

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 2. Organic 3. Physical		33 33 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
	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

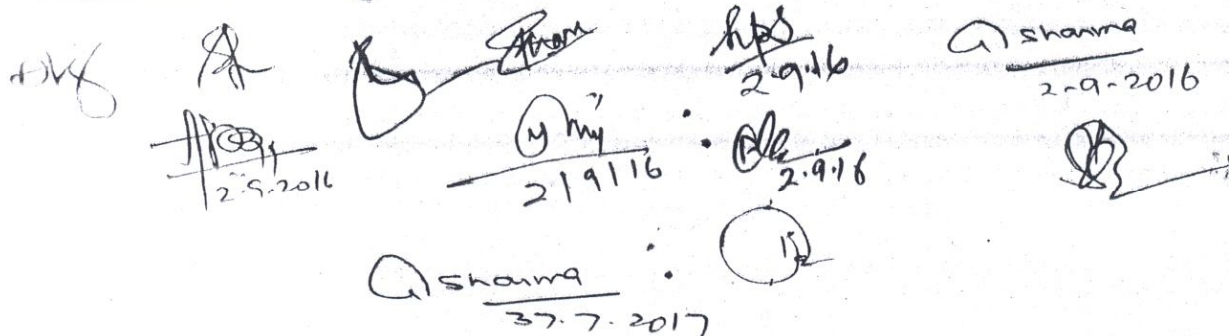
M.Sc. CHEMISTRY (SEMESTER -III)

Paper No.  
Compulsory / Optional  
Max. Marks

: I (Code-MCH-501)  
: Compulsory  
: 100

PAPER I : APPLICATION OF SPECTROSCOPY-I

Unit - 1	<b>Electronic Spectroscopy:</b> Electronic Spectral Studies for $d^1 - d^9$ systems in octahedral, tetrahedral and square planer complexes
Unit - 2	<b>Vibrational Spectroscopy</b> 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	<b>Nuclear Magnetic Resonance Spectroscopy-I</b> 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	<b>Nuclear Magnetic Resonance Spectroscopy-II</b> 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	<b>Mössbauer Spectroscopy</b> 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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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 -III)

Paper No.

: II (Code-MCH-502)

Compulsory / Optional

: Compulsory

Max. Marks

: 100

PAPER II : PHOTOCHEMISTRY

Unit-1	<p><b>Photochemical Reactions</b></p> <p>Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.</p>
Unit-2	<p><b>Determination of Reaction Mechanism</b></p> <p>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.</p>
Unit-3	<p><b>Photochemistry of Alkenes</b></p> <p>Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes.</p> <p><b>Photochemistry of Aromatic Compounds</b></p> <p>Isomerisations, additions and substitutions.</p>
Unit-4	<p><b>Photochemistry of Carbonyl Compounds</b></p> <p>Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, <math>\beta</math>, <math>\gamma</math> unsaturated and <math>\alpha</math>, <math>\beta</math> unsaturated compounds, cyclohexadienones. Intermolecular cycloaddition reactions-dimerisations and oxetane formation.</p>
Unit-5	<p><b>Miscellaneous Photochemical Reactions</b></p> <p>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.</p>

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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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DEVI AHILYA VIŠHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -III)

Paper No.

: I (Code-MCH-503)

Compulsory / Optional

: Compulsory

Max. Marks

: 100

PAPER III: ENVIRONMENTAL CHEMISTRY

Unit-1	<p><b>Atmosphere</b>                  Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. <b>Temperature inversion</b>. Calculation of Global mean temperature of the atmosphere. Pressure variation in atmosphere and scale height. Biogeochemical cycles of carbon, nitrogen, sulphur, phosphorus, oxygen. Residence times.</p> <p><b>Atmospheric Chemistry</b>                  Sources of trace atmospheric constituents : nitrogen oxides, sulphur dioxide and other sulphur compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons.</p> <p><b>Tropospheric Photochemistry</b>                  Mechanism of Photochemical decomposition of NO<sub>2</sub> and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO<sub>2</sub> and NO<sub>2</sub>. Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.</p>
Unit-2	<p><b>Air Pollution</b>                  Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health.</p> <p><b>Acid Rain</b>                  Definition, Acid rain precursors and their aqueous and gas phase atmospheric oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO<sub>2</sub> and NO<sub>2</sub>. Acid rain control strategies.</p> <p><b>Stratospheric Ozone Depletion</b>                  Mechanism of Ozone formation, Mechanism of catalytic ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies.</p> <p><b>Green House Effect</b>                  Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences.</p> <p><b>Urban Air Pollution</b>                  Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies.</p>
Unit-3	<p><b>Aquatic Chemistry and Water Pollution</b>                  Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Aerobic and anaerobic reactions of organic sulphur and nitrogen compounds in water acid-base chemistry of fresh water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.</p>
Unit-4	<p><b>Environmental Toxicology</b>                  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.</p>

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	<p><b>Toxic Organic Compound</b> : Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects.</p> <p><b>Polychlorinated biphenyls</b> : Properties, use and environmental continuation and effects.</p> <p><b>Polynuclear Aromatic Hydrocarbons</b> : Source, structures and as pollutants.</p>
Unit-5	<p><b>Soil and Environmental Disasters</b></p> <p>Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic and m...</p> <p>Methods of re-mediation of soil. Bhopal gas tragedy, Chernobyl, three mile island, Minimata Disease, Seveso (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. Mahahan, 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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**DEVI AHILYA VISHWAVIDYALAYA, INDORE**  
**M.Sc. CHEMISTRY (SEMESTER -III)**

Paper No.  
 Compulsory / Optional  
 Max. Marks

: OPT-1 Code- MCH-504  
 : **Optional**  
 : 100

**Optional Paper : Organotransition Metal Chemistry.**

Unit-1	<p><b>Alkyls and Aryls of Transition Metals</b>                  Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis.</p> <p><b>Compounds of Transition Metal-Carbon Multiple Bonds</b>                  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><b>Transition Metal <math>\pi</math>-Complexes</b>                  Transition metal <math>\pi</math>-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><b>Transition organometallic compounds:</b>                  Transition metal compounds with bonds to hydrogen, boron, silicon</p>
Unit-4	<p><b>Homogeneous Catalysis</b>                  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><b>Fluxional Organometallic Compounds</b>                  Flexionality and dynamic equilibrium in compounds such as <math>\eta^2</math> olefine, <math>\eta^3</math>-allyl and dienyl complexes.</p>

**Books Suggested :**

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

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M.Sc. CHEMISTRY (SEMESTER -III)

Paper No.  
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Max. Marks

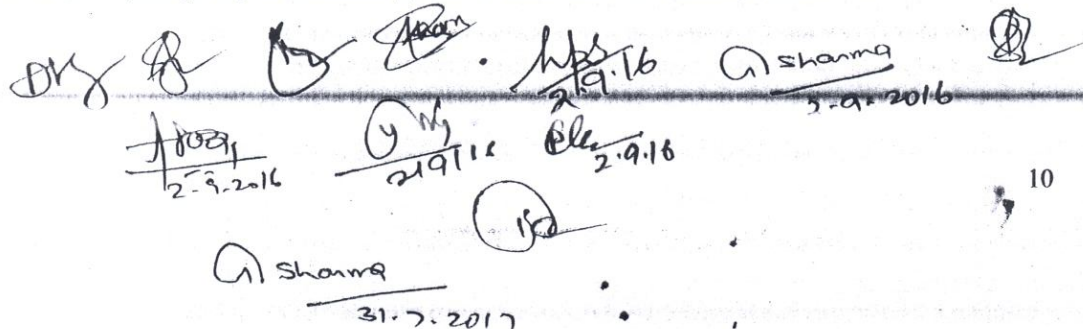
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: Optional  
: 100

Optional Paper : Polymers

Unit-1	<b>Basics</b> 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	<b>Polymer Characterization</b> 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	<b>Analysis and testing of polymers</b> 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	<b>Inorganic Polymers</b> A general survey and scope of Inorganic Polymers special characteristics, classification, homo and hetero atomic polymers. <b>Structure, Properties and Applications of</b> a. Polymers based on boron-borazines, boranes and carboranes. b. Polymers based on Silicon, silicone's polymetalloxanes and polymetallosiloxanes, silazanes.
Unit-5	<b>Structure, Properties and Application of Polymers</b> 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. Alcock and F.W. Lambe, Prentice Hall.


  
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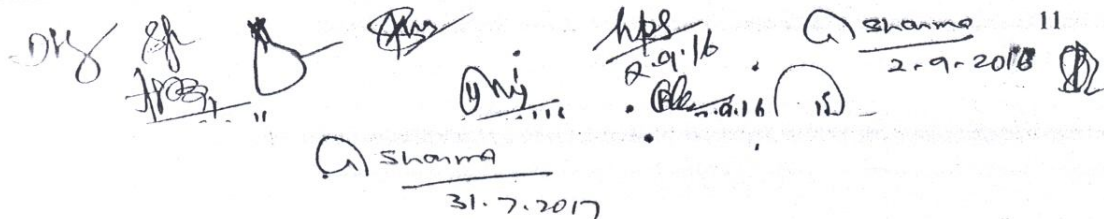
M.Sc. CHEMISTRY (SEMESTER -III)

Paper No.  
Compulsory / Optional  
Max. Marks

: OPT-3 Code- MCH-506  
: Optional  
: 100

Optional Paper : Heterocyclic Chemistry

Unit-1	<p><b>Nomenclature of Heterocycles</b> Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic fused and bridged heterocycles.</p> <p><b>Aromatic Heterocycles</b> General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in <sup>1</sup>H NMR-spectra. Empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.</p>
Unit-2	<p><b>Non-aromatic Heterocycles</b> 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>
Unit-3	<p><b>Small Ring Heterocycles</b> Three-membered and four-membered heterocycles-synthesis and reactions of aziridines, oxiranes, thiranes, azetidines, oxetanes and thietanes.</p> <p><b>Benzo-Fused Five-Membered Heterocycles</b> Synthesis and reactions including medicinal applications of benzopyrroles, bezofurans and benzothiophenes.</p>
Unit-4	<p><b>Meso-ionic Heterocycles</b> General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications.</p> <p><b>Six-Membered Heterocycles with one Heteroatom</b> Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium &amp; thiopyrylium salts and phridones. Synthesis and reactions of quionlizinium and benzopyrylium salts, coumarins and chromones.</p>
Unit-5	<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.</p> <p><b>Heterocyclic Systems Containing P, As, Sb and B</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 Scietic Technial.
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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Paper No.

Compulsory / Optional

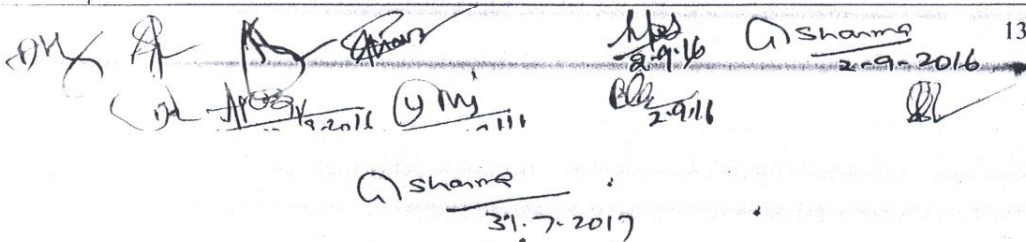
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: Optional

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**Optional Paper : Physical Organic Chemistry**

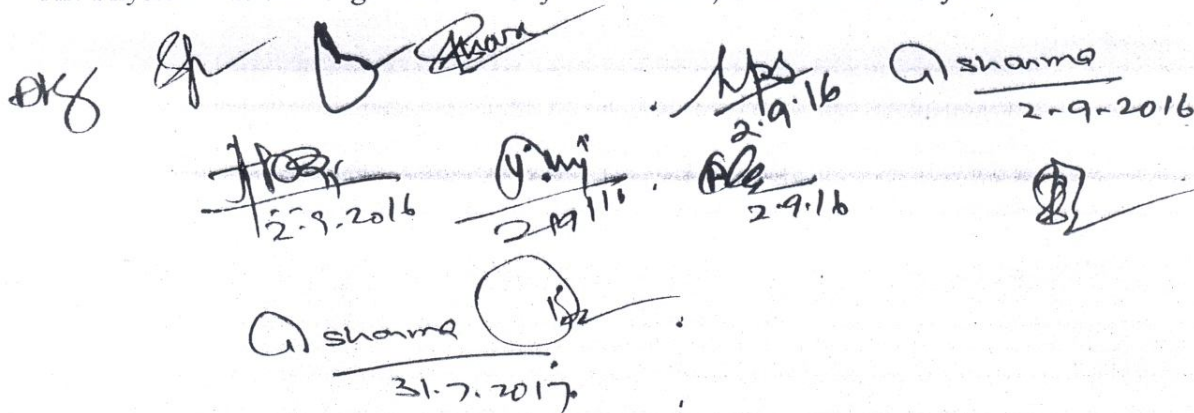
Unit-1	<p><b>Concepts in Molecular Orbital (MO) and Valence Bond (VB) Theory</b> Introduction to Huckel molecular orbital (MO) method as a mean to explain modern theoretical methods. Advanced techniques in PMO and FMO theory. Molecular mechanics, semi empirical methods and ab initio and density functional methods. Scope and limitations of several computational programmes.</p>
Unit-2	<p><b>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.</b> <b>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.</b></p>
Unit-3	<p><b>Principles of Reactivity</b> 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. <b>Reactivity and selectivity principles.</b> <b>Kinetic Isotope Effect</b> Theory of isotope effects. Primary and secondary kinetic isotope effects. Heavy atom isotope effects. Tunneling effect. Solvent effects. <b>Structural Effects on Reactivity</b> Linear free energy relationships (LFER). The Hammett equation, substituent constants, theories of substituent effects. Interpretation of <math>\delta</math>-values. Reaction constants. Deviations from Hammett equation. Dualparameter correlatins, inductive substituent constant. The Taft model, s1 and sR scales.</p>
Unit-4	<p><b>Acids, Bases, Electrophiles, Nucleophiles and Catalysis</b> 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 <math>\alpha</math>-effect. Ambivalent nucleophiles. Acid-base catalysis-specific and general catalysis. Bronsted catalysis, Nucleophilic and electrophilic catalysis. Catalysis by noncovalent binding-micellar catalysis. <b>Steric and Conformation Properties</b> 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	<p><b>Nucleophilic and Electrophilic Reactivity</b>  Structural and electronic effects on <math>SN^1</math> and <math>SN^2</math> reactivity. Solvent effect, Kinetic isotope effects. Intramolecular assistance. Electron transfer nature of <math>SN^2</math> reaction. Nucleophilicity and <math>SN^2</math> reactivity based on curved crossing mode. Relationship between polar and electron transfer reactions, <math>SR_N^1</math> mechanism. Electrophilic reactivity, general mechanism. Kinetic of <math>SE^2</math> Ar reaction. Structural effects on rates and selectivity. Curve-crossing approach to electrophilic reactivity.</p> <p><b>Supramolecular Chemistry</b>  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.</p>
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**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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DEVI AHILYA VISHWAVIDYALAYA, INDORE

M.Sc. CHEMISTRY (SEMESTER -III)

Paper No.

: OPT-5 Code- MCH-508

Compulsory / Optional

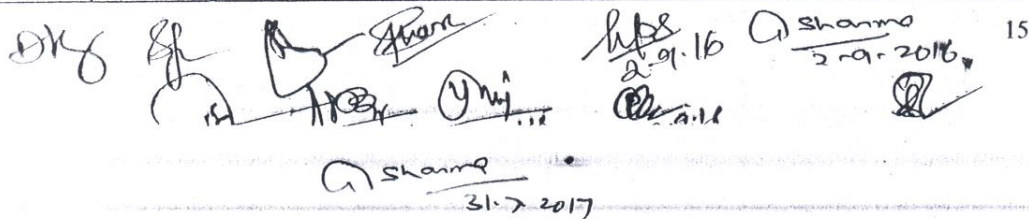
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Optional Paper : Chemistry of Materials

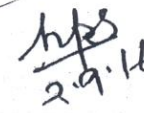
Unit-1	<p><b>A. Multiphase materials</b> Ferrous alloys; Fe-C phase transformations in ferrous alloys; stainless steels, non ferrous alloys, properties of ferrous and non-ferrous alloys and their applications.</p> <p><b>B. Glasses, Ceramics, Composites and Nanomaterials</b> Glassy state, glass formers 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><b>A. Thin Films and Langmuir-Blodgett Films</b> 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>B Liquid Crystals</b> 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><b>A. Polymeric Materials</b> Molecular shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types and their applications, conducting and ferro-electric polymers.</p> <p><b>B. Ionic Conductors</b> 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><b>High <math>T_c</math> Materials</b> Defect perovskites, high <math>T_c</math> 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 <math>T_c</math> materials, applications of high <math>T_c</math> materials.</p>
Unit-5	<p><b>A. Materials of Solid State Devices</b> Rectifiers, transistors, capacitors-IV-V compounds, low-dimensional quantum structures; optical properties.</p> <p><b>B. Organic Solids, Fullerenes, Molecular Devices</b> 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>

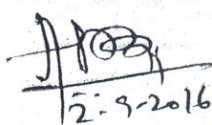
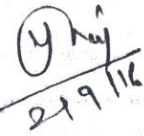


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**Books Suggested:**


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.



15


  
31.7.2017



DEVI AHLAYA 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

- $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Zn}^{2+}$
- $\text{Ag}^{1+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Mg}^{2+}$

**Chromatographic separations & determination of  $R_f$  values :**

(Thin layer / Paper / Column chromatography)

- Group II metal ions.
- Indicators.
- $\text{Cu}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Ni}^{2+}$  &  $\text{Co}^{2+}$ .
- 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) :**

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

*(Handwritten signatures and dates)*

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31-7-2017

## 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 Nostrand.
- The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. Curtin.

Handwritten signatures and dates:

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