

26

DEVI AHILYA VISHWAVIDYALAYA, INDORE

Scheme of Marks

M. Se. Chemistry

SEMESTER - III

Paper	Compulsory/Optional	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	APPLICATION OF SPECTROSCOPY-I	501	85+ 15(CCE) = 100
II	Compulsory	PHOTOCHEMISTRY	502	85+ 15(CCE) = 100
III	Compulsory	ENVIRONMENTAL CHEMISTRY	503	85+ 15(CCE) = 100
IV	Optional -I	ANY TWO	504-508	85+ 15(CCE) = 100
V	Optional -II			85+ 15(CCE) = 100
		PRACTICAL-1. Inorganic		33
		2. Organic		33
		3. Physical		34
				=100
			Total	600

103

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Q = 100

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

Paper No. : I (Code-MCH-501)
Compulsory / Optional : Compulsory
Max. Marks : 100

PAPER I : APPLICATION OF SPECTROSCOPY-I

Unit - 1	Electronic Spectroscopy: Electronic Spectral Studies for $d^1 - d^9$ systems in octahedral, tetrahedral and square planer complexes
Unit - 2	Vibrational Spectroscopy Symmetry and shapes of AB_2, AB_3, AB_4, AB_5 and AB_6 , mode of bonding of ambidentate ligands, nitrosyl, ethylenediamine and diketonato complexes, application of resonance Raman spectroscopy and its applications.
Unit - 3	Nuclear Magnetic Resonance Spectroscopy-I General introduction and definition, chemical shift, spin-spin interaction, shielding and deshielding, mechanism, mechanism of measurement of chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto),
Unit - 4	Nuclear Magnetic Resonance Spectroscopy-II Chemical exchange, effect of deuteration, Complex spin spin interaction between two, three, four and five nuclei (1 order spectra) Stereochemistry, hindered rotation, Karplus, curve-variation of coupling constant with disordered angle, NMR shift reagents, solvent effects, nuclear overhauser effect (NOE).
Unit - 5	Mössbauer Spectroscopy Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{2+} and Fe^{3+} compounds including those of intermediate spin, (2) Sr^{2+} and Sr^{4+} compounds nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms

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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 Spectral : 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, V. Parish, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin, J.J. Deepish 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. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Craddock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.

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DEVI AHILYA VISHWVIDYALAYA, INDORE
M.Sc. CHEMISTRY (SEMESTER -III)

Paper No. : II (Code-MCH-502)
 Compulsory / Optional : Compulsory
 Max. Marks : 100

PAPER II : PHOTOCHEMISTRY

Unit-1	Photochemical Reactions Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.
Unit-2	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-thermal dissociation, gas-phase photolysis.
Unit-3	Photochemistry of Alkenes Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes. Photochemistry of Aromatic Compounds Isomerizations, additions and rearrangements.
Unit-4	Photochemistry of Carbonyl Compounds Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, β , γ unsaturated and α , β unsaturated compounds, cyclohexadienones. Intermolecular cycloaddition reactions-dimerisation and oxetane formation.
Unit-5	Miscellaneous Photochemical Reactions Photo-Fries reactions of anilines, photo-Fries rearrangement, Barton reaction, Singlet molecular oxygen and its reactions, photochemical formation of smog, Photodegradation of polymers, Photochemistry of pigments.

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Books Suggested:

1. Fundamentals of photochemistry, K.K. Rothagi-Mukheriji, Wiley-Eastern.
2. Essentials of Molecular Photochemistry, A. Gilbert and J. Baggott, Blackwell Scientific Publication.
3. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
4. Introductory Photochemistry, A. Cox and T. Camp, McGraw Hill.
5. Photochemistry, R.P. Kundall and A. Gilbert. Thomson Nelson.
6. Organic Photochemistry, J. Coxon and B. Halton, Cambridge University Press.

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Answers

DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -III)

Paper No. : I (Code-MCH-503)
Compulsory / Optional : Compulsory
Max. Marks : 100

PAPER III: ENVIRONMENTAL CHEMISTRY

Table with 2 columns: Unit and Content. Unit-1: Atmosphere, Atmospheric Chemistry, Tropospheric Photochemistry. Unit-2: Air Pollution, Acid Rain, Stratospheric Ozone Depletion, Green House Effect, Urban Air Pollution. Unit-3: Aquatic Chemistry and Water Pollution.

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Unit-4	Environmental Toxicology Toxic heavy metals : Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects. Toxic Organic Compound : Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects. Polychlorinated biphenyls : Properties, use and environmental continuation and effects. Polynuclear Aromatic Hydrocarbons : Source, structures and as pollutants.
Unit-5	Soil and Environmental Disasters Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic an metals. Methods of re-mediation of soil. Bhopal gas tragedy, Chemobyl, three mile island, Minimtata Disease, Sevoso (Italy), London smog.

Books Suggested:

1. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
2. Chemistry of Atmospheres, R.P. Wayne, Oxford.
3. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
4. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
5. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.

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OPTIONAL PAPERS

Out of the following select any two papers:

OPT-1 MCH-504 Organotransition Metal Chemistry

OPT-2 MCH-505 Polymers

OPT-3 MCH-506 Heterocyclic Chemistry

OPT-4 MCH-507 Physical Organic Chemistry

OPT-5 MCH-508 Chemistry of Materials

OPT-1

OPT-2

OPT-3

OPT-4

OPT-5

OPT-1

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

Paper No. : OPT-1 Code- MCH-504
 Compulsory / Optional : Optional
 Max. Marks : 100

Optional Paper : Organotransition Metal Chemistry

Unit-1	<p>Alkyls and Aryls of Transition Metals Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis.</p> <p>Compounds of Transition Metal-Carbon Multiple Bonds Alkylidenes, alkylidynes, low valent carbenes and carbynes-synthesis, nature of bond, structural characteristics, nucleophilic and electrophilic reactions on the ligands, role in organic synthesis.</p>
Unit-2	<p>Transition Metal π-Complexes Transition metal π-Complexes with unsaturated organic molecules, alkenes, alkynes, allyl, diene, dienyl, arene and triene complexes, preparation, properties, nature of bonding and structural features. Important reactions relating to nucleophilic and electrophilic attack on ligands and to organic synthesis.</p>
Unit-3	<p>Transition organometallic compounds: Transition metal compounds with bonds to hydrogen, boron, silicon</p>
Unit-4	<p>Homogeneous Catalysis Stoichiometric reactions for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerization of olefins, catalytic reactions involving carbon monoxide such as hydrocarboxylation of olefins, catalytic reactions involving carbon monoxide such as hydrocarboxylation of olefins, explanation of reactions, activation of C-H bond</p>
Unit-5	<p>Fluxional Organometallic Compounds Flexionality and dynamic equilibrium in compounds such as η^3 olefine, η^3-allyl and dienyl complexes.</p>

Books Suggested :

1. Principles and Application of Organotransition Metal Chemistry, J.P. Collman, L.S. Hegsdus, J.R. Norton and K.G. Finke, University Science Books.
2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree. John Wiley.
3. Metallo-organic Chemistry, A.J. Pearson. Wiley
4. Organometallic Chemistry, R.C. Mehrotra and A. Singh New Age International.

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

Paper No. : OPT-2 Code- MCH-505
Compulsory / Optional : Optional
Max. Marks : 100

Optional Paper : Polymers

Unit-1	Basics Importance of polymers. Basic concepts: Monomers, repeat units, degree of polymerization Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition/radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.
Unit-2	Polymer Characterization Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular-weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.
Unit-3	Analysis and testing of polymers Chemical analysis of polymers, spectroscopic methods, X-ray diffraction study. Microscopy. Thermal analysis and physical testing-tensile strength, fatigue, impact, tear resistance, Hardness and abrasion resistance.
Unit-4	Inorganic Polymers A general survey and scope of Inorganic Polymers special characteristics, classification, homo and hetero atomic polymers. Structure, Properties and Applications a. Polymers based on boron-nitrogen, boranes and carboranes. b. Polymers based on Silicon, borane polymetalloxanes and polymetallosiloxanes, silazanes.
Unit-5	Structure, Properties and Application of Polymers a. Polymers based on Phosphorous-Phosphazenes, Polyphosphates b. Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds. c. Co-ordination and metal chelate polymers.

Books Suggested:

1. Inorganic Chemistry, J.E. Huheey, Harper Row.
2. Developments in inorganic polymer Chaudhary, M.F. Lappert and G.J. Leigh.
3. Inorganic polymers- N.H. Ray.
4. Inorganic polymers, Graham and Stone.
5. Inorganic Rings and Cages : D.A. Armitage.
6. Textbook of Polymers Science, F.W. Billmeyer Jr. Wiley.
7. Contemporary Polymer Chemistry, H.R. Allcock and F.W. Lambe, Prentice Hall.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -III)

Paper No. : OPT-3 Code- MCH-506
 Compulsory / Optional : Optional
 Max. Marks : 100

Optional Paper : Heterocyclic Chemistry

<p>Unit-1</p>	<p>Nomenclature of Heterocycles Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic fused and bridged heterocycles. Aromatic Heterocycles General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in ¹H NMR-spectra. Empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.</p>
<p>Unit-2</p>	<p>Non-aromatic Heterocycles Strain-bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Atereo-electronic effects anomeric and related effects, Attractive interactions-hydrogen bonding and intermolecular nucleophilic electrophilic interactions. Heterocyclic synthesis-principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reactions.</p>
<p>Unit-3</p>	<p>Small Ring Heterocycles Three-membered and four-membered heterocycles-synthesis and reactions of aziridines, oxiranes, thiranes, azetidines, oxetanes and thietanes. Benzo-Fused Five-Membered Heterocycles Synthesis and reactions including medicinal applications of benzopyrroles, benzotriazines and benzothiophenes.</p>
<p>Unit-4</p>	<p>Meso-ionic Heterocycles General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications. Six-Membered Heterocycles with one Heteroatom Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium & thiopyrylium salts and phridones. Synthesis and reactions of quonlizinium and benzopyrylium salts, coumarins and chromones.</p>
<p>Unit-5</p>	<p>Six Membered Heterocycles with Two or More Heteroatoms: Synthesis and reactions of diazoles, triazines, tetrazines and thiazines. Seven-and Large-Membered Heterocycles: Synthesis and reactions of azepines, oxepines, thiepinines, diazepines, thiazepines, azocines, diazocines, dioxocines and dithiocenes. Heterocyclic Systems Containing P, As, Sb and B Heterocyclic rings containing phosphorus : Introduction, nomenclature, synthesis and characteristics of 5- and 6-membered ring systemsphosphorinaes, phosphorines, phospholanes and phospholes. Heterocyclic rings containing As and Sb : Introduction, synthesis and characteristics of 5- and 6-membered ring system. Heterocyclic rings containing B : Introduction, synthesis, reactivity and spectral characteristics of 3- 5- and 6-membered ring system.</p>

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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-Interscience.
6. An Introduction to the Heterocyclic Compounds, R.M. Acheson, John Wiley.
7. Comprehensive Heterocyclic Chemistry, A.R. Katritzky and C.W. Rees, eds. Pergamon Press.

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Paper No. : OPT-4 Code- MCH-507
 Compulsory / Optional : Optional
 Max. Marks : 100

Optional Paper : Physical Organic Chemistry

Unit-1	<p>Concepts in Molecular Orbital (MO) and Valence Bond (VB) Theory Introduction to Huckel molecular orbital (MO) method as a mean to explain modern theoretical methods. Advanced techniques in PMO and FMO theory. Molecular mechanics, semi empirical methods and ab initio and density functional methods. Scope and limitations of several computational programmes.</p>
Unit-2	<p>Quantitative MO theory : Huckel molecular orbital (HMO - method as applied to ethene, allyl and butadiene. Qualitative MO theory ionisation potential. Electron affinities. MO energy levels. Orbital symmetry. Orbital interaction diagrams. MO of simple organic systems such as ethene, allyl, butadiene, methane and methyl group. Conjugation and hyper-conjugation. Aromaticity. Valence bond (B) configuration mixing diagrams. Relationship between VB configuration mixing and resonance theory. Reaction profiles. Potential energy diagrams. Curve-crossing model-nature of activation barrier in chemical reactions</p>
Unit-3	<p>Principles of Reactivity Mechanistic significance of entropy, enthalpy and Gibb's free energy. Arrhenius equation. Transition state theory. Uses of activation parameters, Hammond's postulate, Bell-Evans-Polanyi Principle. Potential energy surface model. Marcus theory of electron transfer. Reactivity and selectivity principles. Kinetic Isotope Effect Theory of isotope effects. Primary and secondary kinetic isotope effects. Heavy atom isotope effects. Tunneling effect. Solvent effects. Structural Effects on Reactivity Linear free energy relationships (LFER). The Hammett equation, substituent constants, theories of substituent effects. Interpretation of ρ-values. Reaction constants. Deviations from Hammett equation. Dualparameter correlatins, inductive substituent constant. The Taft model, σ_I and σ_R scales.</p>
Unit-4	<p>Acids, Bases, Electrophiles, Nucleophiles and Catalysis Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity functions and their applicatins, hard and soft acids and bases. Nucleophilicity scales. Nucleofugacity. The α-effect. Ambivalent nucleophiles. Acid-base catalysis-specific and general catalysis. Bronsted catalysis, Nucleophilic and electrophilic catalysis. Catalysis by noncovalent binding-micellar catalysis. Steric and Conformation Properties Various type of steric strain and their influence on reactivity. Steric acceleration. Molecular measurements of steric effects upon rates. Steric LFET, Conformational barrier to bond rotation-spectroscopic detection of individual conformers. Acyclic and monocyclic systems. Rotation around partial double bonds. Winstein-Holness and Curtin-Hammett principle.</p>



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Unit-5	Nucleophilic and Electrophilic Reactivity Structural and electronic effects on SN^1 and SN^2 reactivity. Solvent effect, Kinetic isotope effects. Intramolecular assistance. Electron transfer nature of SN^2 reaction. Nucleophilicity and SN^2 reactivity based on curved crossing mode. Relationship between polar and electron transfer reactions, SR_N^1 mechanism. Electrophilic reactivity, general mechanism. Kinetic of SE^2 Ar reaction. Structural effects on rates and selectivity. Curve-crossing approach to electrophilic reactivity. Supramolecular Chemistry Properties of covalent bonds-bond length, inter-bond angles, force constant, bond and molecular dipole moments. Molecular and bond polarizability, bond dissociation enthalpy, entropy. intermolecular forces, hydrophobic effects. Electrostatic, induction, dispersion and resonance energy, magnetic interactions, magnitude of interaction energy, forces between macroscopic bodies, medium effects. Hydrogen bond.
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Books Suggested :

1. Molecular Mechanics, U. Burket and N.L. Allinger, ACS Monograph 177, 1982.
2. Organic Chemists, Book of Orbitals : L. Salem and W.L. Jorgensen, Academic Press.
3. Mechanism and Theory in Organic chemistry, T.H. Lowry and K.C. Richardson, Harper and Row.
4. Introduction to Theoretical Organic Chemistry and Molecular Modeling.
5. Physical Organic Chemistry : N.S. Isaacs. ELBS/Longman.
6. Supramolecular Chemistry : Concepts and Perspective, J.M. Lehn, VCH.
7. The Physical Basis of Organic Chemistry : H. Maskill, Oxford University Press.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -III)

Paper No. : OPT-5 Code- MCH-508
Compulsory / Optional : Optional
Max. Marks : 100

Optional Paper : Chemistry of Materials

Unit-1	<p>A. Multiphase materials Ferrous alloys; Fe-C phase transformations in ferrous alloys; stainless steels, non ferrous alloys, properties of ferrous and non-ferrous alloys and their applications.</p> <p>B. Glasses, Ceramics, Composites and Nanomaterials Glassy state, glass formers and glass modifiers, applications. Ceramic structures, mechanical properties, clay products. Refractories, characterizations, properties and applications. Microscopic composites; dispersion-strengthened and particle-reinforced, fibre-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, special properties, applications.</p>
Unit-2	<p>A. Thin Films and Langmuir-Blodgett Films Preparation techniques; evaporation/sputtering, chemical processes, MOCVD, sol-gel etc. Langmuir-Blodgett (LB) film, growth techniques, photolithography, properties and applications of thin and LB films.</p> <p>B Liquid Crystals Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases; smectic-nematic transition and clearing temperature-homeotropic, planer and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals.</p>
Unit-3	<p>A. Polymeric Materials Molecular shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types and their applications. conducting and ferro-electric polymers.</p> <p>B. Ionic Conductors Types of ionic conductors, mechanism of ionic conduction, interstitial jumps (Frenkel); vacancy mechanism, diffusion superionic conductors; phase transitions and mechanism of conduction in superionic conductors, examples and applications of ionic conductors.</p>
Unit-4	<p>High T_c Materials Defect perovskites, high T_c superconductivity in cuprates, preparation and characterization of 1-2-3 and 2-1-4 materials, normal state properties; anisotropy; temperature dependence of electrical resistance; optical phonon modes, superconducting state; heat capacity; coherence length, elastic constants, position lifetimes, microwave absorption-pairing and multigap structure in high T_c materials, applications of high T_c materials.</p>
Unit-5	<p>A. Materials of Solid State Devices Rectifiers, transistors, capacitors-IV-V compounds, low-dimensional quantum structures; optical properties.</p> <p>B. Organic Solids, Fullerenes, Molecular Devices Conducting organics, organic superconductors, magnetism in organic materials. Fullerenes-doped, fullerenes as superconductors. Molecular rectifiers and transistors. artificial photosynthetic devices, optical storage memory and switches-sensors. Nonlinear optical materials; nonlinear optical effects, second and third order-molecular hyperpolarisability and second order electric susceptibility – materials for second and third harmonic generation.</p>

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Books Suggested:

1. Solid State Physics, N.W.Ashcroft and N.D.Mermin, Saunders College.
2. Materials Science and Engineering, An Introduction, W.D.Callister, Wiley.
3. Principles of the Solid State, H.V. Keer, Wiley Eastern.
4. Materials Sciences, J.C.Anderson, K.D.Leaver, J.M.Alexander and R.D. Rawlings, ELBS
5. Thermotropic liquid Crystals, Edl, G.W. Gray, John Wiley.
6. Handbook of Liquid Crystals, Kelker and Hatz, Chemie Verlag.

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

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

Inorganic Chemistry

Quantitative determination of a three component mixture	12
Chromatographic separations	12
Record	04
Viva-Voce	05
Total :	33

Quantitative determination of a three component mixture :

One Volumetrically & two gravimetrically

- a. Cu^{2+} , Ni^{2+} , Zn^{2+}
- b. Ag^{1+} , Ni^{2+} , Mg^{2+}

Chromatographic separations & determination of R_f values :

(Thin layer / Paper / Column chromatography)

- (i) Group II metal ions.
- (ii) Indicators.
- (iii) Cu^{2+} , Fe^{2+} , Ni^{2+} & Co^{2+} .
- (iv) Ink pigment.

Organic Chemistry

Multi - Step Synthesis of Organic compounds	12
Quantitative Estimations	12
Record	04
Viva-Voce	05
Total :	33

Multi - Step Synthesis of Organic compounds :

Exercise should illustrate the use of organic reagents & may involve purification of the products by chromatographic techniques :

Aniline \rightarrow *p*-Nitroaniline; Aniline \rightarrow *p*-Bromoaniline; Phthalic acid \rightarrow Anthranilic acid; Pinacol -Pinacolone rearrangement (Benzophenone \rightarrow Benzopinacol \rightarrow Benzopinacolone); Bezoin Benzilic acid (Bezoin \rightarrow Benzil \rightarrow Benzilic acid); Benzidine rearrangement (Hydrazobenzene \rightarrow Benzidine).

Quantitative Estimations (Titrimetric method) :

- (1) Estimation of glucose, glycine & ascorbic acid from Vitamin - C tablet.
- (2) Determination of DO, COD & BOD of water sample.

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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

Spectroscopy

- (a) Interpretation of IR, NMR spectra.
(b) Numerical problems on UV, IR & NMR.
- Spectrophotometry / Colorimetry**
 - Determination of the composition of a mixture of $K_2Cr_2O_7$ & $KMnO_4$ by the application of mixture law.
 - Determination of Phosphate concentration in a soft drink.
 - Titration of Mohr's salt with $K_2Cr_2O_7$ / $KMnO_4$ solution.
 - Determination of order & energy of activation for the decomposition of violet colour complex formed between ceric ions & N-Pheny. anthranilic acid.

Chemical Kinetics

- Determination of kinetics of decomposition of complex formed between sodium sulphide & sodium nitroprusside spectrophotometrically.
- Investigate the reaction between acetone & iodine.

Section – B

Electronics :

- Study of the charge & discharge of a capacitor through a resistor.
- Verification of Kirchhoff's current law (KCL) & Kirchhoff's voltage law (KVL).

Conductometry :

- Determination of equivalent conductance of a weak electrolyte at different concentrations, and hence the dissociation constant of the electrolyte. Also verify Ostwald's dilution law.
- Determination of equivalent conductance of a weak electrolyte at infinite dilution using Kohlrausch law.

pH metry:

- Determination of Acidic and Basic dissociation constant of an amino acid and Isoelectric point of the acid.
- Measurement of the pH of Buffer Solution ($CH_3COOH + CH_3COONa$) using Henderson's equation and hence pK_a .

Books Suggested:

- Inorganic Experiments, J. Derek Woolings, VCH.
- Microscale Inorganic Chemistry, Z. Szafrani, R.M. Pike and M.M. Singh, Wiley.
- Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrand.
- The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. Curtin.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

Scheme of Marks

M. Sc. Chemistry

SEMESTER - IV

Paper	Compulsory/Optional	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	APPLICATION OF SPECTROSCOPY-II	511	85+ 15(CCE) = 100
II	Compulsory	SOLID STATE CHEMISTRY	512	85+ 15(CCE) = 100
III	Compulsory	BIOCHEMISTRY	513	85+ 15(CCE) = 100
IV	Optional	ANY TWO	514-518	85+ 15(CCE) = 100
V	Optional			85+ 15(CCE) = 100
		PRACTICAL - 1. Inorganic 2. Organic 3. Physical		33 33 34 =100
		Project Work - Duration	60 HOURS	100
		Total		700

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -IV)

Paper No.
Compulsory / Optional
Max. Marks

: I (Code-MCH-511)
: Compulsory
: 100

PAPER I: APPLICATION OF SPECTROSCOPY-II

Unit-1	Ultraviolet and Visible spectroscopy Various electronic transitions (185-800 nm) Beer-Lambert law, Effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Fieser Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic compounds. Steric effect in biphenyls.
Unit-2	Infrared Spectroscopy Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and fermi resonance.
Unit - 3	Nuclear Magnetic Resonance of Paramagnetic Substances in Solution The contact and Pseudo contact shifts, factors affecting nuclear relaxation, some applications including biochemical systems, an overview of NMR of metal nuclide with emphasis on ¹⁹⁵ Pt and ¹¹⁹ Sn NMR.
Unit-4	Carbon-13 NMR Spectroscopy General considerations, chemical shift (aliphatic olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon), coupling constants. Two dimension NMR spectroscopy COSY, NOESY, DEPT, HMBIC and HMQC techniques.
Unit-5	Mass Spectrometry introduction ion production EI, CI FD, ESI 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. Structure elucidation of simple molecules using UV - Visible, IR, NMR and mass spectral techniques.

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Books Suggested:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
3. Infrared and Raman Spectral : 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, .V. Parish, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G.J. Martin, Heyden.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler adn 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. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -IV)

Paper No. : II (Code-MCH-512)
Compulsory / Optional : Compulsory
Max. Marks : 100

PAPER II: SOLID STATE CHEMISTRY

Unit-1	Solid State Reactions General principles, experimental procedure, co-precipitation as a precursory to solid state reactions, kinetics of solid state reactions.
Unit-2	Crystal Defects and Non-Stoichiometry Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky defects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects.
Unit-3	Electronic Properties and Band Theory Metals insulators and semiconductors, electronic structure of solidsband theory band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties-Application of optical and electron microscopy. Magnetic Properties-Classification of materials : Effect of temperature calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.
Unit-4	Organic Solids Electrically conducting solids, organic charge transfer complex, organic metals, new superconductors.
Unit-5	Liquid Crystals: Types of liquid crystals: Nematic, Smectic, Ferroelectric, Antiferroelectric, Various theories of LC, Liquid crystal display, New materials.

Books Suggested:

1. Solid state chemistry and its applications, A.R. West, Peenum.
2. Principles of the Solid State, H.V. Keer, Wiley Eastern.
3. Solid State Chemistry, N.B. Hannay.
4. Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -IV)

Paper No. : III (Code-MCH-512)
Compulsory / Optional : Compulsory
Max. Marks : 100

PAPER III: BIOCHEMISTRY

Table with 2 columns: Unit and Content. Unit-1: Metal Ions in Biological Systems, Bioenergetics and ATP Cycle, Transport and Storage of Dioxygen. Unit-2: Electron Transfer in Biology, Nitrogen fixation. Unit-3: Enzymes, Mechanism of Enzyme Action, Kinds of Reactions Catalysed by Enzymes. Unit-4: Co-Enzyme Chemistry, Enzyme Models.

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	<p>Biotechnological Applications of Enzymes large-scale production and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from cron starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.</p>
<p>Unit-5</p>	<p>Biological Cell and its Constituents Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coils transition.</p> <p>Bioenergetics Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.</p> <p>Biopolymer Interactions Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of binding processes in biological systems. Hydrogen ion titration curves.</p> <p>Cell Membrane and Transport of Ions Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.</p>

Books Suggested :

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
3. Inorganic biochemistry vol. I and II ed. G.J. Eichhorn, Elsevier.
4. Progress in Inorganic Chemistry, Vol 18 and 28 ed J.J. Lippard, Wiley.
5. Bioorganic Chemistry : A chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer Verlag
6. Understanding Enzymes, Trevor Palmer, Freeman Hall.
7. Enzyme Chemistry : Impact and applications, Ed. Collin J suckling, chemistry.
8. Enzyme Mechanisms Ed. M.I. Page and A Williams, Royal Society of Chemistry.
9. Fundamentals of Enzymology, N.C. Price and L. Stevens. Oxford University Press.
10. Immobilized Enzymes : An Introduction and Applications in Biotechnology, Michael ID. Trevan, Hohn Wiley.
11. Enzymatic Reaction Mechanisms. C. Walsh. W.H. Freeman.
12. Enzyme Structure and Mechanism, A Fersht, W.H. Freeman
13. Biochemistry : The Chemical Reactions of Living Cells, D.E. Metzler, Academic Press.

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OPTIONAL PAPERS

Out of the following select any two papers :

- OPT-1 MCH-514 Organic Synthesis
 - OPT-2 MCH-515 Chemistry of Natural Products
 - OPT-3 MCH-516 Analytical Chemistry
 - OPT-4 MCH-517 Electrochemistry
 - OPT-5 MCH-518 Medicinal Chemistry
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~~OPT-1~~

~~OPT-2~~

~~OPT-3~~

OPT-4

~~OPT-5~~

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -IV)

Paper No. : OPT-1 Code- MCH-514
Compulsory / Optional : Optional
Max. Marks : 100

Optional Paper : Organic Synthesis

Unit-1	Disconnection Approach An introduction to synthons and synthetic equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reaction, amine synthesis. Protection of groups, chemo, region and stereo selectivity.
Unit-2	One Group C-C Disconnections Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic Nitro compounds in organic synthesis. Two Group C-C Disconnections Diels-Alder Reaction, 1,3-difunctionalised compounds, a-b- unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds. Micheal addition and Robinson annelation.
Unit-3	Oxidation Introduction, Different oxidative processes. Hydrocarbons-alkenes, aromatic rings, saturated C-H groups (activated and unactivated) Alcohols, diols, aldehyde's, ketones, ketals and carboxylic acids. Amines, hydrazines, and sulphides. Oxidations with ruthenium tetroxide, iodobenzene diacetate and thallium. (III) Nitrate. Reduction Introduction. Different reductive processes. Alkanes, alkenes, alkynes, and aromatic rings. Carbonyl compounds-aldehydes, ketones, acids and their derivatives. Epoxides. Nitro, nitroso, azo and oxime groups. Expoxide, Nitro, Nitroso, azo and oxime groups. Hydrogenolysis.
Unit-4	Organometallic Reagents Principle, preparations, properties and applications of the following in organic synthesis with mechanistic details. Group I and II metal organic compounds Li, Mg, Hg, Cd, Zn and Ce Compounds.
Unit-5	Synthesis of some complex molecules: Application of the above in the synthesis of following compounds: Canphor, longifoline, cartisone, reserpine, vitamin D, juvabion, aphidicolin and fredericamycin. A

Books Suggested:

1. Designing Organic Synthesis, S. Warren. Wiley.
2. Organic Synthesis-Concept, Methods and Starting Materials, J. Fuhrhop.
3. Some Modern Methods of Organic Synthesis. W. carruthers, Cambridge Univ. Press.
4. Modern Synthetic Reactions H.O. House, W.A Benjamin.
5. Advanced Organic Chemistry : Reactions, Mechanisms and Structure, J. March. Wiley.
6. Principles, of Organic Chemistry Part B. F.a. Carey and R.J. Sundberg, Plenum Press.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -IV)

Paper No. : OPT-2 Code- MCH-515
 Compulsory / Optional : Optional
 Max. Marks : 100

Optional Paper : Chemistry of Natural Products

Unit-1	Terpenoids and Carotenoids Calcifications, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules : Citral, Geraniol α -Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β -Carotene.
Unit-2	Alkaloids Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry, synthesis and biosynthesis of the following : Ephedrine, (+)- Coniine, Nicotine, Atropine, Quinine and Morphine.
Unit-3	Steroids Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, Isolation, Structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone, Androsterone, Biosynthesis of Steroids.
Unit-4	Plant Pigments Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin, Quercetin, Myricetin, Quercetin 3-glucoside, Vitexin, Diadzein, Aureusin, Cyanidin, Cyanidin-3-O-glucoside, Cyanidin, Hirsutidin, Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway. Prophyrins Structure and synthesis of Haemoglobin and Chlorophyll.
Unit-5	Prostaglandin Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGF2a. 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).

Books Suggested:

1. Natural Products : Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Bantrophe adn J.B. Harbome, Longman, Esses.
2. Organic Chemistry : Vol. 2 IL. Finar, ELBS
3. Stereoselective Synthesis : A Practical Approach, M. Norgradi, VCH.
4. Rodd's Chemistry of Carbon Compounds, Ed. S. Coffey, Elsevier.
5. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston. harwood Academic Publishers.
6. Introduction to Flavonoids, B.A. Bohm. Harwood Academic Publishers.
7. New Trends in Natural Product chemistry, Ataur Rahman and M.L. Choudhary, Harwood Academic Publishers.
8. Insecticides of Natural Origin, Sukh Dev, Harwood Academic Publishers.

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

Paper No.
Compulsory / Optional
Max. Marks

: OPT-3 Code- MCH-516
: Optional
: 100

Optional Paper : Analytical Chemistry

Unit-1	<p>Introduction Role of analytical chemistry Classification of analytical methods classical and instrumental. Types of instrumental analysis. Selecting an analytical method. Neatness and cleanliness. laboratory operations and practices. Analytical balance. Techniques of weighing, errors. Volumetric glassware cleaning and calibration of glassware. Sample Volumetric glassware cleaning and Calibration of glassware. Sample preparation-dissolution and decompositions. Gravimetric techniques. Selecting and handling or reagents. Laboratory notebooks. Safety in the analytical laboratory.</p> <p>Errors and Evaluation Definition of terms in mean and median. Precision-standard deviation, relative standard deviation. Accuracy-absolute error, relative error. Types of error in experimental data determinate (systematic), indeterminate (or random) and gross. Sources of error and the effects upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data-indeterminate errors. The uses of statistics.</p>
Unit-2	<p>Food analysis Moisture, ash, crude protein, fat crude fiber, carbohydrates, calcium, potassium, sodium and phosphate. Food adulteration-common adulterants in food, contamination of foods stuffs. Microscopic examination of foods for adulterants. Pesticide analysis in food products. Extraction and purification of sample. HPLC. Gas chromatography for organophosphates. Thin-layer chromatography for identification of chlorinated pesticides in food products.</p>
Unit-3	<p>Analysis of Water Pollution Origin of Waste water, types, water pollutants and their effects. Sources of water pollution domestic, industrial, agricultural soil and radioactive wastes as sources of pollution. Objectives of analysis-parameter for analysis-colour, turbidity, total solids, conductivity, acidity, alkalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen. Heavy metal pollution-public health significance of cadmium, chromium, copper, lead, zinc, manganese, mercury and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems. Measurements of DO, BOD, and COD. Pesticides as water pollutants and analysis. Water pollution laws and standards.</p>
Unit-4	<p>Analysis of soil, Fuel, Body Fluids and Drugs (a) Analysis of Soil, moisture per tota nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts. Fuel analysis : liquid and gas. Ultimate and proximate analysis-heating values-grading of coal. Liquid fuels-flash point, aniline point, octane number and carbon residue. Gaseous fuels-produced gas and water gas-calorific value.</p>
Unit-5	<p>(a) Clinical Chemistry : Composition of blood-collection and preservation of samples. Clinical analysis. Serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates. Immunoassay : principles of radio immunoassay (RIA) and applications. The blood gas analysis trace elements in the body (b) Drug analysis : Narcotics and dangerous drug. Classification of drugs. Screening by gas and thin-layer chromatography and spectrophotometric measurements.</p>

Books Suggested:

1. Analytical Chemistry, G.D. Christian, J. Wiley.
2. Fundamentals of analytical Chemistry. D.A. Skoog. D.M. West and F.J. Hooler, W.B. Saunders.
3. Analytical Chemistry-Principles. J.H. Kennedy. W.B. Saunders.
4. Analytical Chemistry-Principles and Techniques. LG. Hargis. Prentice Hall.
5. Principles of Instrumental analysis D.A. Skoog and J.L. Loary, W.B. Saunders.
6. Principles of Instrumental Analysis D.A. Skoog W.B. Saunders.
7. Quantitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
8. Environmental Solution, S.M. Khopkar, Wiley Eastern.
9. Basic Concepts of Analysis Chemistry, S.M. Khopkar, Wiley Eastern.
10. Handbook of Instrumental Techniques for Analytical Chemistry, F. Settle, Prentice Hall

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -IV)

Paper No. : OPT-4 Code- MCH-517
Compulsory / Optional : Optional
Max. Marks : 100

Optional Paper : Electrochemistry

Table with 2 columns: Unit and Content. Unit-1: Conversion and Storage of Electrochemical Energy. Unit-2: Corrosion and Stability of Metals. Unit-3: Bioelectrochemistry. Unit-4: Methods of determining kinetic parameters for quasi-reversible and irreversible waves.

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Unit-5	Potential Sweep Method : Linear sweep Voltammetry, Cyclic Voltammetry, theory and applications. Diagnostic criteria of cyclic voltammetry. Controlled current microelectrode techniques : comparison with controlled potentials methods, chronopotentiometry, theory and applications. Bulk Electrolysis Methods : Controlled potential coulometry, Controlled Coulometry, Electroorganic synthesis and its important applications. Stripping analysis : anodic and Cathodic modes, Pre electrolysis and Stripping steps, applications of Stripping Analysis.
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Books Suggested:

1. Modern Electrochemistry Vol. I, IIa, Vol. IIb J'OM Bockris and A.K.N. Reddy, Plenum Publication, New York.
2. Polarographic Techniques by L. Meites, Interscience.
3. "Fuel Cells : Their electrochemistry". McGraw Hill Book Company, New York.
4. Modern Polarographic Methods by A.M. Bond, Marcell Dekker.
5. Polarography and allied techniques by K. Zutshi, New age International publication. New Delhi.
6. "Electroanalytical Chemistry by Basil H. Vessor & Galen W. ; Wiley Interscience.
7. Electroanalytical Chemistry by Basil H. Vessor & Galen W. ; Wiley Interscience.
8. Topics in pure and Applied Chemistry, Ed. S. K. Rangrajan, SAEST Publication, Karaikudi (India)

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -IV)

Paper No. : OPT-5 Code- MCH-518
Compulsory / Optional : Optional
Max. Marks : 100

Optional Paper : Medicinal Chemistry

Unit-1	Structure and activity : Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis.
Unit-2	Pharmacodynamics: Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.
Unit-3	Antibiotics and antibacterials Introduction, Antibiotic β -Lactam type - Penicillins, Cephalosporins, Antitubercular - Streptomycin, Broad spectrum antibiotics - Tetracyclines, Anticancer - Dactinomycin (Actinomycin D)
Unit-4	Antifungal - polyenes, Antibacterial - Ciprofloxacin, Norfloxacin, Antiviral - Acyclovir Antimalarials : Chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine
Unit-5	Non-steroidal Anti-inflammatory Drugs : Diclofenac Sodium, Ibuprofen and Netopam Antihistaminic and antiasthmatic agents : Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.

Books recommended

1. Introduction to medicinal chemistry, A. Gringuage, Wiley-VCH.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorje.
3. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age International.
4. Burger's Medicinal Chemistry and Drug Discovery, Vol-I (Chapter 9 and Chapter 14), Ed. M.E. Wolff, John Wiley.
5. Goodman and Gilman's Pharmacological Basis of Therapeutics, Mc Graw-Hill.
6. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press.
7. Strategies for Organic Drug synthesis and Design, D. Lednicer, John Wiley.
8. Principles of Medicinal Chemistry W.O. Foye
9. Medicinal Chemistry; The Role of organic chemist in Drug Research, S.M. Roberts and B.J. Pricer.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE
M. Sc. CHEMISTRY PRACTICALS (SEMESTER – IV)

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

Inorganic Chemistry	
Preparation / Ion – Exchange Chromatography	12
Spectrophotometric / Flame Photometric Determinations	12
Record	04
Viva Voce	<u>05</u>
Total :	33

Preparation :

1. Synthesis of metal acetylacetonate
2. Metal complex of DMSO
3. Determination of Cr (III) complex
4. $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$
5. Trans – $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)_2]\text{Cl}$
6. Synthesis of metal – ethylene diamine complex.

Ion Exchange Chromatography

- (a) Capacity of cation / anion exchange resin.
- (b) Separation of cobalt & nickel on anion exchange resin & their estimation volumetrically.

Spectrophotometric Determinations / Spectroscopic identification of recorded spectra like IR, NMR, ESR & Mass

- a. Manganese / Chromium in steel sample
- b. Nickel by extractive spectrophotometric method
- c. Flouride / Nitrite / Phosphate

Flame Photometric Determinations

- A. Sodium & Potassium when present together.
- B. Lithium / Calcium / Barium / Strontium.



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Organic Chemistry

Synthesis of Organic compounds	10
Spectrophotometric Estimations or Isolation	10
Identification of Organic compounds (Spectral data)	04
Record	04
Viva Voce	<u>05</u>
Total :	33

Organic Synthesis (may involve multi – steps)

1. Friedel Crafts reaction.
2. Beckmann's reaction.
3. Synthesis of symmetrical tribromobenzene from aniline.
4. Enzymatic reduction of ethylacetoacetate using Baker's yeast to yield enantiomeric excess of S-ethyl-3-hydroxybutanoate & determine its optical density.
5. Biosynthesis of ethanol from sucrose.
6. Preparation of soap from fat with isolation of glycerol.

Spectroscopic Estimations :

- (1) Amino acids
- (2) Proteins
- (3) Carbohydrates
- (4) Aspirin
- (5) Caffeine

Isolations :

1. Casein from milk
2. Lycopine from tomato
3. Piperine from black pepper
4. Caffeine from tea leaves
5. Lactose from Milk
6. Preparation of Rose water using steam distillation

Identification of Organic compounds by the analysis of their spectral data (UV, IR, & MS).

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Physical Chemistry

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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

Spectroscopy

1. Determination of pK_a of an indicator (e.g., methyl red) in (a) aqueous & (b) micellar media.
2. Determination of stoichiometry & stability constant of Ferric isothiocyanate ion complex in solution.
3. Determination of rate constant of alkaline bleaching of Malachite green & effect of ionic strength on the rate of reaction.

Polarography / Electronics

1. Identification & estimation of metal ions such as Cd²⁺, Pb²⁺, Zn²⁺ & Ni²⁺ etc. Polarographically.
2. Study of a metal ligand complex polarographically (using Lingane's method).
3. Determination of the V – I characteristics of a given diode in :
(a) Forward based mode / function.
(b) Reverse based mode / function.

Section – B

Chemical Kinetics

1. Determination of rate constant & formation of an intermediate complex in the reaction of Ce (IV) & Hypophosphorous acid at ambient temperature.
2. Determination of energy & enthalpy of activation in the reaction of KMnO₄ & benzyl alcohol in acid medium.
3. Determination of energy of activation & entropy of activation from a single kinetic run.
4. Kinetics of an enzyme catalyzed reaction.

Thermodynamics

1. Determination of partial molar volume of solute (e.g., KCl) & solvent in a binary mixture.
2. Determination of the temperature dependence of the solubility of a compound in two solvents having similar intramolecular interactions (benzoic acid in water & in DMSO water mixture & calculate the partial molar heat of solution).

Books Suggested

1. Inorganic Experiments, J. Derek Woolings, VCH.
2. Microscale Inorganic Chemistry, Z. Szafrań, R.M. Pike and M.M. Singh, Wiley.
3. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrand.
4. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. Curtin.

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