents having similar intermolecular interactions (benzoic acid in water and in DMSO water mixture) and calculate the partial molar heat of solution.

3. Determination of pK<sub>a</sub> of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media

4. Determination of stoichiometry and stability constant of inorganic (e.g. ferri-salicylic acid) and organic (e.g. amine-iodine) complexes.

5. Characterization of the complexes by electronic and IR spectral data.

6. Estimation of Pb<sup>2+</sup> and Cd<sup>2+</sup>/Zn<sup>2+</sup> and Ni<sup>2+</sup> by polarography.

7. Determination of dissolved oxygen in aqueous solution of organic solvents.

8. Measurements of resistance with multimeter.

9. To measure the resistance of the given ameter.

10. Voltage measurement with CRO.

**Seminar**

**Paper Code- 02MSC07204**

**Max. Marks- 100**

**Note:** Head of the Department will award the Seminar marks and will handover it to the board of examiners. Seminar includes the power point presentation on any one topic of theory

**Books suggested**

1. Inorganic Experiments, J. Derek Woollins, VCH.
2. Microscale Inorganic Chemistry, Z. Sqafran, R.M. Pike and M.M. Singh, Wiley.
3. Practical Inorganic Chemistry, G.Marr and B.W. Rockelt, Van Nostrand.
4. The Systematic Identification of Organic Compounds, R.L. Shriner and D.Y. Cutin.
5. Semimicro Qualitative Organic Analysis, N.D. Cheronis, J.B. Entrikin and E.M. Hodnett.
6. Experimental Organic Chemistry, M.P. Doyle and W.S. Mungall

7. Small scale Organic Preparations, P. J. Hill.
8. Organometallic Synthesis, J.J. Fisch and R.B. King, Academic.
9. Experimental Physical Chemistry, D.P. Shoemaker, C.W. Garland and J.W. Niber, McGraw Hill Interscience.
10. Findlay's Practical Physical Chemistry, revised B.P. Levitt, Longman
11. Experiments in Physical Chemistry, J. C. Ghosh, Bharti Bhavan.

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