

COURSEWISE SCHEME

THIRD SEMESTER

- | | | | | | |
|----|------------------|---|------------------------|----|------------------------------------------|
| 1. | Course Code | : | | | |
| 2. | Course Name | : | M.Sc. Chemistry | 6. | Practical : 3 |
| 3. | Total Paper | : | 5 | 7. | Practical Passing Marks: 12 (Each Marks) |
| 4. | Compulsory Paper | : | 3 | 8. | Maximum marks : 450 |
| 5. | Optional Paper | : | 2 | 9. | Minimum Passing percentage : 36 |

Sub. code	Subject Name	Theory										Practical		Total	
		Paper					CCE		Total Marks			Max.	Min.	Max.	Min.
		1 st	2 nd	3 rd	Max.	Min.	Max.	Min.	Max.	Min.					
Compulsory paper															
	(i) APPLICATION OF SPECTROSCOPY-I	85	0	0	85	131	15	5	100	36	0	0	100	36	
	(ii) PHOTOCHEMISTRY	85	0	0	85	131	15	5	100	36	0	0	100	36	
	(iii) ENVIRONMENTAL CHEMISTRY	85	0	0	85	131	15	5	100	36	0	0	100	36	
Optional paper – (IV) (Select any two)															
	(i) Organaytransition metal	85	0	0	85	131	15	5	100	36	0	0	100	36	
	(ii) Polymers	85	0	0	85	131	15	5	100	36	0	0	100	36	
	(iii) Heterocyclic chemistry	85	0	0	85	131	15	5	100	36	0	0	100	36	
	(iv) Physical organic chemistry	85	0	0	85	131	15	5	100	36	0	0	100	36	
	(v) Chemistry of materials	85	0	0	85	131	15	5	100	36	0	0	100	36	
	(vi) Industrial Chemistry (Heavy chemical & petroleum)	85	0	0	85	131	15	5	100	36	0	0	100	36	
	Practical (i) inorganic chemistry	0	0	0	0	0	0	0	0	0	33	12	33	12	
	Practical (ii) Organic chemistry	0	0	0	0	0	0	0	0	0	33	12	33	12	
	Practical (iii) Physical chemistry	0	0	0	0	0	0	0	0	0	34	12	34	12	

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केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

~~Syllabus (2019-2020)~~

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	: 55

Particulars/विवरण

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 (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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SUGGESTED READINGS:

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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~~Session (2022-2023)~~

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: PHOTOCHEMISTRY
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: II (Code- MCH-502)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	: 85

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, 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.

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.

	<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 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.

OPTIONAL PAPERS

Out of the following select any two papers each of marks ~~60~~ 85

- 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 & petroleum

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~~Chemistry (MCH-504)~~

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: Organotransition Metal
Chemistry	
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: OPT-1 Code- MCH-504
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks अधिकतम अंक	: 85

Particulars / विवरण

Unit-1	Alkyls and Aryls of Transition Metals Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis. 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.
Unit-2	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.
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 bond.
Unit-5	Fluxional Organometallic Compounds Flexionality and dynamic equilibrium in compounds such as η^2 olefine, η^3 -allyl and dienyl complexes.

Book 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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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	: 85

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

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| | <p>b. Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds.</p> <p>c. Co-ordination and metal chelate polymers.</p> |
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Book 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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~~स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम~~

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
Max. Marks अधिकतम अंक	: 85

Particulars / विवरण

Unit-1	<p>Nomenclature of Heterocycles</p> <p>Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic fused and bridged heterocycles.</p> <p>Aromatic Heterocycles</p> <p>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</p> <p>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</p> <p>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, bezofurans and benzothiophenes.
Unit-4	<p>Meso-ionic Heterocycles</p> <p>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</p> <p>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>
Unit-5	<p>Six Membered Heterocycles with Two or More Heteroatoms: Synthesis and reactions of diazones, triazines, tetrazines and thiazines. Seven-and Large-Membered Heterocycles: Synthesis and reactions of azepines, oxepines, thiepinas, diazepines, thiazepines, azocines, diazocines, dioxocines and dithiocines.</p> <p>Heterocyclic Systems Containing P, As, Sb and B</p> <p>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>

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 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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~~सेमेस्टर - 3~~

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	: 85

Particulars / विवरण

Unit-1	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.
Unit-2	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.
Unit-3	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, s_1 and s_R scales.
Unit-4	Acids, Bases, Electrophiles, Nucleophiles and Catalysis Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity

	<p>functions and their applications. 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.</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 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>
Unit-5	<p>Nucleophilic and Electrophilic Reactivity</p> <p>Structural and electronic effects on SN^1 and SN^2 reactivity. Solvent effect, Kinetic isotope effects. Intramolecular assistance. Electron transfer nature of SN^2 reaction. Nucleophilicity and SN^2 reactivity based on curved crossing mode. Relationship between polar and electron transfer reactions, SR_N^1 mechanism. Electrophilic reactivity, general mechanism. Kinetic of SE^2 Ar reaction. Structural effects on rates and selectivity. Curve-crossing approach to electrophilic reactivity.</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.

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 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



Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: Chemistry of Materials
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र क्रमांक	: OPT-5 (Code- MCH-508)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks अधिकतम अंक	: 100

Particulars / विवरण

Unit-1	<p>A. Multiphase materials Ferrous alloys; Fe-C phase transformations in ferrous alloys; stainless steels, non ferrous alloys, properties of ferrous and non-ferrous alloys and their applications.</p> <p>B. Glasses, Ceramics, Composites and Nanomaterials Glassy state, glass formers and glass modifiers, applications. Ceramic structures, mechanical properties, clay products. Refractories, characterizations, properties and applications. Microscopic composites; dispersion-strengthened and particle-reinforced, fibre-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, special properties, applications.</p>
Unit-2	<p>A. Thin Films and Langmuir-Blodgett Films Preparation techniques; evaporation/sputtering, chemical processes, MOCVD, sol-gel etc. Langmuir-Blodgett (LB) film, growth techniques, photolithography, properties and applications of thin and LB films.</p> <p>B Liquid Crystals Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases; smectic-nematic transition and clearing temperature-homeotropic, planer and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals.</p>
Unit-3	<p>A. Polymeric Materials Molecular shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types and their applications, conducting and ferro-electric polymers.</p>

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

~~2020-21~~

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: Industrial Chemistry-
विषय समूह का शीर्षक	: Heavy Chemicals & Petroleum
Paper No. / प्रश्नपत्र क्रमांक	: OPT-5 (Code- MCH-508 A)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks अधिकतम अंक	: 100

Particulars / विवरण

Unit- I Water, Gases and Heavy Chemicals

Water : Water Pollutants, their classes with examples, Biochemical zoxygen 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.

Unit-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.

Unit-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.

Unit-IV Petroleum : Origin and composition, Refining, Reforming Fractionation; Cracking; knocking and Octane number, Kerosene and Napthe; Liquified petroleum gas (I.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.



बरकतउल्ला विश्वविद्यालय, भोपाल

कार्यालय :- होशंगाबाद रोड, भोपाल (म.प्र.) 462026

क्रमांक: 1870.../अकादमी/पाठक्रम/अ-1/अधि-8/2013

भोपाल, दिनांक : 20/8/13

अधिसूचना

सर्व संबंधितों को सूचित किया जाता है कि एम.एस.सी. (रसायनशास्त्र) के प्रायोगिक पाठ्यविवरण (सिलेबर्स) में संशोधन किया गया है जो सत्र 2013-14 से प्रभावशील होगा। एम.एस.सी. रसायनशास्त्र के ऐच्छिक प्रश्नपत्र के तौर पर ग्रीन कैमेस्ट्री में तथा एम.एस.सी. प्रथम से तृतीय सेमेस्टर प्रायोगिक पाठ्य विवरणों में भी संशोधन किया जाता है। जो बरकतउल्ला विश्वविद्यालय की वेबसाइट www.bubhopal.nic.in पर अपलोड (प्रसारित) किये जा रहे हैं। उक्त प्रायोगिक पाठ्यविवरण (सिलेबर्स) की प्रति आपकी ओर संलग्न कर भेजी जा रही है।

कुलसचिव

बरकतउल्ला विश्वविद्यालय, भोपाल

पृ.क्रमांक 1871/अकादमी/पाठ/अ-1/अधि.-8/2013
प्रतिलिपि :-

भोपाल, दिनांक : 20/8/13

1. आयुक्त एवं सचिव, उच्च शिक्षा विभाग, सतपुड़ा भवन, भोपाल।
2. शासकीय/अशासकीय महाविद्यालयों को इस अनुरोध के साथ की अधिसूचना के साथ संलग्न पाठ्यविवरण (सिलेबर्स) के अनुसार एम.एस.सी. प्रायोगिक रसायनशास्त्र के विद्यार्थियों को अध्यापन कराना सुनिश्चित करें।
3. संबंधित संकायाध्यक्षों, बरकतउल्ला विश्वविद्यालय भोपाल की ओर सूचनार्थ।
4. संबंधित अध्यक्ष एवं सदस्यगण अध्ययन मण्डलों की ओर सूचनार्थ।
5. अधिष्ठाता, छात्र कल्याण, बरकतउल्ला विश्वविद्यालय भोपाल की ओर सूचनार्थ।
6. अधिष्ठाता, महाविद्यालयीन विकास परिषद बरकतउल्ला विश्वविद्यालय भोपाल की ओर सूचनार्थ।
7. परीक्षा नियंत्रक बरकतउल्ला विश्वविद्यालय भोपाल की ओर सूचनार्थ।
8. उप-कुलसचिव परीक्षा/गोपनीय/भंडार कक्ष बरकतउल्ला विश्वविद्यालय भोपाल की ओर सूचनार्थ।
9. सहा कुलसचिव परीक्षा/गोपनीय/भंडार कक्ष, बरकतउल्ला विश्वविद्यालय की ओर सूचनार्थ।
10. जनसम्पर्क अधिकारी (PRO), बरकतउल्ला विश्वविद्यालय की ओर सूचनार्थ।
11. प्रभारी मित्र कार्यालय, बरकतउल्ला विश्वविद्यालय की ओर सूचनार्थ।
12. वेबसाइट प्रभारी की ओर इस आशय के साथ की कृपया इस अधिसूचना के साथ संलग्न संशोधित पाठ्यक्रमों की अधिसूचना एवं सिलेबर्स को विश्वविद्यालय की वेबसाइट पर अपलोड करने का कष्ट करें।
13. श्री एच.सी. पांडे गोपनीय कक्ष बरकतउल्ला विश्वविद्यालय की ओर सूचनार्थ।
14. कुलपति के निज सहायक के माध्यम से कुलपति जी की ओर सूचनार्थ।
15. कुलसचिव के निज सहायक के माध्यम से कुलसचिव जी की ओर सूचनार्थ।
16. संबंधि नरती।

उप-कुलसचिव (अकादमी)

बरकतउल्ला विश्वविद्यालय, भोपाल

BARKATULLAH UNIVERSITY, BHOPAL

Class : **M.Sc.**
Semester : **III Sem.**
Title of Paper : **Green Chemistry**
Paper : **Optional - VII**

Max. Marks : 85

Unit-I Introduction of Green Chemistry, need of Green chemistry, limitations/Obstacles in their pursuits of the goals of Green Chemistry, Twelve Principals of Green Chemistry- their explanations and examples, Designing a green synthesis using these principles, prevention of waste bi-products, Atom Economy-maximum incorporation of the materials used in the process into final products.

Unit-II Organic Synthesis in benign Green solvents- Use of different solvent (benign) for synthesis. Organic Synthesis in Water- Introduction, Different synthesis in water such as Pinacol Coupling, Aldol Condensation, Mannich type reactions, pericyclic reactions, Benzoin condensation, Oxidations, Reductions Wurtzs reaction organic Synthesis in Supercritical Carbon-dioxide-Historical development, use of Supercritical Carbon-dioxide (SC-CO₂) for dry-cleaning, use of Supercritical Carbon-dioxide in some organic reactions-Diels-Alder reaction, Friedel-craft reaction, Hydrogenation, Coupling reactions, Free Radical bromination.

Organic Synthesis using ionic liquids-Types of ionic liquids, Preparation of ionic liquids, Synthetic applications, Organic Synthesis using Polyethylene Glycol and its

solutions- Introduction, Characteristics of the solvent and its applications in different organic reactions.

Unit-III Organic Synthesis using Green Reagents – Use of different Green reagents such as Oxygen, Singlet Oxygen, Ozone, Hydrogen peroxide, Di-oxiranes, Per-oxy acids, Polymer supported reagents. Organic Synthesis using Phase Transfer Catalysis- Mechanism of Phase Transfer Catalysis (PTC), Types of Phase Transfer Catalysts, Advantage and applications of Phase Transfer Catalysis. Organic Synthesis using Crown Ethers and Bio-catalysts.

Unit-IV Use of Alternate Energy Process in Chemical Synthesis –

(a) Microwave Assisted Organic Synthesis-Introduction, Microwave assisted reactions in Water-Hofmann elimination, Hydrolysis of benzyl chloride, benzamide and methyl benzoate, Oxidation of toluence, Microwave assisted reactions in Organic Solvents- Diels- Alder reaction, Fries Rearrangement, Aromatic Substitutions, Esterification.

(b) Ultrasound Assisted Organic Synthesis- Introduction, Homogenous Sonochemical Reactions- Addition Reactions, Oxidations, Organometallic Reactions, Heterogenous liquid-liquid reactions- Esterification, Saponification.

Unit-V Organic Synthesis in Solid State- Solid State Reactions at room temperature- Aldol Condensation, Grignard Reactions, Reformatsky Reaction, Solid State Reactions.

Some Oxidation Reaction Solid State Reactions using Solid support-Protection-deprotection Reactions, Oxidations, Reductions, Isomerisations.

Photo Induced Organic Synthesis- Introduction, Photochemical reactions- Industrial application of Photochemistry- The Barton Reactions, Photochemical synthesis of Vitamin D and related compounds, Photo-Oxygenation, Photonitrosation.

Reference Books :-

1. V.K. Ahluwalia & M.R. Kidwai : "New Trends in Green Chemistry", Anamalya Publishers, 2005.
2. V.K. Ahluwailia : "Green Chemistry A Textbook", Narosa Publishers.
3. P.T. Anastes & J.K. Warner : "Oxford Green chemistry theory & Practical", University Press, 1998.
4. M.C. Cann & M.E. Connely : "Real world cases in Green Chemistry Americal Chemical Society, Washington, 2000.
5. M.A. Ryan & M. Tinnesand : "Introduction to Green Chemistry", Americal Chemical Society, Washington, 2002.

M.Sc. Semester III

Chemistry PRACTICALS

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

1.	Quantitative determinations of a three component mixture	12
2.	Chromatographic Separations	12
	Record	04
	Viva Voice	<u>05</u>
	Total	33

1. **Quantitative determinations of a three component mixture :**

One Volumetrically and two gravimetrically

a. Cu^{+2} , Ni^{+2} , Zn^{+2}

b. Cu^{+2} , Ni^{+2} , Ag^{+1}

2. **Chromatographic Separations**

a. Cadmium and zinc

b. Zinc and magnesium.

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

Organic Chemistry

1.	Estimations	12
2.	Paper Chromatography	12
	Record	04
	Viva Voice	<u>05</u>
	Total	33

1. **Estimations**

1. Estimation of element : Estimation of Sulphur, Nitrogen and Halogens.

2. Estimation of Functional groups and simple organic compound Estimation of Carboxylic group, Aldehyde group, Ketonic group, Carbohydrate group etc.

2. Paper Chromatography

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

Physical Chemistry

1.	Spectroscopy	13
2.	Chemical Kinetics	12
	Record	04
	Viva Voice	05
	Total	34

i. Spectroscopy

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

Books Suggested

- i. Determination of energy and enthalpy of activation in the reaction of KMnO₄ and benzyl alcohol in acid medium.
- ii. Determination of energy of activation and entropy of activation from a single kinetic run.
- iii. Kinetics of an enzyme micellar catalyzed reaction.
- iv. Kinetics of reaction between acetone and iodine spectrophotometrically.
- v. Spectrometric study of oxidation of alcohol by Ce (iv)
- vi. Oxidation of alcohols by chromic acid-a kinetic study.
- vii. Determination of CMC spectrophotometrically.

Books Suggested

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

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

Chemical Kinetics