

Department of Higher Education, Govt. of M.P.
 Post Graduate Semester wise Syllabus
 as recommended by Central Board of Studies and approved by the Governor of M.P.
 उच्च शिक्षा विभाग, म.प्र. शासन
 स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
 केंद्रीय अध्ययन मण्डल द्वारा अनुमोदित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
 Session (सत्र) 2010-2011

Scheme of Marks
 M. Sc. Chemistry
 SEMESTER - III

Paper	Comp/Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	APPLICATION OF SPECTROSCOPY-I	501	35+ 15 (CCE) = 50
II	Compulsory	PHOTOCHEMISTRY	502	35+ 15 (CCE) = 50
III	Compulsory	ENVIRONMENTAL CHEMISTRY	503	35+ 15 (CCE) = 50
IV	Optional -I	ANY TWO	504-508	35+ 15 (CCE) = 50
V	Optional -II		& 508 A	35+ 15 (CCE) = 50
		PRACTICAL -1. Inorganic		33
		2. Organic		33
		3. Physical		34 =10
		Internship		100
		Total		450

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Session (सत्र) 2010-2011

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: APPLICATION OF
SPECTROSCOPY-I	
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: I (Code- MCH-501)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	: 35

Particulars/विवरण

Semester III

Semester III	
Unit - 1	Electronic Spectroscopy: Electronic Spectral Studies for $d^1 - d^9$ systems in octahedral, tetrahedral and square planer complexes
Unit - 2	Vibrational Spectroscopy Symmetry and shapes of AB_2 , AB_3 , AB_4 , AB_5 and AB_6 , mode of bonding of ambidentate ligands, nitrosyl, ethylenediamine and diketonato complexes, application of resonance Raman spectroscopy and its applications.
Unit - 3	Nuclear Magnetic Resonance Spectroscopy-I General introduction and definition, chemical shift, spin-spin interaction, shielding and deshielding mechanism, mechanism of measurement of chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto),
Unit - 4	Nuclear Magnetic Resonance Spectroscopy-II Chemical exchange, effect of deuteration, Complex spin spin interaction between two, three, four and five nuclei (1 order spectra) Stereochemistry, hindered rotation, Karplus curve-variation of coupling constant with disordered angle, NMR shift reagents, solvent effects, nuclear overhauser effect (NOE).

Unit - 5	Mössbauer Spectroscopy Basic principles, spectral parameters and spectral display. Application of the technique to the studies of (1) bonding and structure 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 detection of oxidation state and inequivalent MB atoms.
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SUGGESTED READINGS:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Company.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and Craddock, ELBS.
3. Infrared and Raman Spectral : Inorganic and Coordination Compounds K. Nakamoto, Wiley.
4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.
5. Transition Metal Chemistry ed. R.L. Carlin vol. 3 dekker.
6. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, V. Parisi, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin, J.J. Deepish and G.J. Martin, Heyden.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler and T.C. Morrill, John Wiley.
10. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Application of Spectroscopy of Organic Compounds, J.R. Dyer Prentice Hall.
12. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.
13. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and Craddock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.

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Class / कक्षा
Semester / सेमेस्टर
Subject / विषय
Title of Subject Group
विषय समूह का शीर्षक
Paper No. / प्रश्नपत्र क्रमांक
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य
Max. Marks अधिकतम अंक

: M.Sc.
 : III
 : Chemistry
 : **PHOTOCHEMISTRY**
 :
 : **II (Code- MCH-502)**
 : **Compulsory**
 : 35

Particulars / विवरण

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, cyclohexadionones. 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.

Books Suggested

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Class / कक्षा : M.Sc.
 Semester / सेमेस्टर : III
 Subject / विषय : Chemistry
 Title of Subject Group : ENVIRONMENTAL
CHEMISTRY
 विषय समूह का शीर्षक :
 Paper No. / प्रश्नपत्र क्रमांक : III (Code- MCH-503)
 Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य : Compulsory
 Max. Marks अधिकतम अंक : 35

Particulars / विवरण

Unit-1

Atmosphere

Atmospheric layers, Vertical temperature profile, heat/radiation budget of the atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. Temperature inversion. 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.

Atmospheric Chemistry

Sources of trace atmospheric constituents : nitrogen oxides, sulphur dioxide and other sulphur compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons.

Tropospheric Photochemistry

Mechanism of Photochemical decomposition of NO₂ 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. Reactions of OH radicals with SO₂ and NO₂. Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.

Unit-2

Air Pollution

Air pollutants and their classifications. Aerosols-sources, size distribution and effects on visibility, climate and health.

Acid Rain

Definition, Acid rain precursors and their aqueous and gas phase atmospheric oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO₂ and NO₂. Acid rain control strategies.

Stratospheric Ozone Depletion

	<p>Mechanism of Ozone formation, Mechanism of catalytic ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies.</p> <p>Green House Effect</p> <p>Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences.</p> <p>Urban Air Pollution</p> <p>Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies.</p>
Unit-3	<p>Aquatic Chemistry and Water Pollution</p> <p>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>Environmental Toxicology</p> <p>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> <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 and metals. 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. Manahan, Lewis Publishers.
5. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.

OPTIONAL PAPERS

Out of the following select any two papers each of marks 50:

- ✓ OPT-1 MCH-504 Organotransition Metal Chemistry
- OPT-2 MCH-505 Polymers
- ✓ OPT-3 MCH-506 Heterocyclic Chemistry
- ✓ OPT-4 MCH-507 Physical Organic Chemistry
- ✓ OPT-5 MCH-508 Chemistry of Materials
- OPT-6 MCH-508 Industrial Chemistry petroleum heavy chemicals & petroleu

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Session (सत्र) 2010-2011

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: Polymers
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: OPT-2 (Code- MCH-505)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks अधिकतम अंक	: 35

Particulars / विवरण

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 polymetallosiloxane silazanes.
Unit-5	Structure, Properties and Application of Polymers a. Polymers based on Phosphorous-Phosphazenes, Polyphosphates

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Subject / विषय	: Chemistry
Title of Subject Group	: Polymers
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: OPT-2 (Code- MCH-505)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks अधिकतम अंक	: 35

Particulars / विवरण

Unit-1	<p>Basics</p> <p>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.</p>
Unit-2	<p>Polymer Characterization</p> <p>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.</p>
Unit-3	<p>Analysis and testing of polymers</p> <p>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.</p>
Unit-4	<p>Inorganic Polymers</p> <p>A general survey and scope of Inorganic Polymers special characteristics, classification, homo and hetero atomic polymers.</p> <p>Structure, Properties and Applications of</p> <ol style="list-style-type: none"> Polymers based on boron-borazines, boranes and carboranes. Polymers based on Silicon, silicone's polymetalloxanes and polymetallosiloxanes, silazanes.
Unit-5	<p>Structure, Properties and Application of Polymers</p> <ol style="list-style-type: none"> Polymers based on Phosphorous-Phosphazenes, Polyphosphates

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 Session (सत्र) 2010-2011

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: Organotransition Metal Chemistry
Chemistry	:
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: OPT-1 Code- MCH ₃
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks अधिकतम अंक	: 35

Particulars / विवरण

Unit-1	Alkyls and Aryls of Transition Metals Types, routes of synthesis, stability and decomposition pathways, organocopper synthesis. Compounds of Transition Metal-Carbon Multiple Bonds Alkylidenes, alkylidyne, low valent carbenes and carbynes-synthesis, nature of structural characteristics, nucleophilic and electrophilic reactions on the ligands, organic synthesis.
Unit-2	Transition Metal π-Complexes Transition metal π -Complexes with unsaturated organic molecules, alkenes, alkyne, diene, dienyl, arene and trienyl complexes, preparation, properties, nature of bonds, structural features. Important reactions relating to nucleophilic and electrophilic reactions on ligands and to organic synthesis.
Unit-3	Transition organometallic compounds: Transition metal compounds with bonds to hydrogen, boron, silicon
Unit-4	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 bonds.
Unit-5	Fluxional Organometallic Compounds Flexionality and dynamic equilibrium in compounds such as η^2 olefine, η^3 -allyl and η^5 -cyclopentadienyl complexes.

Book Suggested

1. Principles and Application of Organotransition Metal Chemistry, J.P. Collman, L. Hedgus, 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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 Session (सत्र) 2010-2011

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: Heterocyclic Chemistry
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: OPT-3 (Code- MCH-506)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional ¹
Max. Marks अधिकतम अंक	: 35

Particulars / विवरण

Unit-1	<p>Nomenclature of Heterocycles Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic fused and bridged heterocycles.</p> <p>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>
Unit-2	<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. Stereoelectronic 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>Small Ring Heterocycles Three-membered and four-membered heterocycles-synthesis and reactions of aziridines, oxiranes, thiranes, azetidines, oxetanes and thietanes.</p> <p>Benzo-Fused Five-Membered Heterocycles</p>

	Synthesis and reactions including medicinal applications of benzopyrroles, benzotriazines and benzothiothephenes.
Unit-4	<p>Meso-Ionic Heterocycles General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications.</p> <p>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 quionilzinium 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 dithiococines.</p> <p>Heterocyclic Systems Containing P, As, Sb and B Heterocyclic rings containing phosphorus : Introduction, nomenclature, synthesis and characteristics of 5- and 6-membered ring systems phosphorinanes, 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>

Book Suggested

1. Heterocyclic Chemistry Vol. 1-3, R.R. Gupta, M. Kumar and V. Gupta, Springer Verlag.
2. The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.
3. Heterocyclic chemistry J.A. Joule, K. Mills and G.F. Smith, Chapman and Hall.
4. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical.
5. Contemporary Heterocyclic Chemistry, G.R. Newkome and W.W. Paudler, Wiley-Inter Science.
6. An Introduction to the Heterocyclic Compounds, R.M. Acheson, John Wiley.
7. Comprehensive Heterocyclic Chemistry, A.R. Katritzky and C.W. Rees, eds. Pergamon Press.

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Session (सत्र) 2010-2011

Class / कक्षा

: M.Sc.

Semester / सेमेस्टर

: III

Subject / विषय

: Chemistry

Title of Subject Group

: Physical Organic Chemistry

विषय समूह का शीर्षक

:

Paper No. / प्रश्नपत्र क्रमांक

: OPT-4 (Code- MCH-507)

Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य

: Optional

Max. Marks अधिकतम अंक

: 35

Particulars / विवरण

	<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>
3	<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>
4-3	<p>Principles of Reactivity Mechanistic significance of entropy, enthalpy and Gibb's free energy. Arrhenius equation. Transition state theory. Uses of activation parameters, Hammond's postulate, Bell-Evans-Polanyi Principle. Potential energy surface model, Marcus theory of electron transfer. Reactivity and selectivity principles. Kinetic Isotope Effect Theory of isotope effects. Primary and secondary kinetic isotope effects. Heavy atom isotope effects. Tunneling effect. Solvent effects. Structural Effects on Reactivity Linear free energy relationships (LFER). The Hammett equation, substituent constants, theories of substituent effects. Interpretation of ρ-values. Reaction constants. Deviations from Hammett equation. Dualparameter correlatins, inductive substituent constant. The Taft model, s_I and s_R scales.</p>
Unit-4	<p>Acids, Bases, Electrophilles, Nucleophilles and Catalysis Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity</p>

	<p>functions and their applications. hard and soft acids and bases. Nucleophilicity Nucleofugacity. The α-effect. Ambivalent nucleophiles. Acid-base catalysis- general catalysis. Bronsted catalysis, Nucleophilic and electrophilic catalysis. noncovalent binding-micellar catalysis.</p> <p>Steric and Conformation Properties</p> <p>Various type of steric strain and their influence on reactivity. Steric acceleration Molecular measurements of steric effects upon rates. Steric LFET, Conformational to bond rotation-spectroscopic detection of individual conformers. Acyclic and monocyclic systems. Rotation around partial double bonds. Winstein-Holness and Hammett principle.</p>
Unit-5	<p>Nucleophilic and Electrophilic Reactivity</p> <p>Structural and electronic effects on SN^1 and SN^2 reactivity. Solvent effect, Kinetic effects. Intramolecular assistance. Electron transfer nature of SN^2 reaction. Nucleo and SN^2 reactivity based on curved crossing mode. Relationship between polar and electron transfer reactions, SR_N^1 mechanism. Electrophilic reactivity, general mech Kinetic of S_E^2 Ar reaction. Structural effects on rates and selectivity. Curve-crossing approach to electrophilic reactivity.</p> <p>Supramolecular Chemistry</p> <p>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>

Book 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.

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus

recommended by Central Board of Studies and approved by the Governor of M.P.
उच्च शिक्षा विभाग, म.प्र. शासन

स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
 केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
 Session (सत्र) 2010-2011

को / कक्षा : M.Sc.
 सेमेस्टर / सेमेस्टर : III
 विषय / विषय : Chemistry
 Subject Group : Chemistry of Materials
 समूह का शीर्षक :
 प्रश्नपत्र क्रमांक : OPT-5 (Code- MCH-508)
 अनिवार्य या वैकल्पिक अनिवार्य : Optional
 अधिकतम अंक : 50

Particulars / विवरण

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.

B. Glasses, Ceramics, Composites and Nanomaterials

Glassy state. glass formers and glass modifiers. applications. Ceramic structures, mechanical properties, clay products. Refractories, characterizations, properties and applications.
 Microscopic composites; dispersion-strengthened and particle-reinforced, fibre-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, special properties, applications.

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.

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.

mlt-3

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>B. Ionic Conductors</p> <p>Types of ionic conductors, mechanism of ionic conduction, interstitial jumps (Frenkel), vacancy mechanism, diffusion in superionic conductors; phase transitions and mechanism of conduction in superionic conductors, examples and applications of ionic conductors.</p>
Unit-4	<p>High T_c Materials</p> <p>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, spin lifetimes, microwave absorption-pairing and multigap structure in high T_c materials, applications of high T_c materials.</p>
Unit-5	<p>A. Materials of Solid State Devices</p> <p>Rectifiers, transistors, capacitors-IV-V compounds, low-dimensional quantum structures and optical properties.</p> <p>B. Organic Solids, Fullerenes, Molecular Devices</p> <p>Conducting organics, organic superconductors, magnetism in organic materials. Fullerenes-doped, fullerenes as superconductors.</p> <p>Molecular rectifiers and transistors, artificial photosynthetic devices, optical storage memory and switches-sensors.</p> <p>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>

Book 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.

BARKATULLAH UNIVERSITY, BHOPAL
 Session – 2010-11

Master / संकेत
Subject / विषय
Title of Subject Group
ग्रह समूह का शीर्षक
Paper No. / प्रश्नपत्र क्रमांक
Pulsory / अनिवार्य या
Optional / वैकल्पिक अतिरिक्त
Ex. Marks अधिकतम अंक

: M.Sc.
: III
: Chemistry
: Industrial Chemistry-
: Heavy Chemicals & Petroleum
: OPT-5 (Code- MCH-508 A)
: Optional
: 36

alt- I

Particulars / विवरण

Water, Gases and Heavy Chemicals

Water : Water Pollutants, their classes with examples, Biochemical oxygen demand, thermal pollution, pollution by fertilizers, detergents, pesticides and industrial wastes.

Water Purification : Classical and modern Methods – Ion exchange, electro dialysis, Reverse osmosis. Softening of Hard water. Chlorination and fluoridation.

alt-II

Gases : Chemistry Large-scale production, storage, hazards and uses of the following industrial gases: Hydrogen, oxygen, nitrogen, carbon dioxide, chlorine, fluorine, sulphur dioxide, phosgene, acetylene, argon, neon and helium.

Heavy Chemicals : Manufacture, Physical properties, Analysis, Hazards and applications of the following chemicals :

HCL, H₂SO₄, HNO₃, H₃PO₄, polyphosphoric acid,
NaHCO₃, Na₂CO₃, NaOH, NaCl, Na₂S₂O₃, Bleaching Powder, Bromine.

I-III

Coal & Petroleum

Coal : Origin and economic importance of coal. Coal composition, Coal carbonization, Coal gasification, Coal Gas, Water Gas, Producer gas, coal tar industry and manufacture of coal tar based chemicals and their importance. Role as carcinogens, Non-fuel uses of coal, and C1 Chemistry based on MeOHCOCO₂, CH₄ and CH₂O.

IV

Petroleum : Origin and composition, Refining, Reforming Fractionation, Cracking: Knocking and Octane number, Kerosene and Naptha; Liquefied petroleum gas (L.P.G.) Synthetic Gas, Synthetic Petrol, Petrochemicals.

manufacture of ethylene propylene. Butedimne, xylenes, etc. Economic importance with particular reference to India.

Unit – V Fats & Oils

Fats & Oil Natural Fats, Edible and Industrial Oils of vegetable origin, common fatty acids and glycerides. Hydrogenation of Unsaturated oils, manufacture of Vasaspati and margarine.

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Post Graduate Semester wise Syllabus
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उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुमोदित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
Session (रात्र) 2010-2011

M.Sc. Semester III Chemistry PRACTICALS

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

Quantitative determinations of a three component mixture	12
Chromatographic Separations	12
Record	04
Viva Voice	05
Total	33

Quantitative determinations of a three component mixture :

One Volumetrically and two gravimetrically

- Cu^{+2} , Ni^{+2} , Zn^{+2}
- Cu^{+2} , Ni^{+2} , Ag^{+1}

Chromatographic Separations

- Cadmium and zinc
- Zinc and magnesium.
- Thin-layer/paper chromatography-separation of nickel, manganese, cobalt and zinc.
Determination of R_f values.

Organic Chemistry

Multi-step Synthesis of Organic Compounds

12

Paper Chromatography	12
Record	04
Viva Voice	05
Total	33

Multi-step Synthesis of Organic Compounds

The exercise should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques. Preparation in steps: Benzophenone → Benzpinacol → Benzpinacolone Beckmann rearrangement : Benzanilide from benzene, Benzene → Benzophenone → Benzphenone oxime → Benzanilide, Benzilic acid rearrangement : Benzilic acid from benzoin, Benzoin → Benzil → Benzilic acid Synthesis of heterocyclic compounds Skraup synthesis : Preparation of quinoline from aniline, Fisher Indole synthesis : Preparation of 2-phenylindole from phenylhydrazine, Enzymatic synthesis Enzymatic reduction : reduction of ethyl acetoacetate using Baker's yeast to yield enantiomeric excess of S (+) ethyl-3-hydroxybutanoate and determine its optical purity. Biosynthesis of ethanol from sucrose. Synthesis using microwave Alkylation of diethyl malonate with benzyl chloride. Synthesis using phase transfer catalyst. Alkylation of diethyl malonate or ethyl acetoacetate with an alkylhalide.

Paper Chromatography

Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of RF values/

Physical Chemistry	13
Spectroscopy	12
Chemical Kinetics	04
Record	05
Viva Voice	34
Total	

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i
- i. Determination of pK_a of an indicator (e.g. methyl red) in (a) aqueous and (b) media.
 - ii. Determination of stoichiometry and stability constant of Ferrisulpho-yanatic complex ion in solution.
 - iii. Determination of rate constant of alkaline bleaching of Malachite green and effect of ionic strength on the rate of reaction.

The students are expected to visit industrial to gain practical knowledge, if possible.

Chemical Kinetics

- i. Determination of rate constant and formation constant of an intermediate complex in the reaction of $Ce(IV)$ and Hypophosphorous acid at ambient temperature.
- ii. Determination of energy and enthalpy of activation in the reaction of K_2MnO_4 and benzyl alcohol in acid medium.
- iii. Determination of energy of activation and entropy of activation from a single kinetic run.
- iv. Kinetics of an enzyme micellar catalyzed reaction.

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.