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DEVI AHILYA VISHWAVIDYALAYA, INDORE

Scheme of Marks

M. Sc. Chemistry

2019-20

SEMESTER -- I

Paper	Compulsory/Optional	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	INORGANIC CHEMISTRY	401	85+ 15(CCE) = 100
II	Compulsory	ORGANIC CHEMISTRY	402	85+ 15(CCE) = 100
III	Compulsory	PHYSICAL CHEMISTRY	403	85+ 15(CCE) = 100
IV	Compulsory	GROUP THEORY & SPECTROSCOPY I	404	85+ 15(CCE) = 100
V	For Students Without Mathematics in B.Sc.	MATHEMATICS FOR CHEMISTS	405(a)	85+ 15(CCE) = 100
	For Students Without Biology in B.Sc.	BIOLOGY FOR CHEMISTS	405(b)	85+ 15(CCE) = 100
		PRACTICAL - 1. Inorganic 2. Organic 3. Physical		33 33 34 =100
		Total		600

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER - I)

Paper No. : I (Code-MCH-401)
 Compulsory / Optional : Compulsory
 Max. Marks : 100

Paper - I : Inorganic Chemistry

Unit - I	Stereochemistry and Bonding in Main Group Compounds : VSEPR, Walsh diagram (triatomic and penta-atomic molecules), $d\pi-p\pi$ bond, Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.
Unit - II	Metal-Ligand Equilibrium in Solution Stepwise and overall formation constants and their interaction, trends in stepwise constant, 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 potentiometry and spectrophotometry.
Unit - III	Reaction Mechanism of Transition Metal Complexes Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anion reactions, 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	Metal-Ligand bonding Limitation of crystal field theory, molecular orbital theory for bonding in octahedral, tetrahedral and square planar complexes, π -bonding and molecular orbital theory.
Unit - V	HSAB Theory Classification of acids and bases as hard and soft; HSAB principle, theoretical basis of hardness and softness; Lewis-acid base reactivity approximation; donor and acceptor numbers, E and C equation; applications of HSAB concept.

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.I. Carlin, Springer Verlag.
6. Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER – I)

Paper No. : **II (Code- MCH-402)**
 Compulsory / Optional : **Compulsory**
 Max. Marks : **100**

Paper – II : Organic Chemistry

Unit – I	<p>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, alternate and non-alternate hydrocarbons. Huckel's rule, energy level of π-molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO approach. Bonds weaker than covalent-addition compounds, crown ether complexes and cryptands, inclusion compound, catenanes and rotaxanes.</p>
Unit – II	<p>Stereochemistry Strain due to unavoidable crowding, Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spirane) chirality due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.</p>
Unit – III	<p>Conformational analysis and linear free energy relationship Conformational analysis of cycloalkanes, decalines, effect of conformation on reactivity, conformation of sugars. Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes. The Hammett equation and linear free energy relationship, substituents and reaction constants, Taft equation.</p>
Unit – IV	<p>Reaction Mechanism : Structure and Reactivity Type of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotopes effects.</p>
Unit – V	<p>Aliphatic Nucleophilic Substitution The S_N^2, S_N^1 mixed S_N^1 and S_N^2 and SET mechanism. The neighboring group mechanism, neighboring group participation by p and s bonds, anchimeric assistance. Classical and nonclassical carbocations, phenonium ions, norbornyl systems, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations. The S_N^1 mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.</p>

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, R.T. 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. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
9. Pericyclic Reactions, S.M. Mukherji, Macmillan, India
10. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International.
11. Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER - I)

Paper No. : III (Code- MCH-403)
Compulsory /Optional : Compulsory
Max. Marks : 100

Paper - III : Physical Chemistry

Table with 2 columns: Unit and Description. Units include: Unit - I: Introduction to Exact Quantum Mechanical Results; Unit - II: Approximate Methods, Molecular Orbital Theory; Unit - III: Angular Momentum; Unit - IV: Classical Thermodynamics; Unit - V: Statistical Thermodynamics.

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Books Suggested :

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Coulson's Valence, R. Mc Ween y, ELBS.
5. Chemical Kinetics. K. J. Laidler, McGraw-Hill.
6. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan.
7. Micelles, Theoretical and Applied Aspects. V. MOraoi, Plenum.
8. Modern Electrochemistry Vol. 1 and Vol. II J.O.M. Bockris and A.K.N. Reddy, Planum.
9. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
10. Introduction to Quantum Chemistry-R.K. Prasad, New Age Publication.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER - I)

Paper No.

: IV (Code-MCH-404)

Compulsory / Optional

: Compulsory

Max. Marks

: 100

Paper - IV : Group Theory & Spectroscopy I

Unit - I	<p>Symmetry and Group theory in Chemistry Symmetry elements and symmetry operation, definition of group, subgroup. Conjugacy relation and classes. Point symmetry group. Schonflies symbols, representations of groups by matrices (representation for the C_n, C_{nv}, C_{nh}, D_{nh} group to be worked out explicitly). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use; spectroscopy. Derivation of character table for C_{2v} and C_{3v} point group Symmetry aspects of molecular vibrations of H_2O molecule.</p>
Unit - II	<p>Microwave Spectroscopy Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, nonrigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field applications.</p>
Unit - III	<p>Infrared Spectroscopy Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity. Morse potential energy diagram, vibration-rotation spectroscopy, P, Q, R, branches. Breakdown of Oppenheimer approximation; vibrations of polyatomic molecule, selection rules, normal modes of vibration, group frequencies, overtone bands, factors affecting the band positions and intensities, far IR region, intermolecular vibrations, normal coordinate analysis.</p>
Unit - IV	<p>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 spectroscopy (CARS).</p>
Unit - V	<p>Electronic Spectroscopy Molecular Spectroscopy Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules, emission spectra; radiative and non-radioactive decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra.</p> <p>Photoelectron Spectroscopy Basic principles; photo-electric effect, ionization process, Koopman's theorem, Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA, Auger electron spectroscopy-basic idea.</p>

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Books suggested:

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Applied Electron Spectroscopy for chemical analysis d. 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, Macleers College
5. Chemical Applications of Group Theory, F.A. Cotton
6. Introduction to Molecular Spectroscopy, G.M. Barrow, Me Graw Hill.
7. Basic Principles of Spectroscopy, R. Chang, Me Graw Hill.
8. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBH- Oxford.
9. Introduction to Photoelectron Spectroscopy, P. Xie-shi, John Wiley.
10. Introduction to Magnetic Resonance, A Carrington and A.D. MacLachalan, Harper & Row.

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DEVI AHILYA VISHWAVIDYALAYA , INDORE

M.Sc. CHEMISTRY (SEMESTER – I)

Paper No. : V [Code – 405(a)]
 Compulsory / Optional : Compulsory
 Max. Marks : 100

Paper – V : (a) MATHEMATICS FOR CHEMISTS

(For students without Mathematics in B.Sc.)

Unit-I	Vectors Vectors, dot, cross and triple products etc. gradient, divergence and curl, Vector Calculus. Matrix Algebra Addition, subtraction, multiplication, Transpose of matrix, Symmetric and Skew-symmetric matrices, Singular and non-singular matrices, Adjoint of a matrix, inverse of a square matrix, Determinants (Examples from Huckel's Theory).
Unit-II	Differential Calculus Functions, continuity and differentiability, rules for differentiation, applications of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution etc.).
Unit-III	Integral calculus Basic rules for integration, integration by parts, partial fractions and substitution. Reduction formulae, applications of integral calculus. Functions of several variables, partial differentiation, co-ordinate transformations (e.g. Cartesian to spherical polar).
Unit-IV	Elementary Statistics Organizing and Displaying Data Variables, Univariate Data , Bivariate Data, Random Variables, Summarizing Data and Variation : The Mean, The Median, The Mode , The Mean Deviation, The Variance and Standard Deviation, Coefficient of Variation.
Unit-V	Permutation and Probability Permutations and combinations, probability and probability theorems average, variance root means square deviation examples from the kinetic theory of gases etc., fitting (including least squares fit etc with a general polynomial fit.

Book Suggested

1. The chemistry Mathematics Book, E.Steiner, Oxford University Press.
2. Mathematics for chemistry, Doggett and Suicliffe, Logman.
3. Mathematical for Physical chemistry : F. Daniels, Mc. Graw Hill.
4. Chemical Mathematics D.M. Hirst, Longman.
5. Applied Mathematics for Physical Chemistry, J.R. Barante, Prentice Hall.
6. Basic Mathematics for Chemists, Tebbutt, Wiley.





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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER - I)

Paper No. : V [Code-405(b)]
Compulsory / Optional : Compulsory
Max. Marks : 100

Paper - V : (b) Biology For Chemists

(For students without Biology in B.Sc.)

Table with 2 columns: Unit and Description. Units include Cell Structure and Functions, Carbohydrates, Lipid, Amino-acids, Peptides and Proteins, and Nucleic Acids.

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Books suggested :

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman.
3. Biochemistry, J. David Rawan, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outlines of Biochemistry E.E. Conn and P.K. Stampf, John Wiley.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE
M. Sc. CHEMISTRY PRACTICALS (SEMESTER - I)

Practical examination shall be conducted separately for each branch : (Duration : 6-8 hrs in each branch).

Inorganic Chemistry

Qualitative & Quantitative Analysis	12
Chromatography	06
Preparation	06
Record	04
Viva Voce	<u>05</u>
Total :	33

Qualitative Analysis :

- (a) Analysis of Less common metal ions : W, Mo, Se, Ti, Zr, Ce, V, etc. (Two metal ion in cationic / anionic forms).
- (b) Analysis of Insoluble residue : Oxides, sulphates & halides.

Quantitative Analysis : Separation & estimation of two metal ions viz., Cu - Zn, Fe - Mg, Ni - Zn, etc. involving volumetric & gravimetric methods.

Chromatography: Separation, identification & determination of cations & anions by Paper Chromatography.

Preparation: Preparation of selected inorganic complexes, their analysis, test & characterization by spectral techniques (may be)

- (1) VO (acac)₂.
- (2) Ni (acac)₂.
- (3) [Co(NH₃)₆]Cl₃.
- (4) NH₄ [Cr (NH₃)₂(SCN)₄] ... Reinecke's salt.
- (5) Prussian Blue ; Turnbull's Blue.
- (6) Oxalate complexes of Chromium (III) & Copper (II).

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Organic Chemistry

Qualitative Analysis	12
Organic Synthesis	12
Record	04
Viva-Voce	<u>05</u>
Total :	33

Qualitative Analysis : Separation, purification & identification of compounds of ternary mixture (solid or solid + liquid) using TLC & columns chromatography, chemical tests. IR spectra to be used for functional group identification.

Organic Synthesis :

Acetylation, Nitration, Halogenation, Oxidation, Reduction, Polymerization.

Physical Chemistry

Any one Experiment / Exercise from Section - A	12
Any one Experiment / Exercise from Section - B	13
Record	04
Viva-Voce	<u>05</u>
Total :	34

ANALYTICAL

Error Analysis & Statistical Data Analysis

Errors, types of errors, minimization of error, calibration curves, precision, accuracy & combination; statistical treatment for error analysis - standard deviation, null hypothesis, rejection criteria, t & Q - test; linear regression and its, curve fitting. Calibration of volumetric apparatus : Burette, pipette & standard flask.

Adsorption : To study surface tension - concentration relationship for solutions (Gibb's equation).

Phase Equilibria :

- (i) Determination of congruent composition & temperature of a binary system (e.g., diphenylamine - benzophenone system)
- (ii) Determination of glass transition temperature of given salt (e.g., CaCl₂) conductometrically.
- (iii) To construct the phase diagram for binary immiscible system (e.g., chloroform - acetic acid - water).

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Section – B

Chemical Kinetics :

- (i) Determination of the effect of (a) Change of temperature (b) Change of concentration of reactant & catalyst & (c) Ionic strength of the media on the velocity constant of hydrolysis of an ester / ionic reaction.
- (ii) Determination of the velocity constant of hydrolysis of an ester / ionic reaction in micellar media.
- (iii) Determination of the velocity constant for the oxidation of iodide ions by hydrogen peroxide. Study the kinetics as an iodine clock reaction.
- (iv) Flowing clock reactions (Ref : Experiments in Physical Chemistry by Showmaker).
- (v) Determination of the primary salt effect on the kinetics of ionic reaction & testing of the Bronsted relationship (iodide ion is oxidized by persulphate ion).

Solution:

- (i) Determination of molecular weight of non – volatile & electrolyte / electrolyte by cryoscopic method & to determine the activity coefficient of an electrolyte.
- (ii) Determination of the degree of dissociation of weak electrolyte & to study the deviation from ideal behavior that occurs with a strong electrolyte.

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.P. Pasto, 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. Middleton, Edward Arnold.
6. Handbook of Organic Analysis-qualitative and quantitative, H. Clark, Edward Arnold.
7. Vogel's Textbook of Practical Chemistry, 5th edn, A.R. Fehlebrand, John Wiley.
8. Practical Physical Chemistry, A.M. Jones, G.H. E. Prichard, Longman.
9. Findley's Practical Physical Chemistry, 2nd edn, Longman.
10. Experimental Physical Chemistry, R.K. Murthy and B. Behera, Tata McGraw Hill.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

Scheme of Marks

M. Sc. Chemistry

SEMESTER - II

Paper	Compulsory/Optional	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	INORGANIC CHEMISTRY	406	85+ 15(CCE) = 100
II	Compulsory	ORGANIC CHEMISTRY	407	85+ 15(CCE) = 100
III	Compulsory	PHYSICAL CHEMISTRY	408	85+ 15(CCE) = 100
IV	Compulsory	SPECTROSCOPY II & DIFFRACTION METHODS	409	85+ 15(CCE) = 100
V	Compulsory	COMPUTER FOR CHEMISTS	410	85+ 15(CCE) = 100
		PRACTICAL - 1. Inorganic		33
		2. Organic		33
		3. Physical		34
				=100
		Total		600

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER - II)

Paper No. : I (Code-MCH-406)
Compulsory /Optional : Compulsory
Max. Marks : 100

Paper - I : Inorganic Chemistry

Table with 2 columns: Unit and Description. Units include: Unit - I: Electronic Spectral Studies of Transition Metal Complexes; Unit - II: Magnetic Properties of Transition Metal Complexes; Unit - III: Metal pi-Complexes; Unit - IV: Metal-Clusters; Unit - V: Optical Rotatory Dispersion and Circular Dichroism.

Books Suggested :

- 1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huheey, 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.I. Carlin, Springer Verlag.
6. Comprehensive Coordiantion Chemistry eds. G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty, Pergamon.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER - II)

Paper No. : II (Code-MCH-407)
Compulsory /Optional : Compulsory
Max. Marks : 100

Paper - II : Organic Chemistry

Table with 2 columns: Unit and Description. Unit I: Aromatic Electrophilic Substitution, Aromatic Nucleophilic Substitution. Unit II: Free Radical Reactions. Unit III: Addition Reactions. Unit IV: Addition to Carbon-Hetero Multiple bonds, Elimination Reactions.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER - II)

Paper No. : III (Code- MCH-408)
Compulsory /Optional : Compulsory
Max. Marks : 100

Paper - III : Physical Chemistry

Table with 2 columns: Unit and Description. Units include Chemical Dynamics, Surface Chemistry, Macromolecules, and Non-Equilibrium Thermodynamics.

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Unit -V	Electrochemistry Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination. Structure of electrified interfaces. Overpotentials, exchange current density, derivation of Butler Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces-theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface. Polarography theory, Ilkovic equation; half wave potential and its significance.
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Books Suggested :

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Coulson's Valence, R. Mc Ween y, ELBS.
5. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
6. Kinetics & Mechanism of Chemical Transformation J.Rajaraman & J. Kuriacose, Mc Millan.
7. Micelles. Theoretical and Applied Aspects. V. MOraoi, Plenum
8. Modern Electrochemistry Vol. 1 and Vol. II B.O.M. Bockris and A.K.N. Reddy, Planum.
9. Introduction to Polymer Science, V.R.Gowarikar, N.V. Vishwanathan and J.Sridhar, Wiley Eastern.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER - II)

Paper No. : IV (Code- MCH - 409)
Compulsory /Optional : Compulsory
Max. Marks : 100

Paper - IV : Spectroscopy II & Diffraction Methods

Table with 2 columns: Unit and Description. Units include Nuclear Magnetic Resonance Spectroscopy, Nuclear Quadrupole Resonance Spectroscopy, Electron Spin Resonance Spectroscopy, X-ray Diffraction, and Electron Diffraction.

Books suggested:

- 1. Modern Spectroscopy, J.M. Hollas, John Wiley
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Inter science.
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, G.M. Barrow, Mc Graw Hill.
7. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
8. Theory and Application 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 Cunningham and A.D. MacLachlan, Harper & Row.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER - II)

Paper No. : V (Code- MCH - 410)
Compulsory /Optional : Compulsory
Max. Marks : 100

Paper - V : Computers For Chemists

This is a theory cum-laboratory course with more emphasis on laboratory work.

Table with 2 columns: Unit and Description. Units include: Unit - I: Introduction to computers and Computing; Unit - II: Computer Programming in FORTRAN/C/BASIC; Unit - III: Programming in Chemistry; Unit - IV: Use of Computer Programmes; Unit - V: Internet.

Books suggested:

- 1. Fundamentals of Computer : V. Rajaraman (Prentice Hall)
2. Computers in Chemistry : K.V. Raman (Tata Mc Graw Hill)
3. Computer Programming in FORTRAN IV-V Rajaraman (Prentice Hall)

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DEVI AHILYA VISHWA VIDYALAYA, INDORE
M. Sc. CHEMISTRY PRACTICALS (SEMESTER - II)

Practical examination shall be conducted separately for each branch : (Duration : 6-8 hrs in each branch).

Inorganic Chemistry

Chromatography	12
Preparations	12
Record	04
Viva-Voce	<u>05</u>
Total :	33

Chromatography : Separation, identification & determination of cations & anions by Column Chromatography : Ion exchange.

Preparations : Preparation of selected inorganic complexes, their analysis, test & characterization by spectral techniques (may be).


- | | |
|--------------------------------|-------------------------------------|
| (1) $K_3[Cr(SCN)_6].4H_2O$. | (5) $[Co(py)_2Cl_2]$. |
| (2) $[Co(NH_3)_4(NO_2)_2]Cl$. | (6) $[Cu_3[CS(NH_2)]_2SO_4.2H_2O$. |
| (3) $[Co(NH_3)_5Cl]Cl_2$. | (7) $Na_3[Co(NO_2)_6]$. |
| (4) $Ni(dmgl)_2$. | |

Organic Chemistry

Organic Synthesis	12
Quantitative Analysis	12
Record	04
Viva-Voce	<u>05</u>
Total :	33

Organic Synthesis :

- (A) Synthesis involving name reactions :
- (i) Sandmeyer's reaction.
 - (ii) Cannizaro's reaction.
 - (iii) Diel's Alder reaction.
 - (iv) Knoevenagel reaction.

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(B) Synthesis of Dyes :

- (i) Phenolphthalein, (ii) Fluorescein, (iii) Diazotization followed by coupling.

Quantitative Estimations :

1. Determination of the percentage or number of hydroxyl groups in an organic compound by Acetylation method.
2. Estimation of amines / phenols using Bromate – Bromide solution or Acetylation method.
3. Saponification value, iodine value & acid values of an oil or fat.

Physical Chemistry

Any one Experiment / Exercise from Section – A	12
Any one Experiment / Exercise from Section – B	13
Record	04
Viva-Voce	<u>05</u>
Total :	34

Section – A

Conductometry

- (i) Determination of the velocity constant, order of the reaction & energy activation for saponification of ethyl acetate by sodium hydroxide conductometrically.
- (ii) Determination of solubility & solubility product of sparingly soluble salts (e.g., $PbSO_4$, $BaSO_4$) conductometrically
- (iii) Determination of the strength of strong & weak acid in a given mixture conductometrically.
- (iv) To study the effect of solvent on the conductance of $AgNO_3$ – acetic acid & to determine the degree of dissociation & equilibrium constant in different solvents & in their mixtures (DMSO, DMF, dioxane, acetone, water) & to test the validity of Debye – Huckel – Onsager theory.
- (v) Determination of the activity coefficient of zinc ions in the solution of 0.002M zinc sulphate using Debye Huckel's limiting law.

Polarimetry

- (i) Determination of rate constant for hydrolysis / inversion of sugar using a polarimeter.
- (ii) Enzyme kinetics – inversion of sucrose.

Section - B

Potentiometry / pH metry

1. Determination of strengths of halides in a mixture potentiometrically.
2. Determination of the strengths of strong & weak acids in a given mixture using a Potentiometer / pH-meter.
3. Determination of temperature dependence of EMF of a cell.
4. Determination of the formation constant of silver - ammonia complex & stoichiometry of the complex Potentiometrically.
5. Acid - base titration in a non - aqueous media using a pH-meter.

Refractometry

Determination of Refractive indices & specific refractions, Molar & atomic refractivities, composition of a mixture of liquids, concentration of sugar in a solution & polarizabilities of liquids.

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.P. Pasto, 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. Middleton, 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. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.

J.S. J.P. A. Sharma

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