

**Scheme and Syllabus
of
M.Sc. Chemistry**

III and IV Semesters

Effective from Academic Year 2016-17 onwards

**Devi Ahilya Vishwavidyalaya,
Indore (M.P.), 452001**

DEVI AHILYA VISHWAVIDYALAYA, INDORE

Scheme of Marks

M. Sc. Chemistry

(w.e.f. 2016 and onwards)

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

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		33
		2. Organic		33
		3. Physical		34
				=100
		Project Work – Duration	60 HOURS	100
		Total		700

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -III)

Paper No.
Compulsory / Optional
Max. Marks

: I (Code-MCH-501)
: Compulsory
: 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 (I 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) Sn^{+2} and Sn^{+4} compounds nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.

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- Structural Methods for Chemistry, R.S. Drago, Saunders Compnay.
 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 -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-photo 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 Isomerisations, additions and substitutions.
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-dimerisations and oxetane formation.
Unit-5	Miscellaneous Photochemical Reactions Photo-Fries reactions of annilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen and its reactions. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.

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	<p>toxic Organic Compound : Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects.</p> <p>Polychlorinated biphenyls : Properties, use and environmental continuation and effects.</p> <p>Polynuclear Aromatic Hydrocarbons : Source, structures and as pollutants.</p>
Unit-5	<p>Soil and Environmental Disasters</p> <p>Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic an metals. Methods of re-remediation of soil. Bhopal gas tragedy, Chernobyl, three mile island, Minimtata Disease, Sevoso (Italy), London smog.</p>

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

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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, alkylidyne, 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 trienyl 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 hydrocarbonylation of olefins (oxoreaction), explanation reactions, activation of C-H bond.</p>
Unit-5	<p>Fluxional Organometallic Compounds Flexionality and dynamic equilibrium in compounds such as η^2 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 R.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.

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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 an 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 of a. Polymers based on boron-borazines, boranes and carboranes. b. Polymers based on Silicon, silicone's 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 Chemistry, 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. Al cock and F.W. Lambe, Prentice Hall.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER –III)

Paper No.
Compulsory / Optional
Max. Marks

: **OPT-3 Code- MCH-506**
: **Optional**
: **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, bezofurans 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 quionlizinium 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 dithiocines. 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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egested:

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 Scietific Techinal.
5. Contemporary Hetrocyclic Chemistry, G,.R. Newkome and W.W. Paudler, Wiley-Inter Science.
6. An Introductiion to the Heterocyclic Compounds, R.M. Acheson, Johnwiely.
7. Comprehensive Heterocyclic Chemistry, A.R. Katrizky and C.W. Rees, eds. Pergamon Press.

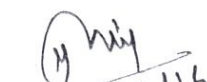

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -III)

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 δ-values. Reaction constants. Deviations from Hammett equation. Dualparameter correlatins, inductive substituent constant. The Taft model, s1 and sR 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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Electrophilic Reactivity

electronic effects on SN^1 and SN^2 reactivity. Solvent effect, Kinetic isotope
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.

Books Suggested :

1. Molecular Mechanics, U. Burkert 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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Optional Paper : Chemistry of Materials

<p>Unit-1</p>	<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.</p> <p>Microscopic composites; dispersion-strengthened and particle-reinforced, fibre-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, special properties, applications.</p>
<p>Unit-2</p>	<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, planar 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>
<p>Unit-3</p>	<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>
<p>Unit-4</p>	<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>
<p>Unit-5</p>	<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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sted:

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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MAHILYA VISHWAVIDYALAYA, INDORE
M. Sc. CHEMISTRY PRACTICALS (SEMESTER – III)

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

Inorganic Chemistry

Quantitative determination of a three component mixture	12
Chromatographic separations	12
Record	04
Viva-Voce	<u>05</u>
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	<u>05</u>
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 – Phenyl 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 Kirchoff's current law (KCL) & Kirchoff'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. Szafran, R.M. Pike and M.M. Singh, Wiley.
- Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
- The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. Curtin.

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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -IV)

Paper No. : I (Code-MCH-511)
 Compulsory / Optional : Compulsory
 Max. Marks : 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, HMBC and HMQC techniques.
Unit-5	Mass Spectrometry Introduction ion production E1, C1 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. Me 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 solids band 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

<p>Unit-1</p>	<p>Metal Ions in Biological Systems Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K⁺/Na⁺ pump. Bioenergetics and ATP Cycle. DNA polymerisation, glucose storage, metal complexes in transmission of energy; chlorophyll's, photosystem I and photosystem II in cleavage of water. Transport and Storage of Dioxygen Heam proteins and oxygen uptake structure and function of haemoglobin's, mygolobin, haemocyanms and hemerythrin, model synthetic complexes of iron, cobalt and copper.</p>
<p>Unit-2</p>	<p>Electron Transfer in Biology Structure and function of metal of proteins in electron transport processes cytochrome's and ion-sulphure proteins, synthetic models. Nitrogen fixation Biological nitrogen fixation, and its mechanism, nitrogenase, Chemical nitrogen fixation.</p>
<p>Unit-3</p>	<p>Enzymes Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshalnd's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michael's-Menten and Lineweaver Burk plots, reversible and irreversible inhibition. Mechanism of Enzyme Action Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chemotrypsin, ribonuclease, lysozyme and carboxypeptidase. Kinds of Reactions Catalysed by Enzymes Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in Isomerisations reactions, b-Cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.</p>
<p>Unit-4</p>	<p>Co-Enzyme Chemistry Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD⁺, NADP⁺, FMN, FAD, lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors. Enzyme Models Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality Biometric chemistry, crown ether, cryptates. Cyclodextrins, cyclodextrin-based enzyme models, clixarenes, ionospheres, micelles synthetic enzymes or synzymes.</p>

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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 corn starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.</p>
Unit-5	<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.L. Eichhorn, Elsevier.
4. Progress in Inorganic Chemistry, Vol 18 and 38 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, Prentice 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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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	<p>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.</p>
Unit-2	<p>One Group C-C Disconnections Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic Nitro compounds in organic synthesis.</p> <p>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.</p>
Unit-3	<p>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 tetraoxide, iodobenzene diacetate and thallium. (III) Nitrate.</p> <p>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.</p>
Unit-4	<p>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.</p>
Unit-5	<p>Synthesis of some complex molecules: Application of the above in the synthesis of following compounds: Canphor, longifoline, cartisone, reserpine, vitamin D, jувabion, aphidicolin and fredericamycin. A</p>

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, Aldosterone, Biosynthesis of Steroids.
Unit-4	Plant Pigments Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin Quercetin, Myrcetin, Quercetin 3-glucoside, Vitexin, Diadzein, Aureusin, Cyanidin-7arabinoside, 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 1L. 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.

: OPT-3 Code- MCH-516

Compulsory / Optional

: **Optional**

Max. Marks

: **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 pH total 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>

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Books Suggested:

1. Analytical Chemistry, G.D. Christian, J.Wicy.
2. Fundamentals o 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

<p>Unit-1</p>	<p>I. Conversion and Storage of Electrochemical Energy Present status of energy consumption : Pollution problem. History of fuel cells, Direct energy conversion by electrochemical means. Maximum intrinsic efficiency of an electrochemical converter. Physical interpretation of the Carnot efficiency factor in electrochemical energy converters. Power outputs. electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells, Hydrogen Air cell, Hydrocarbon air cell, Alkane fuel cell, Phosphoric and fuel cell, direct NaOH fuel cells, applications of fuel cells. Electrochemical Energy Storage : Properties of Electrochemical energy storage : Measure of battery performance, Charging and discharging of a battery, Storage Density, Energy Density. Classical Batteries : (i) Lead Acid (ii) Nickel-Cadmium, (iii) Zinc manganese dioxide. Modern Batteries : (i) Zinc-Air (ii) Nickel-Metal Hydride, (iii) Lithium Battery, Future Electricity storers : Storage in (i) Hydrogen, (ii) Alkali Metals, (iii) Non aqueous solutions.</p>
<p>Unit-2</p>	<p>Corrosion and Stability of Metals : Civilization and Surface mechanism of the corrosion of the metals; Thermodynamics and the stability of metals, Potential -pH (or Pourbaix) Diagrams; uses and abuses, Corrosion current and corrosion potential -Evans diagrams. Measurement of corrosion rate : (i) Weight Loss method, (ii) Electrochemical Method. Inhibiting Corrosion : Cathodic and Anodic Protection. (i) Inhibition by addition of substrates to the electrolyte environment, (ii) by changing the corroding method from external source, anodic Protection, Organic inhibitors, The fuller Story Green inhibitors. Passivation : Structure of Passivation films, Mechanism of Passivation, Spontaneous Passivation Nature's method for stabilizing surfaces.</p>
<p>Unit-3</p>	<p>Bioelectrochemistry : bioelectrodics, Membrane Potentials, Simplistic theory, Modern theory, Electrical conductance in biological organism: Electronic, Protonic electrochemical mechanism of nervous systems, enzymes as electrodes. Kinetic of Electrode Process : Essentials of Electrode reaction. Current Density, Overpotential, Tafel Equation, Butler Volmer equation. Standard rate constant (K₀) and Transfer coefficient (a), Exchange Current. Irreversible Electrode processes : Criteria of irreversibility, informatino from irreversible wave.</p>
<p>Unit-4</p>	<p>Methods of determining kinetic parameters for quasi-rversible and irreversible waves : Koutecky's methods, Meits Israel Method, Gellings method Electrocatalysis : Chemical catalysts and Electrochemical catalysts with special reference to purostates,</p>

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	porphyrin oxides of rare earths. Electrocatalysis in simple redox reactions, in reaction involving adsorbed species. Influence of various parameters.
Unit-5	<p>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.</p> <p>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.</p>

Books Suggested:

1. Modern Electrochemistry Vol. I, Ila, 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 publicatin. New Delhi.
6. "Electroanalytical Chemistry by Basil H. Vessor & Galen W. ; Wiley Interscience.
7. Electroanalytical Chemistry by Basil H. Vessor & alen 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 Dorge.
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.

Handwritten signatures and dates at the bottom of the page, including names like 'Shanme', 'Gang', 'G.M.', 'S', and 'R.K.' with dates such as '2-9-2016' and '2-9-16'.

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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H. S. 2-9-2016
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A. S. 2-9-18
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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

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 pKa 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 Cd^{2+} , Pb^{2+} , Zn^{2+} & Ni^{2+} 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 KMnO_4 & 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. Szafran, 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.