



PSGR KRISHNAMMAL COLLEGE FOR WOMEN

College with Potential for Excellence

(An Autonomous Institution, Affiliated to Bharathiar University)
(Reaccredited with 'A' Grade by NAAC, An ISO 9001:2008 Certified Institution)
Peelamedu, Coimbatore-641004



DEPARTMENT OF CHEMISTRY

MASTER OF CHEMISTRY

2015 - 2017

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PROGRAMME OUTCOMES

After completion of the programme, the students will have

PO1 : ability to function as responsible individuals with ethical values, accountable to the community

PO2 : detailed knowledge of the major areas of chemistry including a wide range of factual

PO3 : ability to apply chemical concepts in new situations i.e., ability to predict physical and chemical properties by comparison with analogues.

PO4 : professional Skill to handle standard equipments and to analyze the data.

PO5 : ability to solve unseen chemical problems both qualitative and quantitative by interpretation and manipulation of experimental data.

PO6 : ability to present chemical research results to a technically literate audience by means of an oral presentation, scientific poster or a written report.

PO7 : ability to assimilate in the course of different modules throughout the various years of study and to apply this when required.

PROGRAMME SPECIFIC OUTCOME

The students at the time of graduation will

PSO1 : possess skills in spectral, analytical, qualitative and quantitative techniques which will be useful in industry

PSO2 :be able to design a synthetic route for new compounds and transform innovative ideas into reality

PSO3 : possess skill in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

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DEPARTMENT OF CHEMISTRY

2015-2018

Scheme of Examination

(Applicable to students admitted during the Academic Year 2015-2018)

Semester	Subject Code	Title of the paper	Instruction hours/week	Total Hours			Duration of Examination	Max. Marks			Credit Points
				Contact Hours	Tutorial Hours			C A	ESE	Total	
I	MCE1401	Paper – I Organic Chemistry – I(Organic Reaction Mechanism & Stereochemistry)	5	71	4	3	40	60	100	5	
	MCE1402	Paper – II Physical Chemistry – I (Classical & statistical thermodynamics)	5	71	4	3	40	60	100	5	
	MCE1403	Paper – III Analytical Techniques in Chemistry	5	71	4	3	40	60	100	5	
	MCE13P1	Practical – I Organic Chemistry Practical - I	5	75	-	-	-	-	-	-	
	MCE13P2	Practical – II Inorganic Chemistry Practical – I	5	75	-	-	-	-	-	-	
	MCE13P3	Practical – III Physical Chemistry Practical – I	5	75	-	-	-	-	-	-	

II	MCE1404	Paper – IV Organic Chemistry II (Rearrangements, Pericyclic Reactions & Photochemistry)	5	71	4	3	40	60	100	5
	MCE1405	Paper – V Physical Chemistry II (Group Theory & Quantum Chemistry)	5	71	4	3	40	60	100	5
	MCE1406	Paper VI- Spectroscopy	4	56	4	3	40	60	100	5
	MCE13P1	Practical I - Organic Chemistry Practical – I	4	60	-	6	40	60	100	4
	MCE13P2	Practical II - Inorganic Chemistry Practical – I	4	60	-	6	40	60	100	4
	MCE13P3	Practical III - Physical Chemistry Practical – I	4	60	-	6	60	90	150	5
	MCE14A1 / MPL14A1	IDC-Clinical microbiology & Biochemistry	4			3	-	100	100	4
III	MCE1407	Paper – VII Organic Chemistry – III (Chemistry of Natural Products)	5	71	4	3	40	60	100	5
	MCE1408	Paper – VIII Elective – I (Coordination & Organometallic Chemistry)	4	56	4	3	40	60	100	4

		(Or)									
	MCE1409	Paper – VIII Elective – II Medicinal Chemistry	4	56	4	3	40	60	100	4	
	MCE1410	Paper -IX-Physical Chemistry III (Reaction Kinetics & Electrochemistry)	4	56	4	3	40	60	100	4	
	MCE13P4	Practical-IV-Organic Chemistry Practical – II	4	60	-	6	40	60	100	4	
	MCE13P5	Practical-V-Inorganic Chemistry Practical – II	4	60	-	6	40	60	100	4	
	MCE13P6	Practical-VI Physical Chemistry Practical – II	5	75	-	6	60	90	150	5	
	MCE13S1	Research Methodology	2	30	-	3	-	-	100	2	
		Information System Security	2	30	-	-	-	-	-		Grade
		Comprehensive Examination	-	-	-	1	-	-	-		Grade
IV	MCE1411	Paper – X Elective III - Chemistry & Technology of Polymers (Or)	4	56	4	3	40	60	100	4	

MCE1412	Paper – X Elective IV – Applied Chemistry	4	56	4	3	40	60	100	4
MCE1413	Paper- XI Green Chemistry	3	41	4	3	40	60	100	3
MCE 1414	paper - XII Nano Chemistry and Bio inorganic Chemistry	3	41	4	3	25	75	100	3
MCE1315 (Optional)	ALC – Environmental Chemistry (Or)	Self study	-	-	3	25	75	100	5
MCE1316	ALC- Industrial Chemistry	Self study	-	-		80	20	100	5
Dec, Jan, Feb	Project& Viva-voce	-	3 Months (Jan - March)	-					5
	Grand Total							2200 +100	90+5

ALC-Advanced Learner's Course * Not considered for Grand Total & CGPA

SEMESTER – I

PAPER I – ORGANIC CHEMISTRY – I (Organic Reaction Mechanism & Stereochemistry)

Credit- 5

MCE1401

(71 Hrs)

Objectives:

- To gain knowledge about the aromaticity and organic reaction mechanism
- To understand the conformation & stereochemistry of organic compounds
- To learn the mechanism of substitution & elimination reactions in aliphatic & aromatic compounds

Unit I

(14 Hrs)

Aromaticity : Criteria - Huckel's rule – Aromatic character in benzene, four, five, seven, eight membered rings- Aromaticity of benzenoids & heterocyclic compounds. Non benzenoid aromatics- azulene, ferrocene, tropolone, sydnones & annulenes (synthesis not required) - Non aromatic & anti-aromatic systems. Nomenclature of bicyclic & tricyclic systems.

Study of Organic Reaction Mechanism: Non kinetic methods- Product analysis, intermediate criteria (isolation, trapping & detection)- Isotopic labeling & cross over experiments- Stereochemical evidence. Kinetic methods- Mechanistic implications of rate law- Isotope effects. Kinetic & Thermodynamic control of reactions - Hammonds postulates, linear free energy relationship- Hammett & Taft equations.

Unit II

(14 Hrs)

Stereochemistry : Optical Isomerism - Concept of chirality- Stereochemistry of sulphur & nitrogen compounds - Concept of prochirality - Enantiotopic & diastereotopic ligands & faces- Stereospecific & stereoselective reactions. R, S - nomenclature of compounds having one & more than one chiral centres- Axial chirality- (Optical isomerism of biphenyl, allenes & spirans)- Planar chirality (Optical isomerism of ansa compounds & cyclophanes)- Helicity (Optical isomerism of over- crowded molecules)

Geometrical Isomerism: E-Z Notation- Determination of configuration of geometrical isomerism- Stereoisomerism of cyclic compounds (upto six membered ring) - Aldoximes & ketoximes.

Conformational Analysis: Configuration & conformation- Conformation of acyclic compounds- cyclohexane, decalins, perhydrophenanthrenes & carbohydrates. Effect of conformation on reactivity.

Unit III

(14 Hrs)

Aliphatic Nucleophilic Substitution : The S_N1 , S_N2 S_Ni mechanisms. The neighbouring group mechanism, neighbouring group participation by π & σ bonds, anchimeric assistance.

*Classical & non-classical carbocations *, phenonium ions, norbornyl system, common carbocation rearrangements.

Nucleophilic substitution at an allylic, aliphatic, trigonal & vinylic carbon. *Reactivity effects of substrate structure, attacking nucleophile, leaving group & reaction medium* phase transfer catalysis, ambident nucleophiles & ambident substrates.

Aromatic Nucleophilic Substitution: The S_NAr , S_N1 , Benzyne & SR_N1 Mechanisms. Reactivity – Effect of substrate structure, leaving group & attacking nucleophile.

Unit IV

(14 Hrs)

Aliphatic Electrophilic Substitution : Bimolecular mechanisms – S_E2 (front), S_E2 (back) & S_{Ei} . Unimolecular mechanism- S_{E1} mechanism, electrophilic substitution accompanied by double bond shifts. * Effect of substrate, leaving group & solvent polarity on the reactivity*, Friedel- Craft's acylation at olefinic carbon, Stork Enamine reaction & decarboxylation of aliphatic acids.

Aromatic Electrophilic Substitution : Mechanism, orientation & reactivity, the ortho/para ratio, Friedel- Craft alkylation , Scholl reaction (arylation). Formylation: Gattermann reaction,

Gattermann-Koch reaction, Reimer- Tiemann reaction, Kolbe-Schmidt reaction & Houben-Hoesch reaction, Vilsmeier Haack reaction, Hoffmann-Martius & Jacobsen reactions.

UNIT V

(15 Hrs)

Elimination Reactions : E1, E2 & E1cB mechanism, orientation of double bond- structural & stereochemical factors governing eliminations - Hoffmann & Saytzeff rules, Bredts rule - Effect of changes in the substrate, base, leaving group & medium in E1, E2 & E1CB reactions- Elimination vs substitution- Pyrolytic elimination- Chugaev reaction- Hoffmann degradation- *Cope elimination*.

*Self study portions

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	I.L. Finar	Organic Chemistry Vol I	Pearson Education	reprint 2007, 6 th Edition
2	I.L. Finar	Organic Chemistry Vol II	Pearson Education	reprint 2009, 5 th Edition
3	Jagdamba Singh & Yadav	Advanced Organic Chemistry	Pragati Prakasham	2010, 6 th Edition
4	Jerry March	Advanced Organic Chemistry	Wiley Publications	reprint 2010, 4 th Edition.

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	R.K. Bansal	Organic Reaction Mechanism	Tata McGraw Hill Publications	reprint 2006, 3 rd Edition
2	F. A.Carey & Sundberg	Advanced Organic Chemistry	A Plenum/ Rosetta Edition	1990, 3 rd Edition
3	D .Nasipuri	Stereochemistry of Organic Compounds	Wiley Eastern Ltd	1991, 2 nd Edition

Question Paper Pattern

Section A: 5*6= 30 marks

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER I

PAPER II- PHYSICAL CHEMISTRY PAPER – I (Classical & Statistical Thermodynamics)

MCE1402

Credit - 5

(71 Hrs)

Objectives:

- To acquire knowledge about fugacity & activity.
- To understand the need for third law of thermodynamics & probability concept
- To gain knowledge about the different distribution laws (classical & statistical) & their applications

Unit I

(14 Hrs)

Classical Thermodynamics : Concept of Chemical potential – Fugacity- Definition- Determination of fugacity of gases by graphical method, from equation of state, approximation method & generalized method- variation of fugacity with temperature. fugacity & the standard state for non ideal gases- Fugacity coefficient, fugacity of mixture of non- ideal gases.

Activity & activity coefficient. Standard states – Activity of solutions. Determination of activity of solute & solvent by freezing point method.

Unit II

(14 Hrs)

Third Law of Thermodynamics: Nernst heat theorem, third law of thermodynamics - Need for third law, different forms of stating third law, negative absolute temperature, thermodynamic quantities at absolute zero, probability & third law, statistical meaning of third law & apparent exceptions.

Probability & Ensembles: Theorems of Permutations, Combinations & Probability. Thermodynamic probability to molecular systems- States of maximum thermodynamic probability of systems involving energy levels.

Distinguishable & indistinguishable particles. Microstates & macrostates. Ensembles – Definition- Microcanonical, canonical & grand canonical ensembles.

Unit III **(14 Hrs)**

Maxwell Boltzmann Statistics : Stirling's approximation formula, Maxwell Boltzmann distribution law – Assumptions, derivation for the system having non- degenerate & degenerate energy levels. Experimental verification of Maxwell' s distribution of molecular velocities by Stern method. Limitations of Maxwell Boltzmann distribution law.

2D Velocity Distribution Law : Maxwell's Distribution law of molecular velocities, evaluation of alpha & beta in Boltzmann statistics. Evaluation of average velocity, root mean square velocity & most probable velocity from distribution law of molecular velocities, molecular velocities & energies of an ideal gas.

Unit IV **(14 Hrs)**

Equipartition of Principle of Energy: Calculation of heat capacities of ideal gases- Limitations.

Partition Functions: Definition- Explanation- Molecular partition function- Molar partition function- Relationship between partition function & thermodynamic properties E, H, S, A, G, C_V & C_p . Translational partition functions- Sackur- Tetrode equation. Rotational partition functions – Ortho/para hydrogen- Vibrational partition functions- Electronic partition functions. Evaluation of thermodynamic properties for mono & diatomic ideal gas molecules from partition functions.

Unit V **(15 Hrs)**

Quantum Statistics: Bose Einstein distribution law- Derivation – Entropy of boson applications. Derivation of Planck's black body radiation law. Bose Einstein condensation. Helium at low temperature Fermi – Dirac distribution law- Derivation, Entropy of fermions, Applications - Electron gas, fermi energy of free electrons at absolute zero. Heat capacity of free electrons in metals. Heat capacity – Einstein theory & Debye theory of heat capacity of solids.

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Samuel Glasstone	Thermodynamic for Chemists	East West Press	2002, 1 st Edition
2	M.C. Gupta	Statistical Thermodynamics	Wiley Eastern Publications	1990, 1 st Edition

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	P.W. Aktins	Physical Chemistry	Oxford University	1978, 1 st Edition
2	Gurdeep Raj	Advanced Physical Chemistry	GOEL Publishing House	2002, 27 th Edition
3	P. Atkins & Julio de Paula	Elements of Physical Chemistry	Oxford University	2 nd Print 2010, 5 th Edition
4	Sears Salinger	Thermodynamics, Kinetic & Statistical thermodynamics	Narosa Publishing House	1990, 1 st Edition
5	F.T. Wall	Chemical Thermodynamics	W.H. Freeman & Co	1974, 1 st Edition.

Question Paper Pattern**Section A: 5*6= 30 marks**

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER – I

Paper- III – ANALYTICAL TECHNIQUES IN CHEMISTRY

MCE1403

Credit - 5

(71 Hrs)

Objectives:

- To learn about the different types of chromatographic techniques.
- To gain knowledge about the different thermal and electro analytical techniques.
- To understand the principles of XRD and to analyze XRD data.

Unit I

(14 Hrs)

Chromatography

High Pressure Liquid Chromatography (HPLC): Introduction, Characteristic features of HPLC, Principle, column processes and band broadening, instrumentation, Applications of HPLC.

Gas Chromatography (GC): Introduction, Principle, Theory, instrumentation, Evaluation of gas chromatogram, identification of chromatogram, plate theory for gas chromatography, Applications.

Gas Chromatography Mass Spectrometry (GC-MS) - Ion monitoring by GC MS system.

Super Critical Fluid Chromatography (SFC): Characteristics of super critical fluids, Instrumentation for SFC, Components for SFC, Comparison of SFC with HPLC & GLC, Applications of SFC

Unit II

(14 Hrs)

Analytical Techniques: ORD & CD – Principle, instrumentation - Visual polarimetry(for ORD) types of ORD curves, axial helicity rule & octant rule – Applications to determine the configuration & conformation of simple monocyclic & bicyclic ketones. Nephelometry & turbidimetry – *Tyndall effect* – Instrumentation & applications.

Unit III

(14 Hrs)

Thermoanalytical Methods: Principle - Thermogravimetric analysis & differential thermal analysis- discussion of various components with block diagram- TGA & DTA curves of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{MgC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ & $\text{Ca}(\text{OOCCH}_3)_2 \cdot \text{H}_2\text{O}$ – Simultaneous DTA-TGA curves of SrCO_3 in air & $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ in air & CO_2 . *Factors affecting TGA & DTA curves*. UPS & ESCA- Basic principles, sources, instrumentation, applications. Discussion of PES spectra of simple molecules nitrogen, oxygen & sulphur.

Unit IV

(14 Hrs)

X-ray Diffraction: Fundamentals of XRD- Powder and rotating crystal methods .

Determination of lattice types, analysis of X-ray data for cubic system- NaCl, KCl crystals.

Fourier synthesis,. Neutron diffraction and structure determination.

Types of solids – close packing of atoms and ions- bcc, fcc, hcp- voids-radius ratio and crystal geometry influence on structures – CsCl, Wurtzite, Zinc blende, rutile, fluorite, antiferite – diamond and graphite.

Unit V

(15 Hrs)

Electro Analytical Techniques

Coulometry: Introduction, Types of Colometric methods, Types of Coulometers – O_2 - H_2 , Ag and I_2 coulometer, Coulometric titrations- Internal and external generation of titrants, application of coulometric titrations.

Polarography: Introduction, apparatus, working, polarographic measurements, Interpretation of polarographic waves, equation for polarographic wave, half wave potential, types of currents, DME advantages, Application of Polarography

Cyclic Voltammetry: Principle, Normal pulse voltammetry (NPV), Differential pulse voltammetry (DPV), Square wave voltammetry (SWV) Preconcentration and stripping technique, Anodic stripping voltammetry, cathodic Voltammetry, adsorptive stripping voltammetry.

***Self study portions**

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	E.L Eliel	Stereochemistry of Carbon Compounds	Tata Mc Graw Hill	2004, 30 th Edition
2.	Dr. H. Kaur	Instrumental Methods of Chemical Analysis	Pragati Prakashan	2008, 4 th Edition
3.	Mahinder Singh	Analytical Chemistry- Instrumental Techniques	Dominant Publishers & Distributors NewDelhi	2003, 1 st Edition
4.	B. K Sharma	Instrumental Methods of Chemical Analysis	Goel Publications	1996, 15 th Edition
5.	H. H Willard, L. L Merritt. & J. A Dean, F.A. Settle	Instrumental Methods of Analysis	CBS Publishers & Distributors	1986, 7 th Edition

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	L.I.Antropov	Theoretical electrochemistry	MIR publishers, Moscow	1972, 1 st Edition
2.	S. M. Khopkar	Basic Concepts of Analytical Chemistry	Wiley Eastern Ltd	1884, First Edition
3.	D. A Skoog, F.J.Holler & D. M West	Analytical Chemistry- An Introduction	Saunders College Publications	1994, 8 th Edition
4.	M.S.Yadav	Instrumental Methods of Chemical Analysis	Campus Book	2006, 1 st Edition

Question Paper Pattern**Section A: 5*6= 30 marks**

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER - II

PAPER – IV -ORGANIC CHEMISTRY –II

(Rearrangements, Pericyclic Reactions, Retro Synthesis & Photochemistry)

Credit - 5

MCE1404

(71 Hrs)

Objectives:

- To enhance the knowledge through elaborative study of carbonyl compounds & Molecular Rearrangements
- To learn the stereo specificity of reactions by PMO, FMO & correlation diagram method.
- To know about the various oxidation – reduction reagents & Retro Synthesis
- To understand the principles of photochemistry

Unit I

(14 Hrs)

Chemistry of carbonyl compounds: Synthesis of Aldehydes & Ketones. Typical additions to carbonyl compounds – *Addition of water, alcohol, thiol, bisulphite, HCN & amino compounds* Mannich reaction, Meerwein Ponnorff –Verley Reduction, Grignard, Claisen & Dieckmann, Stobbe, Knoevenagel, Darzen, Wittig, Thorpe, Benzoin & Darzen's Glycidic Ester Condensation, Michael Addition.

Unit II

(14 Hrs)

Molecular Rearrangements: Intramolecular 1, 2 –shifts, Wagner Meerwein & related rearrangements, Migration to carbonyl carbon –Neber & Baeyer Villiger Rearrangement.* Rearrangement to electron deficient nitrogen & oxygen – Dienone – Phenol, Favorskii, Fries, Wolff, Benzidine, Steven's, Demzanov, Sommet-Hauser, Chapman & Wallach Rearrangements.

Unit III

(14 Hrs)

Pericyclic Reactions: Molecular Orbital Symmetry, Frontier Orbitals of ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene. Classification of pericyclic reactions. Electrocyclic reactions – $4n$ & $4n+2$ systems, Woodward–Hoffmann rules, Correlation Diagram, FMO & PMO approach [1, 3-dienes & 1, 3, 5-trienes]

Cycloadditions: Antarafacial & Suprafacial additions, $4n$ & $4n+2$ systems, 1, 3-dipolar addition, Diel's Alder Reaction.

Sigmatropic Rearrangements: Suprafacial & Antarafacial shifts of Hydrogen, Cope, Claisen & σ - π methane Rearrangement *.

Unit IV

(14 Hrs)

Retro Synthesis: Definitions of some terms used in Retro Synthesis- Guidelines for choosing disconnections- Guidelines - 1 to 3. One Group C-X disconnections- carbonyl derivatives, alcohols & olefins. Chemoselectivity- Introduction - Guidelines-1 to 7. Reversal of polarity(Umpolung) – Definition- Umpolung reagents (Epoxides, α – halo ketones, nitro compounds).

Protecting Groups: Introduction, protection of alcohols- principle – protecting group for alcohols- acetals/ketals, ethers, protection of carbonyl groups- principle – protecting group for carbonyl compounds- acyclic acetals & ketals, protection of carboxylic acid groups- principle – protecting group for carboxylic acid – methylester, protection of amino groups- principle – protecting group for amino group- formamide.

Unit V

(15 Hrs)

Organic Photochemistry: Introductory theory of light absorption, photophysical processes- Jablonski Diagram, IC, ISC, *fluorescence, phosphorescence *. Photochemical reactions of Ketones –Norrish type I & II, Paterno Buchii Reaction, Photoreduction of Ketones. Photochemical reactions of alkenes – Cis-trans isomerism, Photochemistry of α , β -unsaturated Ketones, Photodimerisation.

Oxidation & Reduction: Metal hydride reduction –Reactions involving replacement of oxygen by hydrogen, reactions in which an oxygen is removed from the substrate, Reductive coupling. Oxidation- Aromatisation of six membered rings, oxidation of alcohols to aldehydes & ketones, Oxidative cleavage of glycols, Ozonolysis, Sommet reaction. Reactions involving both oxidation & reduction – Cannizzaro, Tischenko & Willgerodt reactions.

***Self study portions**

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	V.K.Ahluwalia	Organic Reaction Mechanism	Narosa Publishing House	2010, 3 rd Edition
2	Jagadamba Singh & L.D.S. Yadav	Advanced Organic Chemistry	Pragati Prakasam	2007, 6 th Edition
3	Jerry March	Advanced Organic Chemistry – Reactions, Mechanism & Structure	John Wiley Publications Ltd	2008, 4 th Edition.
4	A.Peter Sykes	A Guide Book to Mechanism in Organic Chemistry	Longman Publications	2009, 6 th Edition.

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	T.L. Gilchrist & R.C. Storr	Organic Reactions & Orbital Symmetry	Cambridge University Press	1975, 1 st Edition.
2	Goutam Brahmachari	Organic Name Reactions	Narosa Publishing House	reprint 2009
3	Solomons & Fryhles	Organic Chemistry	John Wiley & Sons	2010, 8 th Edition
4	Stuart Warren	Organic Synthesis- The Disconnection Approach	John Wiley & Sons	2004, 1 st Edition

Question Paper Pattern

Section A: 5*6= 30 marks

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER II
PAPER V- PHYSICAL CHEMISTRY II
(Group Theory & Quantum Chemistry)

MCE1405

Credit - 5

(71 Hrs)

Objectives:

- To enable the students to study the atomic structure & quantum mechanics with the help of group theory
- To understand the significance of operators & their use in Quantum Mechanics.
- To know about the wave nature of particles, derivation of Schrodinger Wave Equations & their applications.

Unit I

(14 Hrs)

Symmetry Elements & Symmetry Operations: Definition of identical & equivalent elements – Configurations – Symmetry operations & symmetry elements – Rotation – Axis of symmetry – Reflections – Symmetry planes – Inversion, centre – improper rotations – Rotation- Reflection axis – Effect of performing successive operations (Commutative & non-Commutative)- Inverse operations. Groups & their basic properties - Definition of a group – Basic properties of a group – Definition of Abelian group – Isomorphic group – Similarity transformation & classes – Group multiplication tables-Symmetry classification of molecules into point groups (Schoenflies symbol only)- *Difference between point group & space group * – Various symmetry operations of tetrahedral point groups.

Matrices: Definition of matrix, square , diagonal , null , unit, row , column , symmetric , skew symmetric & conjugate matrices – Matrix multiplication (Commutative & non-Commutative) determination of inverse of a matrix, block multiplication of matrices – Addition & subtraction of matrices – Matrix notations for symmetry operations of C_{2v} & C_{3v} point groups (use of vectors)- construction of character tables for C_{2v} & C_{3v} point groups.

Unit II

(14 Hrs)

Reducible & Irreducible representations: Definition of reducible & irreducible representations – Irreducible representation as orthogonal vectors – Direct product rule – The Great Orthogonality Theorem & its consequences (statement only, proof not needed)- Determination of the characters for irreducible representation of C_{2v} & C_{3v} point groups – using the Orthogonality Theorem – Calculation of binary co-ordinates in the character tables for C_{2v} & C_{3v} point groups – Calculation of character values of reducible representations per unshifted atom for each type of symmetry operation – *Determination of total Cartesian Representation * – Determination of Direct sum from total Cartesian Representation.

Group theory & Vibrational spectroscopy – Vibrational modes as basis for group representation – Symmetry selection rules for IR & Raman spectra (Mutual Exclusion Principle – Classification of vibrational modes).

Unit III

(14 Hrs)

Birth of Quantum Mechanics: Failure of classical mechanics & need for quantum mechanics. Functions – Types & theorems - Algebra of operators: commutator, linear & non-linear operators. Eigen functions & eigen values. Postulates of quantum mechanics correspondence between physical quantities in classical mechanics & operators in quantum mechanics, linear & angular momentum operators, Hamiltonian operator & Hermitian operator.

De Broglie's Wavelength, Heisenberg's uncertainty principle Schrodinger Wave Equations – (Time dependent & time independent)- Requirements of the acceptable wave function. Particle in a one-dimensional box, quantisation of energy, Normalization of wave function, Orthogonality of the particle in a one dimensional box.

Unit IV

(14 Hrs)

Quantum Mechanics I: *Particle in a 3 dimensional box, separation of variables, degeneracy with respect to particle in a cubical box.* Solving of Schrodinger Equation for the one dimensional harmonic oscillator model of a diatomic molecule, solving of Schrodinger Equation for a Rigid Rotor Model of a diatomic molecule, Schrodinger Equation for the H- atom (H – like species) , separation of variables (solving of radial equation is not needed but nature of the

solution to be given). Radial wave function, Radial distribution curves, Probability wave function, Probability distribution curves, Shapes of s & p orbitals only.

Unit V

(15 Hrs)

Quantum Mechanics II: Electron spin- *the He atom & the Pauli principle, symmetric, & antisymmetric nature of the wave functions.* Slater determinants – Approximate wave function of many electron atoms. Need for approximation methods. The perturbation theory (1st order only). Application of the perturbation method to Helium atom. Variation principle – Application of variation method to helium atom. *Born-Oppenheimer Approximation – Treatment of the H²⁺ ground state by LCAO-MO method. * HMO treatment of simple & conjugated π electrons systems- Ethylene, allyl, butadiene & benzene systems.

*Self study portions

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	A.K Chandra	Introduction to Quantum Chemistry	Tata Mc Graw Hill Publications	1974, 4 th Edition
2	R.K. Prasad	Quantum Chemistry	New Age International Publishers	1996, 4 th Edition
3	K.V.Raman	Group Theory & its Applications to Chemistry	Tata McGraw-Hill Publications	reprint 1994

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	F.A. Cotton	Chemical Applications of Group Theory	Wiley Publications Ltd	2009, 3 rd Edition
2	Donald. A. Mc. Quarrie	Quantum Chemistry	Viva Books Publications	reprint 2011
3	Ira. N. Levine	Quantum Chemistry	Pearson Publications	2007, 6 th Edition

Question Paper Pattern

Section A: 5*6= 30 marks

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER – II

Paper- VI – SPECTROSCOPY

Credit - 5

MCE1406

(56 Hrs)

Objectives:

- To understand the basic concepts of spectra & determine the structure of unknown compounds.
- To understand the basic concepts of UV- VIS, IR, Mass, ESR & NMR.
- To develop problem solving skills.

Unit I

(11 Hrs)

UV & Visible Spectroscopy: Electronic excitation - Origin of different bands - Intensity of bands - Selection rules - Laws of photometry- Correlation of electronic absorption with molecular structure -Simple chromophoric groups - Solvent effect - Woodward's rule - Application of electronic spectroscopy to conjugated dienes, polyenes, * α,β - unsaturated carbonyl compounds *,benzenoid systems.

Unit II

(11 Hrs)

Infrared Spectroscopy: Principle, the modes of stretching & bending vibrations- Bond properties & absorption trends-*Instrumentation of infrared spectroscopy* – Description of double beam IR spectrophotometer – IR spectra of polyatomic molecules – Factors affecting the vibrational frequencies – Applications of IR spectroscopy – Intra & intermolecular hydrogen bonding – Finger Print region – Far IR region - Metal- ligand stretching vibrations.

Unit III

(11 Hrs)

Proton NMR Spectroscopy: Nuclear Spin States- Nuclear magnetic moments-Absorption of energy- ^1H chemical shift – Factors affecting chemical shifts – Spin – spin splitting- (n+1rule) –

Coupling constant - Deuterium exchange - First order & non first order spectra- A review. *
Chemical & magnetic equivalence, Shift reagents, NMR instrumentation –Applications *

Unit IV

(11 Hrs)

Carbon –13 NMR Spectroscopy: The ^{13}C nucleus – Chemical shifts – Spin – spin splitting – Double resonance techniques - * Homonuclear & heteronuclear decoupling *- Broad band decoupling – Off resonance decoupling – ^{13}C relaxation mechanisms.

ESR Spectroscopy: Theory – Derivative curves – *The ‘g’ shift *- Hyperfine splitting – Zero field splitting & Kramer’s degeneracy – Factors affecting the magnitude of the g values - Identification of free radicals- EPR spectra of inorganic compounds.

Unit V

(12 Hrs)

Mass Spectrometry: Introduction – Principle – Ion production (EI, CI, FD & FAB) – Presentation of spectral data – Molecular ions – Meta stable ions – Molecular ion peak. Nitrogen rule – Isotopic abundance analysis.

Fragmentation Process – Symbolism (scission only) – Even & odd electron ions - Scission with Rearrangement. Retro Diels Alder Rearrangement - Mc Lafferty Rearrangement – Double bond &/ or ring equivalents implied from a formula. Fragmentation associated with functional groups – *Aliphatic compounds, aldehydes, ketones, carboxylic acids, esters, amides, alcohols, thiols, amines, ethers, sulphides & halides * – Aromatic compounds - Elimination due to ortho groups.

***Self study portions**

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Jag Mohan	Organic Spectroscopy	Narosa Publishing House	2009, 2 nd Edition.
2	P.S.Kalsi	Spectroscopy	New Age International (P) Ltd	reprint 2009

3	Y. R Sharma	Elementary Organic Spectroscopy	S. Chand Publications	2009, 4 th Edition
4	William Kemp	Organic Spectroscopy	ELBS Publications	1975, 3 rd Edition.

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	R.S. Drago	Physical Methods in Inorganic Chemistry	East West Pvt. Ltd	1978, 1 st Edition.
2	D. L. Pavia, G.M. Lampman, G.S.Kriz & James R.Vyvyan	Spectroscopy	Brooks/Cole Publications	2011, 5 th Edition.
3	R.M. Silverstein, F.X. Webster	Spectrometric Identification of Organic Compounds	John Wiley Publications	2009, 6 th Edition

Question Paper Pattern

Section A: 5*6= 30 marks

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER - I & II
PRACTICAL I - ORGANIC CHEMISTRY PRACTICAL – I

Credit - 4
(135 Hrs)

MCE13P1

1. Qualitative Analysis:

Analysis of two component mixtures – Separation & Characterization of components.

2. One stage preparations:

- (i) m-dinitrobenzene from Nitrobenzene
- (ii) Resacetophenone from Resorcinol
- (iii) Tribromoaniline from Aniline
- (iv) Diazoaminobenzene from Aniline
- (v) Anthranilic acid from Pthalimide
- (vi) Salicylic acid from methylsalicylate
- (vii) Benzoic acid from benzaldehyde
- (viii) Methyl orange from sulphanilic acid

Note: A minimum of six organic mixtures & six preparations should be done by each student.

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Arthur I. Vogel	Elementary Practical Organic Chemistry (part 2) Qualitative Organic Analysis	Pearson Education	2011, 2 nd Edition.
2	F.G. Mann & B.C. Saunders	Practical Organic Chemistry	Pearson Education	2009, 4 th Edition

PRACTICAL II - INORGANIC CHEMISTRY PRACTICAL - I

Credit - 4

MCE13P2

(135 Hrs)

1. Qualitative Analysis:

Qualitative Analysis employing semi micro methods & spot tests of mixtures of common cations & ions of the following less familiar elements.

Molybdenum, Thallium, Tungsten, Selenium, Tellurium, Cerium, Thorium, Titanium, Zirconium, Vanadium, Beryllium, Uranium & Lithium.

2. Titrimetry :

Complexometric titrations using EDTA - Estimations of Calcium, Magnesium, Nickel & Zinc.

3. Preparation of Inorganic Complexes:

- i. Potassium tris(oxalato)aluminate
- ii. Nickel ammonium sulphate
- iii. Tris(thiourea)copper (I)chloride
- iv. Potassium tris(oxalato)ferrate
- v. Hexammine cobalt(III)chloride
- vi. Ammonium hexachloro stannate(IV)
- vii. Tetrammine copper(II)sulphate

4. Colorimetric Estimations of Cu & Ni using Spectronic 20D+.

5. Finding λ_{\max} of Ni & Fe Complexes using UV-Visible Spectrophotometer.

References Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Arthur I.Vogel	Macro & Semimicro Qualitative Inorganic Analysis	Orient Longmans Ltd	1967, 1 st Edition
2	G.Palmer	Experimental Inorganic Chemistry	Cambridge University Press	1962, 3 rd Edition.
3	G.Svehia	Vogel's Qualitative Inorganic Analysis	Pearson Education	Copyrights 1996, 7 th Edition.

PRACTICAL III - PHYSICAL CHEMISTRY PRACTICAL - I

Credit - 5

MCE13P3

(135Hrs)

1. Molecular weight determination by Rast Micro Method
2. Phase study: Simple Eutectic System & Compound Formation
3. Phase Study: System with Compound Formation
4. Determination of Transition Temperature of Salt Hydrate
5. Viscosity: Variation of viscosity of liquids with temperature
6. Refractive Index: Determination of Refractive Index (unknown composition of a mixture of liquids)
7. Electromotive Force:
 - (i) Determination of Standard Potentials (Cu, Zn, Ag)
 - (ii) Evaluation of Thermodynamic Quantities from EMF Data (Daniel Cell)
 - (iii) Determination of pH & pKa values using Hydrogen & Quinhydrone electrodes
8. Potentiometric Titrations:
 - i. Titration of HCl Vs NaOH
 - ii. Titration of mixture of acids against a strong base
 - iii. Titration of CH₃COOH Vs NaOH
 - iv. Redox titrations:
 - (a) Titration of Ferrous ammonium sulphate against Potassium dichromate
 - (b) Titration of Potassium iodide against Potassium permanganate
 - v. Determination of instability constants of Silver ammine Complex
 - vi. Determination of solubility product of a sparingly soluble salt (Concentration Cell & Chemical Cell)
 - vii. Precipitation titrations:
 - (a) Estimation of KI by titration with AgNO₃ using KCl as standard
 - (b) Titration of mixture of halides against AgNO₃ solution
 - viii. Heat of solution by solubility method
 - ix. Determination of pH using pH meter

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	B.P. Levitt	Findlay's Practical Physical Chemistry	Longman Publications	1973, 9 th Edition
2	G.Palmer	Experimental Physical Chemistry	Cambridge University Press	1964, 1 st Edition
3	B. Viswanathan & P.S. Raghavan	Practical Physical Chemistry	Viva Books	2009, 3 rd Edition

INTER DISCIPLINARY COURSE
(For M. Sc., Chemistry/ Botany Students)
CLINICAL MICROBIOLOGY & BIOCHEMISTRY
MCE14A1/ MPL14A1

Credit -4

(60 Hrs)

Objectives:

Objectives:

- To enable the students to understand the principles of clinical chemistry
- To understand the importance of clinical microbiology in disease identification
- To acquire knowledge on common disease

Unit I

(12 Hrs)

Clinical microbiology: Clinical specimens –Collection- needle aspiration, Intubation, Catheter; handling, transport. Isolation of microbes from specimens-selective media, differential media, enrichment media, characteristic media. Identification of microbes (virus, bacteria, fungi and parasites)through morphological and biochemical characteristics

Unit II

(12 Hrs)

Principles of clinical biochemical analysis: Basis of analysis of body fluids for diagnostic prognostic and monitoring purposes.

Blood Analysis: Composition of blood, blood grouping & matching, physiological function of Plasma protein, role of blood as oxygen carrier, blood pressure - Hypertension & hypotension, coagulation of blood, *Anaemia – causes & control *.Urea determination- the urease method, estimation of bile pigment in serum, estimation of total protein in serum, estimation of total proteins and albumin based on biuret method and BCG method.

Unit III

(12 Hrs)

Clinical Chemistry: Determination of Glucose in Serum by Folin & Wu's method, Determination of Serum Cholesterol - Sackett's method for total cholesterol. Diagnostic test for Sugar in Urine. Test for salt in Serum, Test for Chlorides. Detection of Cholesterol in Urine,

*Detection of Diabetes *. Typical reference ranges for biochemical analyst Viz, sodium, potassium, urea, creatinum, AST, ALT, AP and cholesterol and their significance

Biological role of sodium, potassium, calcium, iodine, copper and zinc

Unit IV

(12 Hrs)

Electrophoresis: Principles , Techniques: southern, western and northern blotting **Vaccines and**

immunizations: Active immunization, passive immunization, Type of vaccines- whole organism vaccines, purified macromolecules as vaccines, Recombinant –vector vaccines, DNA vaccines.

Unit V

(12 Hrs)

Common Diseases & their treatments:

Insect borne diseases: Malaria & Plague.

Air Borne diseases: Diphtheria, Whooping cough, Influenza, Measles mumps, Tuberculosis,

Water borne diseases: Cholera, Typhoid, & Dysentery. Common disease of the digestive system- jaundice, respiratory system- asthma.

First aid: for accidents, Common poisons & their antidotes - acid poisoning, alkali poisoning,

*Poisoning by disinfectants *, hallucinogens.

Toxic effects of metals: Toxicity of Iron, Copper, Arsenic, Mercury, Lead, Cadmium ,Aluminium & Radionuclide & Wilson’s disease.

***Self study portions**

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Asim. K. Das	Bioinorganic chemistry	Books & Allied Pvt Ltd	2007, 1 st Edition
2.	Jayashree Ghosh	Fundamental concepts of Applied Chemistry	S. Chand & Co,	2006, 1 st Edition
3.	Jayashree Ghosh	Textbook of Pharmaceutical Chemistry	S. Chand & Co	2003, 3 rd Edition
4.	Lensing M.Prescott, John P, Harley, Donald A Klein	Microbiology	Tata Mc Graw Hill, New Delhi	2005, 6 th Edition

5.	Rana. S.V.S	Bio Techniques. Theory and Practice	Rastogi Publication. Meerut, India	2005, 1 st Edition
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Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Ambika Shanmugam,	Fundamentals of Biochemistry for Medical Students,	Nagaraj and Company Private Limited	Reprint 2005
2.	Keith Wilson, John Walker,	Principles and Techniques of Biochemistry and Molecular Biology	Cambridge University Press	2008, 6 th Edition
3.	Mallikarjuna Rao N	Medical Biochemistry	New Age International (P) Limited, Publishers,	2006, 2 nd Edition

Question Paper Pattern

Section A: 5*5= 25 marks

5 questions from each unit either or type – short answer type

Section B: 5*15 = 75 marks

5 questions from each unit either or type - Essay type answers

Semester –III

Paper-VII Organic Chemistry-III (Chemistry of Natural Products)

MCE1407

Credit - 5

(71 Hrs)

Objectives:

- To learn about isolation, separation & identification of terpenoids, alkaloids & steroids
- To gain knowledge about the structural elucidation of terpenoids, steroids, alkaloids, flavones & anthocyanins.
- To acquire knowledge about the structural elucidation of nucleic acids.

Unit I

(14 Hrs)

Terpenes: Isolation & classification of terpenes. Structural elucidation & synthesis of Zingiberine, Eudesmol, Abietic acid, Caryophyllene, Cadenine, Camphor & *Santonin*.

Unit II

(14Hrs)

Steroids: Introduction-structural elucidation & synthesis of cholesterol, ergosterol, vitamin D, Male sex hormones- androsterone & *testosterone*, Female sex hormones- Oestrone, equilenin, *Progesterone*.

Unit III

(14 Hrs)

Alkaloids: Introduction-structural elucidation & synthesis of Reticuline, Morphine, Reserpine, Quinine, Atropine, *yohimbine & glaucine*.

Unit IV

(14Hrs)

Nucleic Acids: Structure of RNA & DNA, Structure of nucleosides - bases present - point of linkage of base & sugar - structure of nucleotides - pairing of bases-biological functions of RNA & DNA-genetic continuity- *role of RNA in protein synthesis*.

Reagents in Organic Synthesis: DDQ, DCC, OsO₄, H₂O₂ and NBS**Unit V****(15 Hrs)**

Flavones & Anthocyanins: Structure, synthesis & reactions of Flavones, Isoflavones & Flavanols- Apigenin, Diadzein, Quercetin – Anthocyanins - Cyanin chloride - Pelargonin chloride– Delphinin chloride, Peonin chloride- Structure & synthesis. *Colour of Anthocyanins*.

Self study portions*Text Books:**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	O.P. Agarwal	Organic Chemistry Natural Products, Vol.I	Goel Publishers	2008, 38 th Edition
2	O.P. Agarwal	Organic Chemistry Natural Products, Vol.II	Goel Publishers	2009, 36 th Edition
3	O.P. Agarwal	Organic Chemistry- Reactions & Reagents Vol-II	Goel Publishers	2009, 45 th Edition

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	V.K. Ahluwalia	Chemistry of Natural Products	Ane Books Pvt. Ltd	2006, 1 st Edition
2	P.S. Kalsi	Chemistry of Natural Products	Kalyani Publishers	1983, 1 st Edition
3	I.L. Finar	Organic Chemistry Vol.I	Pearson Education	reprint, 2007, 6 th Edition
4	I.L. Finar	Organic Chemistry Vol.II	Pearson Education	reprint, 2011
	K. Nakanishi	Natural Product Chemistry Vol. I & II	Academic Press, Inc	1975, 1 st Edition

Question Paper Pattern

Section A: 5*6= 30 marks

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

Semester –III

Paper – VIII Elective: I -Co-ordination and Organometallic Chemistry

Credit - 4

MCE1408

(56 Hrs)

Objectives:

- ❖ To understand the theories of bonding in complexes & spectral applications
- ❖ To acquire knowledge regarding organometallic complexes, industrial applications & catalysis by co-ordination compounds

Unit I

(11Hrs)

Coordination Chemistry: Nomenclature of coordination compounds – isomerism, structural & stereoisomerism – octahedral & square planar complexes. Bonding in complexes -*Valence bond theory*, Crystal field theory- Crystal field effects in tetrahedral, octahedral & square-planar symmetries. CFSE-Weak & strong field effects-Spectrochemical Series. Applications of CFSE. Molecular Orbital Theory- Based on group theoretical approach, M.O diagrams of octahedral complexes with & without pi-bonding. - Experimental evidence for pi-bonding.

Unit II

(11 Hrs)

Electronic spectra of complexes: Characteristics of d-d transitions - selection rules. Energy level diagrams –Orgel diagrams. Sugano –Tanabe diagrams (only for d^2, d^3 & d^6 ions), *Jahn-Teller tetrahedral distortions*. Spin-orbit coupling. Nephelauxetic effect. Charge transfer spectra. Mossbauer spectroscopy- Principle- Applications of Mossbauer spectroscopy in the characterization of Fe complexes.

Unit III

(11 Hrs)

Reactions of complexes - Inert and labile complexes- Substitution reactions in square planar and octahedral complexes, S_N^1 CB mechanism. Trans effect- mechanism and *applications*. Oxidation –reduction reactions – through atom/group transfer-through electron transfer. Mechanism of electron transfer reactions in solution phase – outer sphere mechanism and inner sphere mechanism.

Unit IV**(11 Hrs)****Organometallic Chemistry**

Basics of Organometallic Chemistry – Hapticity- Classification of ligands and its limitations- 18 e⁻ rule, *Metal carbonyls- Preparation*, Structure, bonding and reactions. Metal Nitrosyls – Preparation and Bonding, Dinitrogen complexes- Metal alkenes – Zeise salt – bonding, Cyclopentadienyl complexes (Ferrocene) – Preparation and properties. Concept of Isolobality and Isolobal analogues- ML₅, ML₄, ML₃ Fragments- Examples- Mn(CO)₅, Fe(CO)₄, Co(CO)₃.

Unit-V**(12Hrs)****Catalysis by Organometallic compounds**

Organometallic reactions - Co-ordinative unsaturation, *oxidative addition reaction*, Reductive elimination, Insertion reaction, Hydrogenation of alkenes (Wilkinson catalysis), Hydroformylation (Oxo process), Oxidation of Olefins (Wackers process), Carbonylation of Methanol (Monsanto Process), Polymerisation of Olefins (Zeigler –Natta catalysts) Metal clusters – Introduction to metal carbonyl cluster - Wade's rule.

*** Self study portions****Text Books:**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	James. E. Huheey, Ellen. A. Keiter, R. Keiter, O.K. Medhi	Inorganic Chemistry- Principles of Structure & Reactivity	Pearson education	2011, 9 th Edition.
2	R.C Mehrotra & A. Singh	Organometallic Chemistry- A Unified Approach	New Age Publishers	2000, 2 nd Edition.
3	Puri, Sharma & Kalia	Principles of Inorganic Chemistry	Milestone Publishers and Distributors	2012-13, 31 st Edition
4	Wahid.U.Malik, G.D.Tuli & R.D.Madan	Selected Topics in Inorganic Chemistry	S.Chand & Co	2010, 30 th Edition.

References Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	F.A. Cotton & G. Wilkinson	Basic Inorganic Chemistry	Wiley Interscience Publishers	2007, 3 rd Edition.
2	J.D.Lee	Concise Inorganic Chemistry	Chapman and Hall	1991, 4 th Edition

Question Paper Pattern**Section A: 5*6= 30 marks**

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

Semester III

PAPER – VIII -Elective II– Medicinal Chemistry (Optional)

Credits - 4

MCE1409

(56 Hrs)

Objectives:

- To give basic ideas about drug chemistry.
- To introduce various drugs & their activity.
- To enable the students to have a basic idea about different treatments for disease.

Unit I

(11 Hrs)

Introduction to drugs

Development of new drugs, procedures followed in drug design, concepts of lead compound & lead modification, *concepts of prodrugs & soft drugs*, structure activity relationship(SAR), factors affecting bioactivity, resonance, inductive effects, isosterism, bio isosterism, spatial considerations. Theories of drug activity : occupancy theory, rate theory, induced fit theory. Quantitative structure activity relationship. History & development of QSAR. Concepts of drug receptors. Elementary treatment of drug receptor interactions.

Unit II

(11 Hrs)

Pharmacokinetics : Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition & in therapeutics. *Mention of uses of pharmacokinetics in drug development process*.

Pharmacodynamics : Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, sulphonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

Unit III**(11 Hrs)**

Antineoplastic Agents : *Introduction, classification, cancer chemotherapy *, special problems, role of alkylating agents & anti metabolites in treatment of cancer. Mention of carcinolytic antibiotics & mitotic inhibitors.

Synthesis of mechlorethamine, cyclophosphamide, melphalan, uracil, mustards & 6-mercaptopurine. Recent development in cancer chemotherapy. Hormone & Natural products.

Unit IV**(11Hrs)**

Cardiovascular Drugs: Introduction - classification of cardiac glycosides, antiarrhythmic drugs, therapeutic uses. Antihypertensive agents, Vasopressor Drugs – Mechanism of Action. Synthesis of verapamil, *methldopa*.

Unit V**(12 Hrs)**

Local Antiinfective Drugs: Introduction & general mode of action. Synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapsone, *amino salicylic acid, isoniazide *, ethionamide, ethambutal, fluconazole, econazole, griseofulvin, chloroquin & primaquin.

*** Self Study Portions**

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Ashutosh Kar	Medicinal Chemistry	New Age international	2005, 3 rd Edition
2	R.S Satoskar & S.D.Bharkar	Pharmacology & Pharmatherapeutics Vol 1 & 2	Popular Prakashan	1989, 11 th Edition.

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	G. Padrick	Medicinal Chemistry	Viva Books Pvt. Ltd	2002, 2 nd Edition
2	Sriram & Yogeewari	Medicinal Chemistry	Pearson Education	2010, 2 nd Edition.

Question Paper Pattern

Section A: 5*6= 30 marks

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER III

Paper –IX Physical Chemistry – III (Reaction Kinetics & Electrochemistry)

MCE1410

Credit - 4

(56 Hrs)

Objectives:

- To give basic ideas about reaction kinetics & its applications
- To introduce the concepts of catalysis, adsorption & the mechanisms
- To enable the students to have a basic idea about corrosion & batteries

Unit I

(11Hrs)

Theories of Electrolytes: Arrhenius theory (Basic idea) – Limitations - Debye-Huckel-Onsager equation – Calculation of A & B, physical significance of k, Tests of Debye-Huckel. Wein effect, Debye- Falkenhagen effect.

Electrode electrolytic interface: *Electrical double layer*, electrocapillary phenomena- Lippman equation, Measurements of double layer capacitances, theoretical models of double layers- Helmholtz model, Guoy Chapmann model- potential of zero charge, Stern model- outer & inner Helmholtz planes

Unit II

(11Hrs)

Electrode Kinetics: Kinetics of electron transfer, the transfer coefficients, Butler Volmer equation, Tafel equation, charge transfer resistance, Multistep process.

Irreversibility in electrochemical reactions : Overvoltage – Hydrogen overvoltage, oxygen overvoltage, measurement of overvoltage, factors affecting overvoltage, *importance of overvoltage*.

Unit III

(11Hrs)

Chemical Kinetics: The ARRT – Thermodynamic treatment of ARRT- Significance of reaction coordinate- Application of ARRT- Unimolecular & bimolecular processes- *Potential energy

surface*- Kinetic isotopic effects- Principles of microscopic reversibility- Steady State Approximation- Third order & termolecular reactions.

Reactions in solutions: Factors affecting reaction rates in solution – The influence of solvent, ionic strength, dielectric constant & pressure on reactions in solutions.

Unit IV (11 Hrs)

Catalysis : Acid – base catalysis – specific & general (Bronsted Catalysis law), Enzyme catalysis – Michaelis-Menten equation, effect of pH & temperature on an enzyme catalysed reaction (Single substrate only)

Adsorption: *Differences between physisorption & chemisorptions* - Theories of adsorption – Freundlich, Langmuir, BET & Gibb’s, Langmuir – Hinshelwood.

Unit V (12Hrs)

Batteries : Types, characteristics. Primary batteries – Dry cells, metal-air batteries, Ag₂O-Zn batteries. Secondary batteries – Pb-acid battery.

Fuel cells: Classification, H₂ – O₂ fuel cell, Hydrocarbon – Oxygen fuel cell, Phosphoric acid fuel cells.

Corrosion: Types & importance of corrosion. Electrochemical principles of corrosion - Polarisation of the electrodes – Concentration polarization, *Activation polarization*.

***Self study portions**

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	S. Glasstone	Introduction to Electrochemistry	EastWest Press Private Ltd	1942, 10 th Printing.
2	K.J. Laidler	Chemical Kinetics	Pearson Education Pvt. Ltd	2007, 3 rd Edition.
3	B.R. Puri, L.R. Sharma, M.S. Pathania	Principles of Physical Chemistry	Vishal Publications	2010, 45 th Edition

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	A. Frost & R.G.Pearson	Kinetics & Mechanism	Wiley Eastern Pvt Ltd	1970, 2 nd Edition
2	Gurdeep Raj	Advanced Physical Chemistry	GOEL Publishing House	2002, 27 th Edition
3	John.O.M. Bockris & A.K.N. Reddy	Modern Electrochemistry (Vol I & II)	Plenum Publishing Corporation	2006, 2 nd Edition
4	Raj Narayanan	An Introduction to Metallic Corrosion & its Prevention	Oxford & IBH Publishing Co., Pvt Ltd	1988, 1 st Edition.

Question Paper Pattern

Section A: 5*6= 30 marks

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

Semester –III

RESEARCH METHODOLOGY

SP. COURSE

Credit - 2

MCE14S1

(30 Hrs)

Objectives:

- To acquire knowledge about sampling & errors
- To inculcate basic ideas regarding research, thesis/report writing
- To gain knowledge about use of MS office in research
- To understand the principle, types & instrumentation of AAS

UNIT I

(6 Hrs)

Errors involved in Chemical Analysis: Classification of errors. Determination of accuracy of results -significant figures - *mean standard deviation*. Gaussian distribution - deviation from the Gaussian law of error distribution.

UNIT II

(6 Hrs)

IUPAC rules for Nomenclature: Introduction to chemical abstracts – Subject index, substance index, author index, formula index & other indices. Use of these indices with examples –Use of computer browsing for literature search & downloading – *Basics of internet services* – Different sources of abstracts, articles & papers for browsing & downloading.

Unit III

(6 Hrs)

Principles of Research: Title & abstract, writing the thesis. Types of report. Laboratory observation, records. Document preparation using computers - *Use of Microsoft word & Microsoft excel*, word perfect & other packages for document preparation & formatting.

Unit IV

(6 Hrs)

Sampling : Introduction to sampling-Definitions, theory of sampling-techniques of sampling – Statistical criteria of good sampling & required size-*Stratified sampling Vs random sampling.*

Unit V**(6 Hrs)**

Atomic Absorption Spectroscopy: Types of Atomic Absorption Spectra-Emission methods- Absorption methods- fluorescence methods-Atomizers for Atomic spectra-Flame atomizers- flames of flame spectra, electro thermal atomizers –*Application of atomic absorption spectroscopy *

Self study portions*Text Books :**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	S.M. Khopkar	Basic Concepts of Analytical Chemistry	Wiley Eastern Ltd	1985, 1 st Edition
2	D.A. Skoog, D.M. West & F. James Holler	Analytical Chemistry – An Introduction	Saunders College Publishing	1994, 6 th Edition
3	Hans F. Ebel, Claus Bliefert	The Art of Scientific Writing	Wiley Publishing	2005, 2 nd Edition

Reference Books :

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	C.R. Kothari	Research Methodology- Methods & Techniques	New Age International Publishers	reprint 2011, 2 nd Edition
2	D.A. Skoog & F.J. Holler	Principles of Instrumental Analysis	Harcourt College Publishers	2001, 5 th Edition
3	Y.K. Singh, R. Nath	Research Methodology	APH Publishing Corporation	2005, 1 st Edition

Question Paper Pattern**Section A: 5*5= 25 marks**

5 questions from each unit either or type – short answer type

Section B: 5*15 = 75 marks

5 questions from each unit either or type - Essay type answer

SEMESTER – III

PRACTICAL IV – ORGANIC CHEMISTRY PRACTICAL II

MCE13P4

Credit - 4

(60 Hrs)

1. Estimations:

Estimation of phenol, aniline, methyl ketone, glucose & unsaturation.

2. Analysis of oils :

Reichert-Meissel value, Iodine value, Saponification value & Acetyl value.

3. Extraction & estimation of active constituents:

i. Lactose from milk.

ii. Caffeine from tea

iii. Citric acid or ascorbic acid from a tablet or from a natural source.

4. Two stage preparations:

i. p-nitro acetanilide

ii. 1,3,5-tribromo benzene

iii. p-bromo acetanilide

iv. Eosin

v. p-bromo aniline

vi. m-nitro benzoic acid from methyl benzoate.

5. Interpretation of FT-IR of the following – carbonyl compounds, azomethine, alcohol, phenol & amine.

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	F.G. Mann & B.C. Saunders	Practical Organic Chemistry	Pearson Education	2009, 4 th Edition
2	S. Vogel	Text Book of Quantitative Chemical Analysis	Pearson	2009, 6 th Impression

Semester-III

Practical V - Inorganic Chemistry Practical-II

MCE13P5

Credit - 4

(60 Hrs)

Cerimetry

1. Estimation of ferrous iron in ferrous ammonium sulphate.
2. Estimation of oxalic acid.
3. Estimation of Nitrite.

Estimation of metal ions in a mixture

1. Estimation of copper & nickel in a mixture
2. Estimation of Iron & Nickel in a mixture
3. Estimation of Copper & Zinc in a mixture
4. Estimation of Calcium & Barium in a mixture.
5. Estimation of Copper & Iron in a mixture.

Chromatography: Column, Paper & Thin layer: Separation of Components in ink & flowers.

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	J.Mendham,R.C.Denney, J.D.Barnes,M.Thomas,B. Sivasankar	Vogel's, Text Book of Chemical Analysis	Pearson Publications	1996, 6 th Edition
2	G.Palmer	Experimental Inorganic Chemistry	Cambridge University Press	1962, 3 rd Edition
3	A.I Vogel	A Text Book of Quantitative Inorganic Analysis	The ELBS and Longmans, Green & Co.Ltd	1964, 3 rd Edition

III Semester
Practical VI – Physical Chemistry – II
MCE13P6

Credit – 5

(75 Hrs)

Conductivity Experiments:

1. Determination of equivalent conductance of a strong electrolyte & the verification of DHO equation.
2. Verification of Ostwald's Dilution Law & Kohlrausch's Law for weak electrolytes.
3. Determination of pK_a of a weak acid.
4. Determination of solubility of a sparingly soluble salt.
5. Acid-base titration (strong acid vs strong base, weak acid vs strong base)
6. Precipitation titrations (mixture of halides only)
7. Determination of hydrolysis constant of aniline hydrochloride.

Kinetics:

1. Acid hydrolysis of an ester at room temperature
2. Saponification of ester at room temperature
3. Evaluation of Arrhenius parameters E & A (any two temperatures only)
4. $S_2O_8^{2-}$ - Study on Primary salt effect & determination of concentration of KNO_3
5. Bronsted Catalysis Law

Adsorption : Adsorption of oxalic acid on charcoal & determination of surface area (Freundlich isotherm only)

Reference Books :

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	G. Palmer	Experimental Physical Chemistry	Cambridge University Press	1964, 1 st Edition
2	B. Viswanathan & P.S. Raghavan	Practical Physical Chemistry	Viva Books	2009, 3 rd Edition.

SEMESTER- IV
Paper -X- Elective –III Chemistry & Technology of Polymers

MCE1411

Credit - 4

(56 Hrs)

Objectives:

- To understand the kinetics of polymerization.
- To gain knowledge about Z-N Polymerization.
- To learn the technology & applications of polymers.

Unit I

(11 Hrs)

Step & Chain Growth Polymerization : Polymers – Introduction, *Classification of polymers
* – Polymerization reactions – Chain polymerization & Step Polymerization – Types, Mechanism & Kinetics. Molecular weight control in linear polymerization, Flory's MWD, Interfacial polymerization. Radical chain polymerization - General Mechanism, Kinetics & Sequence of events – Initiation by Thermolysis, Photolysis & Redox method.

Unit – II

(11 Hrs)

Copolymerization & Ring Opening Polymerization : Copolymers - Types, *Importance of Copolymerization*, Copolymer equation – Derivation – Significance & Experimental determination of Monomer reactivity ratios. Ideal, Alternating & Block copolymerization Behavior. Q-e scheme. Rate of Copolymerization- Derivation based on chemical controlled termination & Diffusion controlled termination.

General characteristics ring opening polymerization.

Unit III

(11 Hrs)

Ziegler – Natta Polymerization : Definition of Z-N catalysts – Modification of Z-N catalysts by Third components – Mechanism of Z-N polymerization of α –Olefins – Monometallic &

Bimetallic. Kinetics of Z-N polymerization – Rate curves, polymerization product – Adsorption kinetics. *Stereochemical structures of PP, PB & PIP*.

Unit IV

(11 Hrs)

Fibre Technology: Criteria for fibre formation – properties of textile fibres- Denier, Crimp, Moisture regain, Moisture absorption – Tenacity, aesthetic properties. Spinning – melt, wet, & dry. Fibre after treatments - Scouring, Sizing, Lubrication, Finishing. *Manufacture of Nylon, Polyester*, Viscose rayon & Polyacrylonitrile fibre.

Unit V

(12 Hrs)

Elastomers : Molecular requirements, Vulcanization- Sulphur & Non sulphur, Mechanism & Reinforcement- Synthetic rubbers – Composition, Properties & Uses: SBR, *Nitrile*, Butyl rubber, Neoprene, Thiokol, Composition, Properties & uses.

Specialty polymers: Polyelectrolytes, Conducting polymers – Biomedical polymers – as implant materials, carriers of bioactive substances & polymeric drugs.

***Self study portions**

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	F. W. BillMeyer	Text Book of Polymer Science	John Wiley	2002, 3 rd Edition
2.	P. J Flory	Principles of Polymer Chemistry	Asian Books,	2006, 1 st Edition
3.	George Odian	Principles of Polymerization	Wiley	Reprint 2007, 4 th Edition

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	V.K. Ahluwalia	Polymer Sciences	Anes Student Edition	2008 1 st Edition

2.	George. T. Austin	Shreves Chemical Process Industries	McGraw Hill International	1988 5 th Edition
3.	V.A. Shenai	Technology of Textile Processing Vol. I Textile Fibres	Viva Books Sevak Publishing	1984 2 nd Edition

Question Paper Pattern

Section A: 5*6= 30 marks

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER IV

Paper – X- Elective-IV- APPLIED CHEMISTRY

MCE1412

Credits- 4

(56 Hrs)

Objectives

- To understand the principle and chemistry of milk and leather processing
- To understand the chemistry of explosives and rocket fuels
- To acquire knowledge about ceramic industries and lubricants

UNIT I

(11Hrs)

Dairy chemistry

Milk and milk products

Composition of Milk; Flavour and aroma of Milk; Physical properties of Milk;* Effect of heat on Milk*; Pasteurization; Homogenization; Milk products; Cream; Butter; Ice Cream; Milk Powder.

UNIT II

(11Hrs)

Leather Chemistry

Introduction, Structure of hides and skin, Leather Processing – Process before tannage-flaying and curing (drying, salt curing and brine curing and pickling), Soaking, Liming, Fleshing, Unhairing, Deliming and Bating.

Tanning Process – Vegetable tanning, Synthetic tanning, Chrome tanning and Aldehyde tanning.

*Tannery effluents and byproduct problems – primary treatment and secondary treatment *.

UNIT III**(11Hrs)**

Ceramic Industries: Basic raw materials- Chemical conversions including basic ceramic chemistry, Whitewares, Structural clay products, Refractories – specialized ceramic products, *vitreous enamel*, kilns.

UNIT IV**(11 Hrs)**

Lubricants: Introduction, functions, requirements, mechanism of lubrication, classification of lubricants, properties of lubricating oil – viscosity, viscosity index, oiliness, *flash and fire points* , cloud and pour points, carbon residue, aniline point, volatility, corrosion stability and decomposition stability.

UNIT V**(12 Hrs)**

Explosives and rocket fuels: Introduction, characteristics, classification – primary, high and low, requirements of explosives, rocket propellants, characteristics, *classification – solid and liquid propellants with examples*.

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Durga Nath Dhar	Applied Chemistry – II	Vayu Education of India	2009 1 st Edition
2.	R.Gopalan, Chitra Ramachandran,	Applied Chemistry for Engineers	Vikas Publishing House	2001 1 st Edition
3.	Jayashree Ghosh	Fundamental Concepts of Applied Chemistry	S. Chand &Co	2006 1 st Edition

References Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	George T.Austin	Shreve's Chemical Process Industries	McGraw – Hill Book Co	1984 5 th Edition.
2.	M..Karunanithi, T.Ramachandran, H.Venkataraman, N. Ayyaswamy	Applied Chemistry	Anuradha Agencies	Reprint 2006

Question Paper Pattern**Section A: 5*6= 30 marks**

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER IV
PAPER – XI- GREEN CHEMISTRY
MCE1413

Credit - 3

(41 Hrs)

Objectives

- To understand the Principles and applications of Green Chemistry
- To acquire knowledge about the Microwave and Ultra sound assisted Synthesis

Unit I

(8 Hrs)

Green Chemistry: Definition- Need for green chemistry- Basic principles - Planning a green synthesis in the laboratory- Atom efficiency process & atom economy- Rearrangement, addition, substitution, elimination.

Synthesis involving basic principles of green chemistry – synthesis of styrene, adipic acid- green chemistry in day-today life – Dry cleaning of clothes, versatile bleaching agents.

Unit II

(8 Hrs)

Green reagents : dimethyl carbamate, polymer supported reagents, green catalysts-acidic ,basic, oxidation and polymer supported catalysts.

Microwave Induced Green Synthesis- Introduction- Microwave assisted reactions in water – Hoffmann elimination, hydrolysis, oxidation, inorganic solvents- Esterification, chalcone synthesis, Diel’s Alder reaction, decarboxylation and Fries rearrangement.

Unit III

(8 Hrs)

Ultrasound Assisted Green Synthesis- Introduction- esterification, saponification, oxidation, reduction, hydroboration, coupling reaction, Diels Alder reaction, Cannizaro reaction, Strecker synthesis, Reformatsky reactions. .

Ionic liquids- Introduction, Applications in organic synthesis-Diels Alder reaction, Advantages & disadvantages of ionic liquids.

Unit IV

(8 Hrs)

Phase transfer catalysts: Introduction, definition, mechanism of phase transfer catalysed reaction, types and advantages of phase transfer catalysts, types of phase transfer catalysed

reactions, Preparation of phase transfer catalysts, applications of phase transfer catalysis in organic synthesis- alcohols from alkyl halides and addition to olefins.

Unit V

(9 Hrs)

Crown ethers: Introduction, nomenclature, special features, nature of donor site, general synthesis of crown ethers -synthesis of [12] crown- 4, [18] crown -6 and cryptates. Synthetic applications –esterification, saponification and KMnO_4 oxidation.

*Self study portions

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	V.K.Ahluwalia	Environmentally Benign Reaction	Ane Books Pvt Ltd	2009, 1 st Edition- Reprint
2.	Ahluwalia, M.Kidwai	New trends in Green Chemistry,	Anamaya Publishers	2007, First reprint of second edition
3.	V.K.Ahluwalia, Renu Aggarwal	Organic synthesis- Special techniques	Narosa Publishing House	Copyright 2001

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Rashmi Sanghi, M.M.Srivastava	Green Chemistry Environment Friendly Alternatives	Narosa Publishing House	2009, Fourth reprint.

Question Paper Pattern

Section A: $5 \times 6 = 30$ marks

(5 out of 7) (Not to exceed one page)

Section B: $4 \times 12 = 48$ marks

(4 out of 6) (Not to exceed four pages)

Section C: $2 \times 11 = 22$ marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER IV

Paper – XII- NANO CHEMISTRY AND BIOINORGANIC CHEMISTRY

MCE1414

Credit - 3

(41 Hrs)

Objectives

- To gain knowledge about Nano chemistry.
- To enable the students to know about the various synthesis and properties of nanomaterials.
- To learn the applications of nanoparticles in modern technology.
- To understand the mechanism of oxygen transport by haemoglobin and myoglobin.
- To learn about the biological functions of co-ordination complexes and their applications in various fields.

Unit I

(8 Hrs)

Nanochemistry I: Introduction, Definition, Characterization of Nanomaterials (SEM, Scanning Tunneling Microscopy & atomic force microscopy), Stability of nanoparticles in solution. Synthesis of metal nanoparticles – Physical methods (Laser Ablation, Physical Vapour Deposition, Sputtering & Solvated Metal Atom Dispersion) Chemical Methods – *Thermolysis, Sonochemical Approach, Reduction of metal ions*

Unit II

(8 Hrs)

Nanochemistry II : Phase Transfer processes in nanomaterial Synthesis, biosynthesis of nanoparticles. Synthesis of semiconductors nanomaterials – Precipitation method, thermal decomposition of complex precursors. Synthesis of ceramic nanomaterials – Physical methods (Gas condensation method, Laser method), chemical method (Sol-Gel Synthesis). Properties of Nanomaterials – Size effect, optical, electrical & magnetic properties, *Brief account of application of nanomaterials*.

Unit III**(8 Hrs)**

Nanochemistry III : Fullerenes -Introduction and properties, Carbon Nanotube- types, properties, defects, synthesis and applications-structural materials, electromagnetic field, chemical field, electrical circuits and current applications.

Unit IV**(8 Hrs)****Inorganic chemistry of biological systems 1**

Metalloporphyrines and Respiration – cytochromes, dioxygen binding, transport and utilization. The binding of dioxygen to myoglobin, physiology of myoglobin and haemoglobin, structure and function of haemoglobin, ferredoxins and rubredoxins, blue copper protein.

Unit V**(9 Hrs)****Inorganic chemistry of biological systems 2**

Photosynthesis- chlorophyll and the photosynthetic reaction centre, enzymes – structure and function of carboxy peptidase A, carbonic anhydrase, vitamin B12 – structure and functions , applications of coordination complexes in medicine, agriculture, horticulture and industry

Self study portions*Text Books:**

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	James.E.Huheey, Keiter	Inorganic chemistry- Principle of structure and reactivity	Pearson	2006, 4 th Edition
2.	Mark Ratner, Daniel Ratner	Nanotechnology	Pearson education	2008, 1 st Edition
3.	S .Shanmugam	Nanotechnology	MJPPublishers	2010,First Edition
4.	B. Viswanathan	Nanomaterials	Narosa Publishing House	Reprint 2010

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	Asim K.Das	Bioinorganic chemistry	Books and Allied Pvt Ltd	2007, 1 st Edition.
2.	Richard Booker	Nanotechnology	Earl Boyren , John Wiley.	2005, 1 st Edition

Question Paper Pattern

Section A: 5*6= 30 marks

(5 out of 7) (Not to exceed one page)

Section B: 4*12= 48 marks

(4 out of 6) (Not to exceed four pages)

Section C: 2*11= 22 marks

(Compulsory) (Essay type from different units, Not to exceed four pages)

SEMESTER-IV
ALC-OPTIONAL - ENVIRONMENTAL CHEMISTRY
MCE1315

Credit - 5

Self study

Objectives:

- To elaborate the environmental concepts & ecological perspectives.
- To gain vivid knowledge about air & water pollution.
- To create awareness amongst the students regarding the environmental management & environmental legislations in India

Unit I

Environment: Components of Environment, factors affecting, types, concepts. Segments of environment- Atmosphere, hydrosphere, lithosphere & biosphere.

Ecology: Definitions, kinds of ecology, environment & ecofactors- Abiotic & biotic factors.

Unit II

Air Pollution: Introduction, major sources of air pollution, classification of air pollutants- NO_x , SO_x , CO_x , hydrocarbons, and particulates- Effect & control of air pollutants. Green house gases effect- Major sources, impact, consequences, control & remedial measures.

Unit III

Water Pollution: Definitions- Types of water pollution- Ground water, surface water, lake water, river water & sea water. Sources of water pollution – Sewage & domestic wastes, industrial effluents, agricultural discharges, fertilizers, detergents, toxic metals, radioactive materials – harmful effects. Classification of water pollutants – Inorganic pollutants & toxic metals, organic pollutants, detergents.

Unit IV

Water Treatment: Softening of water, demineralization of water – Water quality parameters- Physio-Chemical measurements – Suspended solids, dissolved solids, pH values,

acidity, alkalinity, DO, BOD, COD, chlorides, fluorides & nitrates. Major industrial effluents- Pulp, paper & board, textile, tannery, electroplating, distillery – Effects & treatment.

Unit V

Environmental Management: Environmental impact assessment (EIA) – Types, benefits, characteristics. Environmental management system (EMS) – Basic considerations, elements. Environmental audit (EA) – Objectives, audit process. Environmental risk assessment (ERA) – Precautionary principle, polluter pays principle & beneficiary pays principle. Environmental legislations in India – The Water (Prevention & Control of Pollution) Act 1977. The Air (Prevention & Control of Pollution) Act 1981, Forest (Conservation) Act 1980, The Environment (Protection) Act 1986.

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	N.Manivasakam	Industrial Effluents	Sakthi Publications, Coimbatore	Reprint 1997
2.	B.K.Sharma & H.Kaur	Environmental Chemistry	Goel Publishing House	1995, 2 nd Edition
3.	N.Vasudevan	Essentials of Environmental Sciences	Narosa Publishing House Pvt. Ltd	Reprint 2009

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	A.K.De	Environmental Chemistry	New Age International Pvt Ltd	2003, 5 th Edition.
2.	James E.Girard	Principles of Environmental Chemistry	Sanat Printers	2011, 2 nd Edition
3	B.K.Sharma	Industrial Chemistry	Goel Publishing House	2008, 14 th Edition.

Question paper pattern**Section A: 5*5= 25 marks**

(5 out of 8)

Section B: 5*10 = 50 marks

(5 out of 8)

SEMESTER-IV

ALC (OPTIONAL) INDUSTRIAL CHEMISTRY

MCE1316

Credits- 5

Self Study

Objectives:

- To gain knowledge in the manufacture of Sugar, Glass and Cement
- To understand the properties of Glass, Cement and Rubber
- To know the applications of Paints, Varnishes , Glass, Cement and Rubber

Unit I

Sugar: Introduction - Manufacture of Cane Sugar - Extraction of juice - Purification of Juice - Defection, Sulphitation and carbonation - Concentration or evaporation. Crystallization- Separation of crystals, drying, refining- Recovery of sugar from molasses, bagasse- Manufacture of sucrose from beet root.

Unit II

Paints: Classification of paints- Constituents of paints – Setting of the paint – Requirements of a good paint – Methods of applying paints.

Varnishes: Introduction – Raw materials – Manufacture of varnishes.

Unit III

Glass: Introduction – Physical properties of glass - Chemical properties of glass – Characteristics of glass - Raw Materials - Chemical reactions – Methods of manufacture – Formation of the batch material, melting, shaping, annealing and finishing.

Unit IV

Cement: Introduction – Raw materials – Manufacture – Wet process, Dry process – Reactions in kiln – Setting of cement – Properties of cement- uses. Plaster of Paris–Gypsum – Lime.

Unit V

Rubber: Introduction – Importance of rubber – Types of rubber - Coagulation of rubber – Refining of crude rubber – Drawbacks of raw rubber – Rubber fabrication – Vulcanization – Techniques, properties. Properties of rubber

Text Book:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	B.K.Sharma	Industrial Chemistry	Goel Publishing House	2008, 14 th Edition

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1.	P.C.Jain & Monika Jain	Engineering Chemistry	Dhanpat Rai Publishing Co., (P) Ltd	2003, 14 th Edition
2.	C Parameswara Moorthy & C.V.Agarwal, Andhra Naidu,	Text Book of Engineering Chemistry	BS Publications	2006, 1 st Edition

Question paper pattern

Section A: 5*5= 25 marks

(5 out of 8)

Section B: 5*10 = 50 marks

(5 out of 8)