ANNA ADARSH COLLEGE FOR WOWEN, CHENNAI

PG DEPARMENT OF CHEMISTRY

COURSE OUTCOMES AND PROGRAMME OUTCOMES

(For the academic year – 2021-2022)

PROGRAMME: M.Sc. CHEMISTRY

LIST OF STAFF MEMBERS

S.No.	Name	Designation	Degree
1	Dr. S. Shanthi	Associate Professor	M.Sc., M.Phil., Ph.D
2	Dr. P. Shanthi	Associate Professor	M.Sc., M.Phil., Ph.D
3	Dr. T. Sobana Premlatha	Associate Professor	M.Sc., M.Phil., Ph.D., SLST
4	Dr. E. Thamaraiselvi	Assistant Professor	M.Sc., M.Phil., Ph.D., SLET
5	Ms. K. Priya Sudha	Assistant Professor	M.Sc., M.Phil (Ph.D)., SET
6	Dr. R. Vashantha	Assistant Professor	M.Sc., Ph.D
7	Dr. A. Sumita	Assistant Professor	M.Sc., SET., Ph.D
8	Dr. V. Sribharathy	Assistant Professor	M.Sc., M.Phil., Ph.D
9	Dr. K. Sangeetha	Assistant Professor	M.Sc., M.Phil., Ph.D
10	Dr. R.J. Kavitha	Assistant Professor	M.Sc., Ph.D
11	Dr. N.S. Sangeetha	Assistant Professor	M.Sc., M.Phil., Ph.D

Programme Outcomes

PO1: On completion of this program, the graduates will get enhanced career prospects, improved problem-solving and decision-making skills.

PO2: Graduates will have good personal, professional, and intellectual abilities in their respective disciplines.

PO3: Graduates would have received good professional and hands-on training in their respective field of study which makes them job-oriented Post Graduates.

PO4: Graduates will be able to do academic research in their specialized disciplines using all modern methods and technology.

PO5: Graduates will have the ability to apply professional ethics, accountability, and equity in all their endeavors.

Programme Specific Outcomes

PSO1: Provide theoretical background and develop practical skills for analyzing materials using modern analytical methods and instruments and the students will become technically sound to handle the advanced analytical instruments.

PSO2: Understands the background of organic reaction mechanisms, complex chemical structures, and instrumental method of chemical analysis, molecular rearrangements and separation techniques.

PSO3: Appreciates the importance of various elements present in the periodic table, coordination chemistry, in living system and structure, properties, application of molecules, enzymes, proteins and structural determination of complexes using theories and instruments.

PSO4: Gathers attention about the physical aspects of atomic structure, dual behavior, reaction pathways with respect to time, various energy transformations, significance of electrochemistry using their symmetry.

PSO5: Carry out experiments in the area of organic analysis, estimation, separation, derivative process, inorganic semi micro analysis, preparation, conductometric and potentiometric analysis.

PSO6: The students will intensify their desire to contribute to the nation in the capacity of chemist or as innovator by taking up research career and to pursue Ph.Dprogramme.

PSO7: Becomes professionally skilled for enormous job opportunities at all level of chemical, pharmaceutical, food products, life oriented material industries and synthetic division of polymer industries & allied division.

PSO8: The students will be able to clear CSIR-NET examination and competitive exams conducted by service commissions.

PSO9: Develop an understanding of eco-friendly chemical processes and impact of chemistry on health and environment.

M.Sc., DEGREE COURSE IN CHEMISTRY
REGULATIONS
(w.e.f. 2015-2016**)**

FIRST SEMESTER

Course Components/Title of the paper	**Inst. Hours/ week**	**Credits**	**Exam Hours**	**MARKS**		
				CIA	**EXT**	**TOTAL**
Core Paper – I : Organic Chemistry-I	6	4	3	25	75	100
Core Paper – II :Inorganic Chemistry-I	6	4	3	25	75	100
Core Paper – III :Physical Chemistry-I	6	4	3	25	75	100
Core Paper – IV :Organic Chemistry practical-I*	6	4	6	40	60	100
Core Paper – V :Inorganic Chemistry practical-I*	6	4	6	40	60	100
Soft Skill -1	--	2	3	40	60	100
	30	22				

SECOND SEMESTER

Course Components/Title of the paper	Inst. Hours/ week	Credits	Exam Hours	MARKS		
				CIA	EXT	TOTAL
Core Paper – VI; Organic Chemistry-II	6	4	3	25	75	100
Core Paper – VII: Inorganic Chemistry-II	6	4	3	25	75	100
Core Paper – VIII : Physical Chemistry-II	6	4	3	25	75	100
Extra Disciplinary Paper – I: Chromatographic Techniques/ /Analytical Techniques in Chemistry/Environmental Chemistry/Polymer Chemistry	4	3	3	25	75	100
Elective Paper – I : Analytical Chemistry practical-I*	4	3	6	40	60	100
Elective Paper – II : Physical Chemistry practical-I*	4	3	6	40	60	100
Soft Skill Paper – II	--	2	3	40	60	100
Internship **		2				
	30	27				

***Practical examinations to be conducted at the end of the academic year.**

****** Internship will be carried out during the summer vacation of the first year and marks should be sent to the University by the College and the same will be included in the Third semester Marks Statement.**

THIRD SEMESTER

Course Components/Title of the paper	Inst. Hours/ week	Credits	Exam Hours	MARKS		
				CIA	EXT	TOTAL
Core Paper – IX: Organic Chemistry-III	6	4	3	25	75	100
Core Paper – X :Inorganic Chemistry-III	6	4	3	25	75	100
Core Paper – XI: Physical Chemistry-III	6	4	3	25	75	100
Extra Disciplinary Paper – II: Materials Science/ Bioorganic Chemistry/ Research Methodology/Bioinorganic Chemistry	4	3	3	25	75	100
Elective Paper –III : Organic Chemistry Practical-II*	4	3	6	40	60	100
Elective Paper –IV: Inorganic Chemistry Practical-II*	4	3	6	40	60	100
Soft Skill Paper – III	--	2	3	40	60	100
	30	23				

FOURTH SEMESTER

Course Components/Title of the paper	Inst. Hours/ week	Credits	Exam Hours	MARKS		
				CIA	EXT	TOTAL
Core Paper XII : Organic Chemistry-IV	6	4	3	25	75	100
Core Paper XIII: Inorganic Chemistry-IV	6	4	3	25	75	100
Core Paper XIV: Physical Chemistry-IV	6	4	3	25	75	100
Core Paper XV: Physical Chemistry practical-II*	6	4	6	40	60	100
Elective Paper-V: Dissertation & Viva Voce exam.	6	3	6	40	60	100
Soft Skill -IV	--	2	3	40	60	100
	30	21				

***Practical examinations to be conducted at the end of the academic year.**

FIRST SEMESTER

CORE PAPER- I - ORGANIC CHEMISTRY - I

SEMESTER I	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER- I – ORGANIC CHEMISTRY - I	MER1A	90	4

COURSE OBJECTIVE:-

This course aims to explain basic concepts in stereo chemistry and conformational analysis of organic molecules. In addition, the reaction mechanism and synthetic application of aliphatic and aromatic substitution reaction in organic synthesis will be discussed in detail.

COURSE OUTCOME:

1. To understand the stereochemistry of organic compounds which includes optical activity, chirality, R- S nomenclature, molecular dissymmetry, optical isomerism and geometrical isomerism.
2. To understand the conformational analysis of some simple organic compounds and its derivatives.
3. To know about the kinetic and non-kinetic methods - aliphatic nucleophilic substitution reaction mechanisms like S_N1, S_N2 and neighbouring group participation – by aryl group, O, N, S halogens, single, double and triple bonds.
4. To understand the aliphatic and aromatic nucleophilic substitution reactions with mechanisms.
5. To learn about the electrophilic substitution reactions for aromatic and compounds with mechanism – name reactions - synthesis of di & tri substituted benzenes.

UNIT I: STEREOCHEMISTRY: -

Introduction to optical activity and chirality, Stereomers-definition based on symmetry and energy criteria, Rotamers, prochiral carbons. Elements of chirality-Molecules with C, N, S based chiral centers. Configuration and conformational isomers. Absolute configuration-enatiomers- R, S nomenclature.

Steroisomerism due to molecular dissymmetry-allenes, biphenyls, spiro compounds, trans cyclooctene and cyclononene and molecules with helical structures enantiotopic, homotopic and diastereotopic hydrogens in compounds up to ten carbons only. Stereo specific and stereo selective reactions. Inter conversion of Sawhorse, Newman and Fischer projections. Molecules with more than one asymmetric center - definition of diasteroisomer-constitutionally symmetrical, unsymmetrical chiral compounds E.g. erythro and threo compounds.

Geometrical isomerism. E, Z nomenclature of olefins, geometrical and optical isomerism (if shown) of disubstituted cyclopropane, cyclobutane and cyclopentanes.

UNIT II: CONFORMATIONAL ANALYSIS: -

Conformation of some simple, 1, 2-disubstituted ethane derivatives. Conformational analysis of disubstituted cyclohexanes and their stereo chemical features [cis, trans and optical isomerism (if shown) by these derivatives]. Conformation and reactivity of substituted cyclohexanols (oxidation and acylation), cyclohexanones and tert butyl cyclohexanols (reduction involving selectrides) and cyclohexane carboxylic acid derivatives (esterification and hydrolysis). Conformation and stereochemistry of cis and trans decalin and 9-methyl decalin.

UNIT III: ALIPHATIC NUCLEOPHILIC SUBSTITUTION REACTIONS: -

Kinetic Vs Thermodynamic control of product formation. Hammet equation. Derivation and free energy relationship, simple problems. Taft equation

S_N1, S_N2 and S_Ni mechanism - Nucleophile and leaving groups Stero chemistry and Ion pairs. Neighbouring group participation – by Aryl group, O, N, S halogens, single, double and triple bonds. Reactivity, structural, solvent and steric effects. Substituent effect on carbocations – cyclopropyl and carbonyl cations. Substitution in norbornyl system and at bridgehead carbon. Substitutions by ambident nucleophiles such as CN, NO_2, phenoxide and alkylation using dianion (EAA), acylation and alkylation of active methylene compounds.

UNIT IV: NUCLEOPHILIC SUBSTITUTION REACTIONS: -

Nucleophilic substitution at carbon which is doubly bonded to oxygen and nitrogen - alkylation and acylation of amines, halogen exchange, Von-Braun reaction. Enamines – synthesis-alkylation and acylation of enamines, hydrolysis of esters, Claisen and Dieckmann condensations.

Aromatic nucleophilic substitution - methods of generation of benzyne intermediate and reactions of aryne intermediates. Nucleophilic substitution involving diazonium ions. Aromatic nucleophilic substitution of activated halides. Ziegler alkylation. Chichibabin reaction.

UNIT V: AROMATIC ELECTROPHILIC SUBSTITUTION REACTIONS: -

The arenium ion mechanism. Orientation and reactivity (ortho, meta and para directing groups). Typical reactions to be studied - nitration, halogenation, alkylation, acylation and diazonium coupling. Formylation reactions - Gatterman, Gatterman-Koch, Vilsmeyer-Hack & Reimer-Tieman Reaction. Synthesis of di & tri substituted benzenes (symmetrical tribromobenzene, 2-amino-5-methylphenol, 3-nitro-4-bromobenzoicacid, 3, 4-dibromonitrobenzene, 1, 2, 3 - trimethylbenzene) starting from benzene or any mono substituted benzene. Electrophilic substitution of furan, pyrrole, thiophene, pyridine and pyridine-N-oxide.

TEXT BOOKS: -

1. E. Eliel, S.H.Wilen and L.N.Mander, 1994, Stereochemistry of Carbon Compounds, 2nd Edition, John Wiley & Sons, New York
2. D.Nasipuri, 1994, Stereochemistry of Organic Compounds, 2nd Edition, Wiley Eastern Ltd, New Delhi
3. PS. Kalsi, 1993, Stereochemistry, Conformation Analysis and Mechanism, 2nd Edition, Wiley Eastern Limited, Chennai
4. P.S. Kalsi, 1994, Stereochemistry and Mechanism Through Solved Problems Wiley Eastern Ltd.
5. Niel Isaacs, 1987, Physical Organic Chemistry, ELBS Publications
6. R.Bruckner, 2002, Advanced Organic Chemistry, Reaction Mechanism, Elsevier, New Delhi
7. F.A. Carey and R.J. Sundberg, 2001, Advanced Organic Chemistry, Part A and Part-B, 4th Edition, Plenum Press, New York
8. J. March, 1992, Advanced Organic Chemistry, 4th Edition, John Wiley & Sons, Singapore.
9. T.L. Gilchrist and C.W. Rees, Carbenes, Nitrenes and Arynes, Thomas Nelson and Sons Ltd., London.

10 T.L. Gilchrist, 1992, Heterocyclic Chemistry, 2nd Edition, Longman, Essex, England.
11. J.A.Joule and K.Mills, 2000, Heterocyclic Chemistry, 4th Edn, Backwell Science Publishers, England.

WEBSITES: -

1. http :// info dome .sdsu, ./research/ guides/ science/ org chemistryblr. html
2. http :// www.liv.ac.uk/chemistry/links /reactions.html
3. http ://orgchem.chem..uconn.edu/namereact/named.html
4. www.gcocities.com/chempen softwar4ee/reactions.html

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	M
CO2	S	M	S	M	S
CO3	M	M	S	M	S
CO4	M	M	M	S	M
CO5	M	M	S	S	M

KEY: S – Strong, M – Medium, L – Low

CORE PAPER- II - INORGANIC CHEMISTRY – I

SEMESTER I	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER- II - INORGANIC CHEMISTRY - I	**MER1B**	**90**	**4**

COURSE OBJECTIVES:-

To impart the theories about bonding and structure of various inorganic compounds and few analytical techniques. The basics of reaction Mechanisms in coordination chemistry are also introduced.

COURSE OUTCOME:

1. To understand the structure, bonding and properties of poly acids and inorganic polymers were explained thoroughly.
2. To learn about the preparation, properties and structure of boron hydrides and some low molecular weight metal clusters.
3. To understand the fundamentals and synthesis, properties of gold and silver nanoparticles, nanorods, carbon nanotubes, graphene, and nanostructures.
4. To understand the fundamentals and various theories of coordination compounds.
5. To know the stability and stereo isomerism of coordination complexes.

UNIT I: BONDING IN INORGANIC COMPOUNDS: -

Poly acids: Isopolyacids and heteropolyacids of vanadium, chromium, molybdenum and tungsten.

Inorganic Polymers: Silicates, structure - properties - correlation and applications - molecular sieves, polysulphur - nitrogen compounds and poly - organophosphazenes.

UNIT II: BORON COMPOUNDS AND CLUSTERS: -

Boron hydrides: Polyhedral boranes, hydroborate ions, carboranes and metallocarboranes. Wade’s rules, preparation and reactions of Boron hydrides.

Metal Clusters: Chemistry of low molecularity metal clusters upto trinuclear metal clusters; multiple metal-metal bonds.

UNIT III: NANO MATERIAL CHEMISTRY: -

Synthesis and Properties - Metallic nanoparticles – gold and silver – Nanorods and Nanotubes – Nanostructures – One, two and three dimensional – semiconductor quantum dots – carbon nanotubes, graphene – Core-shell and Quantum well structures.

UNIT IV: THEORIES OF COORDINATION:

Inadequacies of VB Theory- Crystal field theory- d-orbital splitting; octahedral, tetrahedral and square planar-LFSE, spectro chemical series-- Applications of crystal field theory – Spectral properties, magnetic properties-low spin and high spin complexes, thermodynamic properties and structural aspects: Ligand Field Theory**.** MO theory – LCAO method – Sigma and pi-bonded complexes.

UNIT V: STABILITY AND STEREO ISOMERISM OF COORDINATION COMPLEXES: -

Stability of complexes: thermodynamic stability – stepwise and overall stability constants, their relationships, factors affecting the stability, HSAB approach , chelate effect, importance of chelates.

Macrocyclic ligands; types; schiff bases; crown ethers; cryptands;Chelating agents; types of EDTA titrations; direct and back titrations; replacement titrations; masking and demasking reagents. Determination of stability constants by spectrophotometric, polarographic and potentiometric methods.Stereochemical aspects; Stereoisomerism in inorganic complexes; isomerism arisingout of ligand and ligand conformation; chirality and nomenclature of chiral complexes; optical rotatory dispersion and circular dichroism.

TEXT BOOKS: -

1. J.E. Huheey, 1993, Inorganic Chemistry - Principles, Structure and Reactivity; IV Edition, Harper Collins, NY.
2. F.A. Cotton and G. Wilkinson, 1988, Advanced Inorganic Chemistry - A Comprehensive Text, V. Edition, John Wiley & Sons.
3. K.F. Purcell and J.C. Kot, 1977, Inorganic Chemistry - WB Saunders Co., USA.
4. M.C. Day and J. Selbin, 1974, Theoretical Inorganic Chemistry, Van Nostrand Co., NY.
5. G.S. Manku, 1984, Inorganic Chemistry, TMG Co.,

6. D.A. Skoog, 1985, Principles of Instrumental methods of Analysis, III Edition, Saunders College Publication.
7. Willard Merrit, Dean and Settle, 1986, Instrumental methods of Analysis, VI Edition CBS Publication.
8. A.I. Vogel, 1985, 1976, Text Book of Qualitative Inorganic Analysis, ELBS III Edition, and IV Edition.
9. D.A. Skoog D.M. West, 1982, Fundamental of Analytical Chemistry, IV Edition, Holt Reinheart& Winston Publication.

SUGGESTED REFERENCE BOOKS: -

1. D.F. Shrivers, P.W. Atkins and C.H. Langfor 1990, Inorganic Chemistry, CH Langford, OUP
2. N.N. Greenwood and Earnshaw, 1984, Chemistry of the Elements, Pergamon Press, NY.
3. F.A. Kettle, 1973, Coordination Chemistry, ELBS.
4. K. Burger, 1973, Coordination Chemistry, Burtterworthy.NewYork.
5.
6. Basolo and R.G. Pearson, 1967, Mechanism of Inorganic Reactions, Wiley,
7. R.Sarker, general and Inorganic chemistry, (Parts I and II), New Book Agency, Calcutta
8. G.D. Christian & J.E.O. Reily, 1986, Instrumental Analysis, II Edition, Allegn
9. Becon.
10. H.A. Strobel, 1976, Chemical Instrumentation, Addison - Wesley Publ. Co.
11. Kolthoff and Elwing (all series), Treatise on Analytical Chemistry.
12. Wilson and Wilson series, Comprehensive Analytical Chemistry.
13. R.C. Kapoor and B.S. Aggarwal, Ms. 1991, Principles of Polarography, Wiley
14. Eastern Limited.

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	M	S	M	S	M
CO3	S	M	S	S	M
CO4	M	M	M	S	M
CO5	M	M	M	M	M

KEY: S – Strong, M – Medium, L – Low

CORE PAPER - III – PHYSICAL CHEMISTRY - I

SEMESTER I	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER - III – PHYSICAL CHEMISTRY - I	MER1C	90	4

COURSE OBJECTIVE: -

To learn the basic concepts in chemical kinetics and group theory and the inadequacy of classical mechanics leading to the formation of quantum mechanics. Mathematical basic for quantum mechanics must be taught.

COURSE OUTCOMES:

1. To understand the concept of collision theory and transition state theory.
2. To have a core idea about reactions in solutions, homogeneous catalysis and its mechanism.
3. To understand the basic concepts of group theory.
4. To understand the application aspects of group theory, symmetry selection rules for infrared, Raman and electronic Spectra - mutual exclusion principle.
5. To learn about the basic concepts of quantum chemistry.

UNIT I: CHEMICAL KINETICS - I

Effect of temperature on reaction rates - collision theory - molecular beams - collision cross sections - effectiveness of collisions - probability factors - potential energy surfaces – transition state theory - partition functions and activated complex. Eyring equation - estimation of free energy, enthalpy and entropy of activation and their significance.

UNIT II: CHEMICAL KINETICS - II

Reactions in solutions - effect of pressure, dielectric constant, ionic strength and salt effect - kinetic isotopic effects - linear free energy relationships-Hammett and Taft equations - Homogeneous catalysis - Acid base catalysis - mechanisms and Bronsted catalysis law.

UNIT III: GROUP THEORY – I

Symmetry elements and operations. Concepts of groups, Sub groups, class, order, Abelian and Non-Abelian point groups. Products of symmetry operations and group multiplication table, point groups-identification and determination-reducible and irreducible representations-Direct product representation-orthogonality theorem and its consequences-character table – construction (NH_3, H_2O). Symmetry adapted linear combinations of atomic orbitals (water as example).

UNIT IV: GROUP THEORY - II:

Hybrid orbital in non-linear molecules (CH_4, XeF_4, BF_3, SF_6 and NH_3). Determination of representations of vibrational modes in non-linear molecules (H_2O, CH_4, XeF_4, BF_3, SF_6 and NH_3)

Symmetry selection rules for infrared, Raman and electronic Spectra - mutual exclusion principle. Electronic Spectra of Ethylene and formaldehyde-Applications of group theory.

UNIT V: QUANTUM CHEMISTRY - I:-

Inadequacy of classical theory - black body radiation, photo electric effect - the Compton effect - Bohr's Quantum theory and subsequent developments -wave particle duality- de Broglie equation, Heisenberg uncertainty principle.

Text Books:-

1. G.K. Vemulapalli, 2000, Physical Chimistry, Prentice - Hall.
2. J. Rajaram and J.C. Kuriacose, 1993, Kinetics and mechanism of chemical transformations, MacMillan India Ltd.
3. K.J. Laidler, 1987, Chemical Kinetics, Harper and Row, New York.
4. K. L. Kapoor, 2001, A Text book of Physical Chemistry, Macmillan India Ltd.
5. V. Ramakrishnan and M.S. Gopinathan, 1988, Group Theory in Chemistry,
    a. Vishal Publications.
6. P.W. Atkins, 1990, Physical Chemistry, Oxford.
7. K.V. Raman, 1990, Group theory and its applications to Chemistry, Tata McGraw Hill.
8. D.A. McQuarrie, 1983, Quantum Chemistry, University Science Books, Mil Valley, California.
9. I.N. Levine, 1983, Quantum Chemistry, Allyn and Bacon, Boston.

10. R. Anantharaman, 2001, Fundamentals of quantum chemistry, Macmillan India Limited.
11. R.K. Prasad, 1992, Quantum Chemistry, New Age, India.

SUGGESTED REFERENCE BOOKS:-

1. W.J. Moore, 1972, Physical Chemistry, Orient Longman, London.
2. L.K. Nash, 1962, Elements of Chemical Thermodynamics, Addision Wesley.
3. G.M. Barrow, 1988, Physical Chemistry, McGraw Hill.
4. R.G. Frost and Pearson, 1981, Kinetics and Mechanism, Wiley, New York.
5. Moore and R.G. Pearson, 1981, Kinetics and Mechanism.
6. I. Amdur and G.G. Hammes, 1968, Chemical Kinetics, Principles and selected
7. topics, McGraw Hill, New York.
8. G.M. Harrus, 1966, Chemical Kinetics, D.C. Health and Co.
9. F.A. Cotton, 1971, Chemical Application of Group Theory, John Wiley and Sons
10. Inc., NewYork.
11. Alan Vincent, 1977, Molecular symmetry and Group theory-programmed
12. introduction to Chemical Aplications, Wiley, New York.

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	S	M	S	S
CO3	M	S	M	S	M
CO4	S	S	M	S	S
CO5	M	M	M	M	M

KEY: S – Strong, M – Medium, L – Low

CORE PAPER - IV - ORGANIC CHEMISTRY PRACTICAL I

SEMESTER I	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER - IV - ORGANIC CHEMISTRY PRACTICAL I	**MER11**	**120**	**4**

COURSE OUTCOME:

Students are well trained to separate and identify the components in a Two component mixture and to prepare their derivatives and to synthesize organic compounds in a single step.

I. ANALYSIS OF THE ORGANIC MIXTURE: -

1. Separation and Identification of components in a two-component mixture and preparation of their derivatives.

2. Determination of b.p./ m.p. for purified components and m.p. of the derivatives.

II. SYNTHESIS OF ORGANIC COMPOUNDS INVOLVING SINGLE STEP (ANY SIX):

1. Preparation of o-benzylbenzoic acid
2. p-Nitrobenzoic acid from p-Nitrotoluene
3. Anthroquinone from anthracene
4. Benzhydrol from benzophenone
5. m-Nitroaniline from m-dinitrobenzene
6. 1, 2, 3, 4-Tetrahydrocarbozole from cyclohexanone
7. p-chlorotoluene from p-toluidine

8. 2, 3-Dimethylindole from phenyl hydrazine and 2-butanone (boiling acetic acid)

9. Methyl orange from sulphanilic acid

10. Diphenyl methane from benzyl chloride

RECOMMENDED BOOKS:-

1. Arthur I. Vogel, A Text Book of Practical Organic Chemistry.
2. Raj K. Bansal, Laboratory Manual of Organic Chemistry, Wiley Eastern Limited.
3. Mann and Saunders, Laboratory manual of Organic Chemistry

CORE PAPER - V - INORGANIC CHEMISTRY PRACTICAL I

SEMESTER I	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER - V - INORGANIC CHEMISTRY PRACTICAL I	**MER12**	**120**	**4**

COURSE OUTCOME:

Students acquire a clear knowledge of analyzing two common cations and two rare cations in a mixture using semi micro qualitative analysis and preparation of inorganic complexes.

UNIT I:-

Semi micro qualitative analysis of mixtures containing two common and two rare cations. The following rare cation are included: W, Mo, Ti, Te, Se, Ce, Th, Zr, V, U and Li.

UNIT II: PREPARATION OF THE FOLLOWING: -

1. Tris (thiourea) copper (I) chloride
2. Potassium tris (oxalato) chromate (III) trihydrate
3. Tris (thiourea) copper (I) sulphate
4. Potassium tris (oxalato) aluminate (III) trihydrate.

TEXT BOOKS: -

1. Vogel, Text book of Inorganic quantitative analysis.
2. Dougles A. Skoog, Principles of Instrumental Analysis, 3rd Edition.

SECOND SEMESTER

CORE PAPER - VI – ORGANIC CHEMISTRY - II

SEMESTER	Subject Title	Subject Code	Total Hours	Credit
II	CORE PAPER - VI – ORGANIC CHEMISTRY - II	MRE2A	90	4

COURSE OBJECTIVE: -

This paper explains the basic concepts of addition reaction of carbon carbon double bond and elimination reactions. In addition, mechanism of some of the important rearrangements in organic chemistry will be discussed. The salient features of oxidation and reduction reactions in organic synthesis are discussed at the end.

COURSE OUTCOME:

1. To understand the stereochemical aspects of nucleophilic addition to carbonyls and the mechanisms of electrophilic, nucleophilic and addition reactions.
2. To understand the mechanism of important naming reactions like Diels Alder reaction, Simmon Smith reaction, Mannich, Knoevengal, Stobbe condensation, Shapiro reaction, Julia olefination, Darzen, and benzoin reactions.
3. To know about E1, E2 and E1cB mechanism and details about long- and short-lived free radicals.
4. To understand the molecular rearrangement reactions like Pinacol-Pinacolone, Wagner-Meerwein, Demjanov, dienone-phenol, Favorski, Baeyer-Villiger, Cope, Claisen, Stevens, Sommelet-Hauser and Von Richter rearrangements.
5. To understand the various oxidation and reduction reactions with mechanisms.

UNIT I: ADDITION TO CARBON-CARBON AND CARBON-HETERO MULTIPLE BONDS: I

Nucleophilic addition to carbonyls and Stereo Chemical aspects through various model (Cram/Cram chelation/Felkin – Anh model)-Crams rule- Prevost rule-Re face-si face on addition reaction.

Mechanism of electrophilic, nucleophilic and neighbouring group participation in addition reactions. Addition of halogen and nitrosyl chloride to olefins, hydration of

olefins and acetylenes, hydroboration, Lithium and boron enolates in aldol, Michael reactions. Alkylation and acylation using Lithium enolates, hydrogenation of ethylene and acetylene- partial reductions- Homogeneous hydrogenation- Wilkinson's catalyst.

UNIT II: ADDITION TO CARBON-CARBON AND CARBON-HETERO MULTIPLE BONDS: II

Ylides: Chemistry of phosphorous and sulfur ylides – Wittig and related reaction, Peterson Olification.

Diels Alder reaction, 1, 3-dipolar additions, carbenes and carbenoids - addition to double bonds - Simmon Smith reaction, Mannich, Knoevengal, Stobbe condensation, Shapiro reaction, Julia olefination, Acyloin condensations, Darzen, and benzoin reactions. Stereochemical aspects to be studied wherever applicable - Nitrenes: Methods for generating carbenes and nitrenes and their reactions.

UNIT III: ELIMINATION AND FREE RADICAL REACTIONS: -

E1, E2 and E1cB mechanism - Orientation of the double bond. Regio selectivity and stereoselectivity of elimination reactions in cyclic systems, pyrolytic eliminations. Chugaev, Hofmann and Cope Elimination.

Long- and short-lived free radicals - methods of generation. Adddition of free radicals to olefinic double bonds. Sandmayer - Gombereg-Gauchmann, Pschorr, Ulmann and Hunsdicker reactions.

UNIT IV: MOLECULAR REARRANGEMENTS: -

A detailed study of the mechanism of the following rearrangements with suitable examples Pinacol-Pinacolone (examples other than tetramethyl ethylene glycol) - Wagner-Meerwein, Demjanov, dienone-phenol, Favorski, Baeyer-Villiger, Cope, Claisen, Stevens, Sommelet-Hauser (in cyclic systems also) and Von Richter rearrangements.

UNIT V: OXIDATION AND REDUCTION REACTIONS: -

Oxidation: Mechanism - study of the following oxidation reactions - oxidation with LTA, SeO_2, DDQ, Oxalyl chloride, Dess-martin reagent DMSO in combination with DCC or acetic anhydride in oxidizing alcohols – Hydroxylations with – OsO_4, $KMnO_4$, Woodward prevost, epoxidation (per oxides/per acids). Sharpless epoxidation.

Reductions: Synthetic importance of Clemensen and Wolf-Kishner reductions and its Modifications, Birch reduction, MPV reduction.

TEXT BOOKS: -

1. R.Bruckner, 2002, Advanced Organic Chemistry, Reaction Mechanism, Elsevier, New Delhi
2. F. A . Carey and R.J. Sundberg, 2001, Advanced Organic Chemistry, Part A and Part-B, 4th Edition, Plenum Press., New York
3. J.March, 2002, Advanced Organic Chemistry, 4th Edition, John Wiley & Sons Singapore.
4. T.L. Gilchrist and C.W. Rees, Carbenes, Nitrenes and Arynes, Thomas Nelson and Sons Ltd., London.
5. Niel Issacs, 1987, Physical Organic Chemistry, ELBS Publications.
6. W. Carruthers, 1993, Some Modern Methods of Organic Synthesis, 3rd Edition, Cambridge University Press.
    i. Reduction:- Hydride transfer reagents.
    ii. $NaBH_4$, $LiAlH_4$, DIBAL-H, Red-Al, Selectrides, Et_3SiH and Bu_3SnH
7. H.O. House, 1972, Modern Synthetic Reactions, The Benjamin Cummings Publishing Company, London.

WEBSITES:-

1. http :// info dome .sdsu, ./research/ guides/ science/ org chemistryblr. html
2. http :// www.liv.ac.uk/chemistry/links /reactions.html
3. http ://orgchem.chem..uconn.edu/namereact/named.html
4. www.gcocities.com/chempen softwar4ee/reactions.html

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	M
CO2	S	M	M	S	M
CO3	M	M	S	S	M
CO4	S	M	M	S	M
CO5	M	M	M	S	M

KEY: S – Strong, M – Medium, L – Low

CORE PAPER - VII – INORGANIC CHEMISTRY - II

SEMESTER II	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER - VII – INORGANIC CHEMISTRY - II	MRE2B	90	4

COURSE OBJECTIVES: -

The student can gain the knowledge and understanding of all aspects of inorganic polymers, solid state and nuclear chemistry.

COURSE OUTCOME:

1. To understand the mechanism of electron Transfer reactions and formation of precursor complexes.
2. To gains knowledge about substitution reactions in various square planar complexes and octahedral complexes.
3. To understand the structure of solids Semiconductors, Superconductors, Solid State Electrolytes, Types of Magnetic Behaviour - Dia, Para, Ferro, Antiferro and Ferrimagnetism.
4. To understand the nuclear properties, types of radioactive decay and various nuclear reactions.
5. To learn the applications of radioactive elements as tracers in various fields.

UNIT I: COORDINATION CHEMISTRY – REACTION MECHANISMS: -

Electron transfer reactions; outer and inner sphere processes; atoms transfer reaction, complementary and non-complementary reactions.

Formation and rearrangement of precursor complexes, binding ligand, successor complexes, Marcus theory.

UNIT II: SUBSTITUTION REACTIONS IN COORDINATION COMPOUNDS: -

Substitution Reactions : Substitution in square planar complexes, reactivity of platinum complexes, influence of entering, leaving and other groups, trans-effect, substitution of octahedral complexes of cobalt and chromium, replacement of coordinated

water, solvolytic (acids and bases) reactions applications in synthesis (platinum and cobalt complexes only).

Rearrangement in 4 and 6 coordinate complexes: reaction at coordinated ligands-template effect.

UNIT III: SOLID STATE CHEMISTRY:-

Preparation Methods: Ceramic method – Sol-gel method – Hydrothermal synthesis –chemical vapour deposition: Structure of Solids: Structure of ZnS, Rutile, Pervoskite, Cadmium iodide and nickel arsenide; spinels and inverse spinels; defects in solids, non-stoichometric compounds - High Temperature Superconductors

Band theory, Semiconductors, Superconductors, Solid State Electrolytes, Types of Magnetic Behaviour - Dia, Para, Ferro, Antiferro and Ferrimagnetism, Hysterisis, Solid State Lasers, Inorganic Phosphorus, Ferrites, Garnets.

Reactions in solid state and phase transitions, diffusion, diffusion coefficient, diffusion mechanisms, vacancy and interstitial diffusion, formation of spinels.

Solid solutions: Order-disorder transformations and super structure.

UNIT IV: NUCLEAR CHEMISTRY: -

Nuclear properties-nuclear spin and moments, origin of nuclear forces, salient features of liquid drop and shell models.

Types of radioactive decay: Orbital electron capture, nuclear isomerism, internal conversion, detection and determination of activity by cloud chamber, nuclear emulsion, bubble chamber, G.M., Scintillation and Cherenkov counters; Accelerators- Linear and Cyclotron

Nuclear reaction: Types, reaction cross section, Q-value, threshold energy, compound nucleus theory: high nuclear reactions, nuclear fission and fusion reactions as energy sources; photonuclear and thermo nuclear reactions. Components of nuclear reactors – the fast breeder reactor – nuclear reactors in India.

UNIT V: NUCLEAR CHEMISTRY APPLICATION: -

Radioactive tracers: Preparations - principles of tracer technique - application of tracers in the study of reaction mechanism and in analytical chemistry - neutron activation analysis, isotope dilution analysis - radio chemical determination of age of geological specimen. Tracers as applied to industry and agriculture - radioactive tracer in the diagnosis and treatment in the field of medicine.

TEXT BOOKS: -

1. K.F. Purcell and J.C. Kotz, 1977, Inorganic Chemistry WB Saunders Co., U.S.A.
2. J.E. Huheey, 1993, Inorganic Chemistry, IV Edition, Harper and Collins, NY.
3. F.A. Cotton and G.W. Wilkinson, 1988, Advanced Inorganic Chemistry - A Comprehensive Text; John Wiley & Sons.
4. B.E. Dogulas DH MX Daniels and Alexander, 1983, Concepts and Models of Inorganic Chemistry, Oxford IBH.
5. W.U. Mallik, G.D. Tul, R.D. Madan, 1992, selected topics in Inorganic Chemistry, S. Chand & Co., New Delhi.
6. A.R. West, 1991, Basic Solid State Chemistry, John Wiley.
7. W.E. Addison, 1961, Structural Principles in Inorganic Chemistry, Longman.
8. M. Adams, 1974, Inorganic Solids, John Wiley Sons.
9. S. Glasstone, Source Book on Atomic Energy, East West Press.
10. C.R. Choppin and J. Ryd Berg: Nuclear Chemistry - Theory and
    i. Applications, Pergamon Press.
11. B.G. Harvey, Introduction to Nuclear Physics and Chemistry Prentice Hall, 1962.

SUGGESTED REFERENCE BOOKS: -

1. S.F.A. Kettle, 1973, Coordination Chemistry, ELBS.
2. B.N. Figgis, 1966, Introduction to Ligand Fields, Interscience.
3. M.N. Hughes, 1982, The Inorganic Chemistry of Biological processes, II Edition, Wiley London
4. D. Nicholas, 1974, Complexes of First Row Transition Elements.
5. M.C. Shrivers, PW. Atkins, CH Langford, 1990, Inorganic Chemistry, OUR
6. M.C. Day and J. Selbin, 1974, Theoretical Inroganic Chemistry, Van Nostrand Co., NY.
7. G.S. Manku, 1984, Inorganic Chemistry, TMH.
8. U. Sathyanarayana - Essentials of Biochemistry, Books and Allied (P) Ltd.
9. A.F. Wells, - 1984, Structural Inorganic Chemistry, V. Edition, Oxford
10. A.R. West, 1990, Solid State Chemistry, John Wiley..
11. 11.G.D.Christian& J.E.O. Reily, 1986, Instrumental Analysis, II Edition, Allegn Recon.
12. 12.H.A. Strobel, 1976, Chemical Instrumentation, Addition- Wesely Publ. Co.
13. Kolthoff and Elwing (All Series) - Treatise on Analytical Chemistry.
14. Willson Series - Comprehensive Analytical Chemistry.

15. H.A.O. Hill and P. Day, 1968, Physical methods in Advanced Inorganic Chemistry, JohnWiley.
16. K. Burger, 1973, Coordination Chemistry, Experimental methods, Butterworths.
17. C.N.R. Rao, J.R. Ferraro, 1970, Spectroscopy in Inorganic Chemistry, Vol. I and Vol. II. Academic Press.
18. G. Aruldas, Molecular Structure and Spectroscopy, Prentice Hall.
19. E.L. Mutterties, 1975, Polyhedral Borneds, Academic Press, NY.
20. NH Ray, 1978, Inorganic Polymers, Academic Press.
21. C. Kellter: Radiochemistry, Ellis Hardwood Ltd., John Wiley and Sons.
22. G.R. Chopin, Experimental Nuclear Chemistry, Prentice Hall, 1962.
23. G. Friedlander, J.W. Kennedy, and J.M. Miller, Nuclear and Radio Chemistry, John Wiley.

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	M
CO2	M	S	M	S	M
CO3	S	S	S	S	M
CO4	S	S	M	S	M
CO5	M	M	S	M	S

KEY: S – Strong, M – Medium, L – Low

CORE PAPER VIII – PHYSICAL CHEMISTRY - II

SEMESTER II	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER VIII – PHYSICAL CHEMISTRY - II	MRE2C	90	4

COURSE OBJECTIVES: -

To learn the concepts in enzyme kinetics, surface reactions and fast reactions, and to understand the formulation and applications of quantum mechanics in atomic and molecular structure. In addition to learn fundamentals of spectroscopy.

COURSE OUTCOME:

1. To understand the enzyme catalysed reactions and adsorption Isotherms.
2. To understand the fundamentals of Kinetics of complex reactions and the methods employed to study Fast reactions.
3. To understands the Quantum mechanical postulates and the operators used in Quantum chemistry and to solve the Schrodinger equation for a simple one electron system.
4. To know the Schrodinger wave equation for Rigid rotor, Linear harmonic oscillator, and hydrogen like atoms and to calculate their respective energies.
5. To learn the selection rules of rotational, vibrational and electronic spectra.

UNIT I: CHEMICAL KINETICS - III: -

Catalysis by Enzymes-rate of enzyme catalyzed reactions, Michaelis-Menten equation effect of substrate concentration, pH and temperature - inhibitions of enzyme catalyzed reactions – three types with mechanism.

Heterogeneous catalysis, Langmuir and BET adsorption isotherms- Kinetics of Heterogeneous catalysis, Unimolecular and Bimolecular reaction. Langmuir-Rideal and Langmuir-Hinshelwood mechanisms. Adsorption coefficient and its significance. Kinetics and mechanism of surface reactions-catalysis by metals, Hydrogenations and semiconductor oxides.

UNIT II: CHEMICAL KINETICS - IV: -

Kinetics of complex reactions – reversible, consecutive and parallel reactions. Chain reactions: general treatment. Rice Herzfeld Mechanism - Decomposition of

acetaldehyde and hydrobrominations. Comparison of HCl and HBr formation and explosion limits.

Study of fast reactions-relaxation methods-temperature and pressure jump - stopped flow and flash photolysis methods.

UNIT III: QUANTUM CHEMISTRY - II: -

Quantum mechanical postulates- Eigen value and function - the Schrodinger wave equation-elementary applications of Schrodinger's equation-the particle in a box (one-, two- and three-dimensional cases) - particle in a ring.

UNIT IV: QUANTUM CHEMISTRY - III: -

The harmonic oscillator- the rigid rotor- the hydrogen atom- the Schrodinger equation for hydrogen atom- angular momentum - term symbols -the solution- the origin of quantum numbers (angular momentum and spin) -their physical significance.

UNIT V: SPECTROSCOPY I

Electromagnetic radiation: Quantization of energy- rotational, vibrational and electronic energy levels and transitions in molecules- regions and representation of spectra. Resolution and intensity of spectral transition: signal to noise ratio- width of spectral lines- collision broadening – Doppler broadening – Heisenberg uncertainty principle – intensity of spectral lines- selection rules and transition probability- transition moment integral- Eienstein absorption coefficient.

Electronic spectra of polyatomic molecules, Franck-condon principle- selection rules – types of transition in saturated and unsaturated hydrocarbons, effect of conjugation and solvent effects.

TEXT BOOKS: -

1. J.Rajaram and J.C.Kuriakose, 1993, Kinetics and mechanism of chemical transformations, Macmillan India Ltd.
2. K.J.Laidler, 1987, Chemical Kinetics, Harper and Row, New York.
3. D.A. McQuarrie, 1983, Quantum Chemistry, University Science Books, Mil Valley, California.
4. I.N. Levine, 1983, Quantum Chemistry, Allyn and Bacon, Boston.
5. R. Anantharaman, 2001, Fundamentals of quantum chemistry, Macmillan India Limited.
6. R.K. Prasad, 1992, Quantum Chemistry, Wiley Eastern, New Delhi.

SUGGESTED REFERENCE BOOKS: -

1. R.G.Frost and Pearson, 1961, Kinetics and Mechanism, Wiley, New York.
2. W.J.Moore and R.G.Pearson 1981, Kinetics and Mechanism.
3. R.K.Prasad, 1992, Quantum Chemistry, Wiley Eastern, New Delhi.
4. J.Goodman, 1997, Contemporary Quantum Chemistry, An Introduction, Plenum Press, New York.
5. R.Mcweeny, 1979, Coulon's Valence, ELBS Oxford University Press.
6. F.J.Bockhoff, 1976, Elements of Quantum theory, Addison Wesley, Reading Mass.
7. P.W.Atkins, 1990, Physical Chemistry, Oxford University Press.
8. H.Eyring, J.Walter and G. Gimball, 1944, Quantum Chemistry, John Wiley and Sons, New York.
9. L.S.Pauling and F.B.Wilson, 1935, Introduction to Quantum mechanics, Mc Graw Hill Book Company, New York.
10. P.W.Atkins, 1983, Molecular Quantum Mechanics, Oxford University Press, Oxford.

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	M
CO2	M	M	M	M	M
CO3	S	M	M	S	M
CO4	S	M	M	M	S
CO5	M	M	M	S	S

KEY: S – Strong, M – Medium, L – Low

POLYMER CHEMISTRY

SEMESTER II	Subject Title	Subject Code	Total Hours	Credit
	POLYMER CHEMISTRY	MERBD	60	3

COURSE OBJECTIVES: -

To know about various types of polymers and their properties. Application of the polymer in the present context and its biodegradation is included.

COURSE OUTCOME:

1. To understands the basic concept of polymer chemistry and various mechanism of polymerization.
2. To understand the various polymerization techniques and methods to determine Molecular weight along with the concept of Glass transition temperature.
3. To know the various synthetic resins and plastics and applications of them in various fields.
4. To have an overview of synthetic fibres, synthetic rubber and conducting polymers.
5. To learn the polymer degradation methods and the additives used in polymers and the applications of biodegradable polymers.

UNIT I: METHODS OF POLYMERIZATION: -

1.1 Basic concepts of polymer chemistry: Repeating unit, degree of polymerisation, classification, stereochemistry of polymers and nomenclature of stereoregular polymers.

1.2 Chain, free radical, ionic and ring opening polymerizations. Ziegler – Natta catalyst involment in step polymerisation ring opening polymerisation.

1.3 Copolymerisation: Block and graft copolymers – preparation.

UNIT II: PROPERTIES OF POLYMERS: -

2.1 Polymerisation techniques: Bulk, solution, suspension and emulsion polymerisation. Melt, solution and interfacial polycondensation. Solid and gas phase polymerisation.

2.2 Molecular weight and size: Number and weight average molecular weights. Polydispersity and molecular weight distribution in polymers, the practical significance of polymer molecular weights and size of polymers. (Molecular weight determination is not required)

2.3 Glass transition temperature: Concept, associated properties and determination. Glassy solids and glass transition. Factors influencing it.

2.4 Crystallinity in polymers: Polymer crystallisation, structural and others factors affecting crystallisability and effect of crystallinity on the properties of polymers.

UNIT III: RESINS AND PLASTICS: -

3.1 Processing: Calendering, die casting, rotational casting. Compression, injection, blow and extrusion moulding. Thermoforming, foaming and reinforcing techniques.

3.2 Synthetic resins and plastics: Manufacturing and applications of polyethylene, PVC, teflon, polystyrene, polymethylmethacrylate, polyurethane, phenol – formaldehyde resins, urea – formaldehyde and melamine – formaldehyde resins and epoxy polymers.

UNIT IV: SYNTHETIC FIBERS AND RUBBERS: -

4.1 Synthetic fibers: Rayon, nylons, polyesters, acrylics, modacrylics and spinning techniques.

4.2 Synthetic rubber: SBR, butyl rubber, nitrile rubber, neoprene, silicone rubber and polysulphides.

4.3 Conducting polymers and applications.

UNIT V: DEGRADATION OF POLYMERS:-

Polymer degradation: Types - thermal, mechanical, photo, hydrolytic and oxidative.

Degradations. Additives for polymers: Fillers, plasticisers, thermal stabilizers, photo stabilizers, Antioxidants and colourants. Biodegradable Polymers and their applications.

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	M	S	M	S
CO3	M	S	M	S	M
CO4	S	M	S	M	S
CO5	M	M	M	M	M

KEY: S – Strong, M – Medium, L – Low

ELECTIVE PAPER I- ANALYTICAL CHEMISTRY PRACTICALS

SEMESTER II	Subject Title	Subject code	Total Hours	Credit
	ELECTIVE PAPER I- ANALYTICAL CHEMISTRY PRACTICAL	**MERAA**	**90**	**3**

COURSE OUTCOME:

Students are well trained to estimate ions using Spectrophotometric method and to separate mixtures using Chromatographic Technique

I. COLORIMETRIC ANALYSIS

Spectrophotometric method: Estimation of iron, nickel, manganese and copper.

II. CHROMATOGRAPHIC SEPARATIONS

1 Separation of a mixture of two metal ions by paper chromatography.

2 Separation of zinc and magnesium on an anion exchanger

3 Separation of green leaf pigments by thin layer chromatography

4 Separation of o and p-nitro phenols by column chromatography

III. TO LEARN THE BASIC PRINCIPLES - EXTRACTION OF ORGANIC COMPOUNDS FROM NATURAL SOURCE.

1. Caffeine from tea leaves
2. Lactose from milk
3. Citric acid from lemon
4. Pipierine from black pepper
5. Lycopene from tomatoes

TEXT BOOKS:-

1. Raj K. Bansal, Laboratory Manual of Organic Chemistry, Wiley Eastern Limited.
2. Mann and Saunders, Laboratory Chemistry manual of Organic compounds.
3. Dougles A. Skoog, Principles of Instrumental Analysis, 3rd Edition.

ELECTIVE PAPER II - PHYSICAL CHEMISTRY PRACTICALS I

SEMESTER II	Subject Title	Subject Code	Total Hours	Credit
	Elective Paper II - Physical Chemistry Practical I	**MERAB**	**90**	**3**

COURSE OUTCOME:

Students gain knowledge through various experiments in Kinetics, Partition Coefficient and construction of phase diagram of simple binary systems.

1. Study of the adsorption of acetic acid or oxalic acid on charcoal, verification of Freundlich isotherm and determination of concentration of given acid
2. Construction of phase diagram for a simple binary system; naphthalene – biphenyl, naphthalene –p-dichlorobenzene, naphthalene-diphenylamine.
3. Determination of partition coefficient, equilibrium constant and unknown concentration of potassium iodide of the reaction between iodidine and potassium iodide by partition method.
4. Determination of molecular weight of benzoic acid in benzene and the degree of association of benzoic acid in benzene using partition method.
5. Kinetic study and comparison of rate constants of different acids or acids of different strength for the inversion of cane sugar by polarimetric method.
6. Kinetic study of the reaction between acetone and iodine in acidic medium and determination of the order with respect to iodine and acetone
7. Saponification of ethylacetate by sodium hydroxide and determination of order of the reaction.
8. Comparison of acid strengths for hydrolysis of methylacetate catalyzed by acids
9. Determination of temperature coefficient and energy of activation for the acid catalysed
10. hydrolysis of methylacetate.
11. Determination of the rate constant and order for the reaction between potassium persulphate and potassium iodide
12. Study of the primary salt effect on the kinetics of oxidation of iodide by persulphate
13. Kinetic study of the decomposition of sodium thiosulphate by mineral acid.

THIRD SEMESTER

CORE PAPER - IX – ORGANIC CHEMISTRY – III

SEMESTER III	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER - IX – ORGANIC CHEMISTRY – III	MER3A	90	4

COURSE OBJECTIVES: -

To explain the instrumental methods and their application in the determination of structure of organic molecules and the basic concepts of aromaticity and photochemistry. A detailed account of orbital symmetry which forms the basis of many organic reactions is also included. The last part of the subject deals with heterocyclics, terpenoids and steroids.

COURSE OUTCOME:

1. To know the principles and applications of UV and IR spectroscopy – Mass spectrometry – optical rotatory in organic molecular structuredetermination.
2. To understand the principles and structural elucidation using NMRspectroscopy.
3. To know about the aromaticity of heterocyclic compounds – Photochemical reactions – Photochemistry of ketones, oxygenation,reduction and cycloaddition.
4. To learn about pericyclic reactions, orbital symmetry - related name reactions and rearrangements.
5. To understand about the reduction, oxidation and hydroxylation reactions.

UNIT I: PHYSICAL METHODS OF STRUCTURE DETERMINATION

Principles and applications of ultraviolet and infrared spectroscopy in organic molecular structure determination. Mass spectrometry and its applications. Optical rotatory dispersion and its applications. Cotton effect, Octant rule and axial haloketone

rule. Problem solving approach. (For molecules with a maximum number of C_{10}) Woodward Fieser Rule (only applications).

UNIT II: NMR SPECTROSCOPY

Nuclear magnetic resonance spectroscopy. Proton chemical shift, spin-spin coupling, coupling constants and applications to organic structures-FT NMR ^{13}C NMR Spectroscopy (elementary treatment). Nuclear overhauser effect (applications only)

UNIT III: ORGANIC PHOTOCHEMISTRY AND AROMATICITY: -

Aromaticity of benzenoid, non-benzenoid and heterocyclic compounds, Huckel's rule-Aromatic systems with pielectrons - numbers other than six non-aromatic (cyclooctatetraene etc) and anti-aromatic systems (cyclobutadiene etc)- with more than 10 pi electrons – Annulenes up to C_{18} (synthesis not expected).

Photo chemistry of ketones, photo oxygenation, photo reduction, photocycloaddition, Paterno - Buchi reaction, Di –pi- methane rearrangement. cis- trans isomerisation, Barton reaction, photo- Fries reaction, photochemistry of cyclohexadienones synthesis of Vit - D.

UNIT IV: ORBITAL SYMMETRY AND CORRELATION: -

Pericyclic reactions-classification, electrocyclic, cycloaddition reactions. Woodword Hoffman rules, FMO-Analysis of electrocyclic, cycloaddition and sigmatropic reactions-correlation diagram for cycloaddition reaction ($€^{2s} + €^{2s}$) and ($€^{4s} + €^{2s}$) – butadiene – cyclobutene system and Inter conversion of hexatriene to cyclohexadiene. Structure of bulvalene, a fluxional molecule- MO treatment on Cope, Claisen rearrangements, Diels-Alder and Ene reaction.

UNIT V: HETEROCYCLIC COMPOUNDS, TERPENOIDS AND STEROIDS: -

Flavones, isoflavones, anthocyanins (Synthesis of parent and simple alkyl or aryl substituted derivatives are expected). Synthesis of carotenoids, licopenesand Vitamin A1 (Reformatsky and Wittig reaction methods only).

Structural elucidation of cholesterol (by chemical degradation). Conversion of cholesterol to progestrone, esterone and testosterone.

TEXT BOOKS: -

1. R.M. Silverstein, G.C. Bassler and Morril, 1991, Spectrometric identification of Organic Compounds, 5th Edition, John Wiley and Sons, New York..
2. I.L. Finar, 1986, Organic Chemistry – Vol.II, 5th edition, ELBS Publication.

3. P.S. Kalsi, 2002, Spectroscopy of Organic Compounds, Wiley Eastern Ltd, Chennai.
4. H. Depuy and Orville, Molecular reaction and Photochemistry Charles, L.Chapman, Prentice Hall of India Pvt. Ltd., New Delhi
5. L.A. Pacquette, 1978, Principles of Modern Heterocyclic Chemistry, Benjamin Cummings Publishing Co., London.
6. J. March, 1992, Advanced Organic Chemistry, 4th Edition, Singapore
7. F.A. Carey and R.J. Sundberg, 1990, Advanced Organic Chemistry, 4th Edition, Plenum Press, New York.
8. Neil S. Issacs, 1987, Physical Organic Chemistry, ELBS Publication.
9. P.S. Kalsi, 1999, Texbook of Organic Chemistry, Mcmillan India Ltd.

WEBSITES:-

1. http :// info dome. sdsu, ./research/ guides/ science/ org chemistryblr. html
2. http :// www.liv.ac.uk/chemistry/links /reactions.html
3. http ://orgchem.chem..uconn.edu/namereact/named.html
4. www.gcocities.com/chempen softwar4ee/reactions.html

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	M	S
CO2	S	S	M	S	S
CO3	M	S	S	S	M
CO4	S	M	M	M	S
CO5	M	S	S	S	M

KEY: S – Strong, M – Medium, L – Low

CORE PAPER – X – INORGANIC CHEMISTRY – III

SEMESTER III	Subject Title	Subject Code	Total Hours	Credit
	Core Paper – X – Inorganic Chemistry – III	**MER3B**	**90**	**4**

COURSE OBJECTIVES: -

To understand the applications of different spectroscopic methods in the study of Inorganic compounds.

COURSE OUTCOME:

1. To understand the IR and Raman spectra application in coordination complexes.
2. To understand Jahn-Teller Distortion Nephelauxetic effect and Charge Transfer Spectra.
3. To know various spectroscopic techniques such as electronic UV, IR, RAMAN, NMR, NQR, MOSSBAUERESR, ESR, Photoelectron, XRF, XRD, Electron microscopy and determination of structures using these techniques.
4. The knowledge of spectral techniques was useful in understanding and interpretation of spectra for problem solving in practical papers and characterization during project work.
5. To understand the X-Ray Diffraction and Microscopy Application.

UNIT I: IR AND RAMAN SPECTRA APPLICATION:

Effect of coordination on ligand bands- Ammine, Nitro, nitrito, thiocyanato.

Urea complexes, dithiocarbamato complexes, carboxylate complexes, nitrosyl complexes, cyano complexes- nitrate, sulphate and perchlorate complexes- differentiation of geometric isomers. Metal carbonyls, olefin complexes, sandwich complexes.

Raman spectroscopy of metal complexes, organometallic and simple inorganic compounds with special reference to coordination sites, isomerism.

UNIT II: ELECTRONIC SPECTRA APPLICATION:

Classification of Transitions – Selection Rules – Free ion terms – Racah Parameter – Ligand field perturbations on the free ion terms – Spectra of Octahedral complexes:d^n configurations- Weak field and strong field ligands – Orgel and Tanabe-Sugano Diagrams – Evaluation of $10D_q$ – Spectra of distorted octahedral complexes – Jahn-Teller Distorion – Tetrahedral Complexes - Nephelauxetic effect – Charge Transfer Spectra.

UNIT III: NMR, NQR AND MOSSBAUER: -

NMR, NQR, Mossbauer spectra: NMR spectra of ^{31}P, ^{19}F, NMR shift reagents, NQR-Nitrosyl compounds. Mossbauer of Fe and Sn systems.

UNIT IV: APPLICATION OF ESR AND PHOTO ELECTRON SPECTROSCOPY TO COORDINATION COMPLEXES:

ESR introduction-Zeeman equation, g value, nuclear hyperfine splitting, Interpretation of ESR spectrum of simple carbon centered free radicals. Anisotropy in g value and hyperfine splitting constant. McConnels equation, Kramer's theorem, esr of transition metal complex of copper, manganese and vanadyl complexes.

Photoelectron spectroscopy – UPS and XPS-Photoelectron spectra – Koopman's theorem, -Fine structure in PES, Chemical shift and Correlation with electronic charges.

UNIT V: X-RAY DIFFRACTION AND MICROSCOPY APPLICATION:

Basic Principles of diffraction – Bravis Lattices- Use of X-ray power diffraction data in identifying inorganic crystalline solids. Single crystal diffraction in crystal structure analysis. Optical Microscopy, Electron Microscopy – SEM and TEM. X-ray Flourescence Spectroscopy – structure determination.

TEXT BOOKS:-

1. L.Smart, E.Moore – Solid State Chemistry – An Introduction-2nd Edition
2. A.R.West – Basic Solid state Chemistry 1961 – John Wiley
3. A.R.West – Solid state Chemistry and its applications 2007 – John Wiley
4. W.E Addison, 1961, Structural principles in Inorganic Chemistry, Longman
5. Structural principles in inorganic Chemistry –Adams
6. Physical methods in inorganic Chemistry – Russel Drago
7. Physical methods in inorganic Chemistry – E.A.V Ebsworth, Rankin and
8. Caddock. 1987.

9. Vibrational Spectroscopy Theory and Applications – New Age,
10. D.N.Sathyanarayana, 2011.
11. Magenetic Resonance Spectroscopy-ESR, NMR, NQR-IK International
    a. D.N. Sathyanarayana, 2014.

REFERENCES:-

1. R.B.Heslop and K.Jones, inorganic Chemistry, Elsevier ScintificPubl .1976.
2. H.A.O Hill and P.Day, physical methods in dvanced Inorganic Chemistry, John wiley 1968.
3. C.N.R Rao, J.R.Ferraro, Spectrosopy in inorganic chemistry, Vol.I and Vol II, Academic press, 1970.
4. G.Aruldhas, molecular structures and spectroscopy-Prentice hall.
5. M.F.Lappert –Physical inorganic Chemistry-inorganic Electron Spectrosopy 1968.

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	S	S
CO3	M	M	M	M	M
CO4	S	S	S	S	S
CO5	M	M	M	M	M

KEY: S – Strong, M – Medium, L – Low

CORE PAPER - XI - PHYSICAL CHEMISTRY – III

SEMESTER	Subject Title	Subject Code	Total Hours	Credit
III	Core Paper - XI - Physical Chemistry – III	MER3C	90	4

COURSE OBJECTIVES: -

To understand and appreciate the significance and applications of classical thermodynamics, electrochemistry in solutions and to learn the principle and applications of optical and resonance spectroscopy.

COURSE OUTCOME:

1. To understand the concept of partial molar properties, fugacity and its variation with temperature and pressure and concept of activity and activity coefficients.
2. To study the Rotational and Vibrational spectroscopy was discussed
3. To understand the Principle, Theory and Instrumentation of NMR, ESR and MASS spectra were studied in detail
4. To know the Mean Ionic activity, activity co-efficient and theory of strong electrolytes. The redox reaction of cell, electrode potential and electrochemical cells were taught in detail.
5. To understand the approximation methods used to solve the Schrodinger equation for multielectron systems.

UNIT I: THERMODYNAMICS - I: -

Partial molar properties - Partial molar free energy (Chemical potential) - Partial molar volume and partial molar heat content - their significance and determination of these quantities. Variation of chemical potential with temperature and pressure.

Thermodynamics of real gases - gas mixture - fugacity definition - determination of fugacity variation of fugacity with temperature and pressure -thermodynamics of ideal and non-ideal binary solutions-dilute solutions-excess functions for non-'ideal solutions

and their determination-the concepts of activity and activity coefficients-determination of standard free energies.

Choice of standard states - determination of activity and activity coefficients for non-electrolytes.

UNIT II: SPECTROSCOPY - II: -

Rotational spectroscopy of a rigid rotor – non-rigid rotor-diatomic and polyatomic molecules. Vibrational spectroscopy-harmonic oscillator-anharmonicity –Vibration – rotation spectra of diatomic vibrating molecules selection rules-P, Q and R branches. Vibrational spectra of polyatomic molecules- fundamental vibrations – normal modes of vibration- overtones, combination and difference bands- Fermi resonance. Raman spectra: Classical theory of Raman effect and molecular polarizability – pure rotational Raman spectra – Vibrational Raman spectra – Rotational fine structure – Rule of mutual exclusion – Polarization of light and Raman effect.

UNIT III: SPECTROSCOPY - III: -

Resonance spectroscopy-Zeeman effect-equation of motion of spin in magnetic fields-chemical shift-spin-spin coupling-NMR of simple AX and AMX type molecules- H^1 ,^{13}C, ^{19}F, ^{31}P NMR spectra - a brief qualitative discussion of Fourier transform spectroscopy. ESR: principle, spin-orbit coupling. Hyperfine interaction. McConnell reactions.

Mass spectra: Theory and instrumentation, McLaffetry rearrangement fragmentation pattern for simple aliphatic and aromatic alkanes, alcohols, aldehydes and ketones - Mossbauer spectroscopy- Doppler effects, isomer shift, electron-neutron hyperfine interactions. Quadrupole interactions and Magnetic interactions.

UNIT IV: ELECTROCHEMISTRY OF SOLUTION: -

Mean ionic activity and activity coefficient: concept of ionic strength, Debye-Huckel theory of strong electrolytes-activity coefficient of strong electrolytes-determination -Debye Huckel limiting law at appreciable concentration of electrolytes - Debye Huckel Bronsted equation-qualitative and quantitative verification.

Redox reaction: cell potential, Galvanic cell, Electrolytic cell, Nernst equation for cell potential of electrolyte. Electrode equilibrium-thermodynamic electrodes and electrode potential, electrochemical cells and electromotive force.

UNIT V: QUANTUM CHEMISTRY – IV: -

Approximation methods –perturbation and variation method –application to hydrogen, helium atoms –R.S. coupling and term symbols for atoms in the ground state – Slater orbital and HF –SCF methods Born – Heimer approximation – valence bond theory for hydrogen molecule –LACO –MO theory for di and polyatomic molecules –concept of hybridization – Huckel theory for conjugated molecules (ethylene, butadiene and benzene)- semi empirical methods.

TEXT BOOKS: -

1. S. Glasstone, 1960, Thermodynamics for chemists, Affiliated East West Press, New Delhi.
2. J. Rajaram and J.C. Kuriacose, 1986, Thermodynamics for students of chemistry, Lal Nagin Chand, New Delhi.
3. A. Caringtion and A.D Mc Lachlan, 1967, Introduction to Magnetic Resonance Harper and Row, New York.
4. G. Aruldas, 2002, Molecular structure and spectroscopy, Prentice Hall.
5. C.N. Banwell, 2003, Fundamentals of Molecular, Spectroscopy Tata McGraw Hill.
6. D.N. Sathyanarayana vibrational spectroscopy
7. D.N. Sathyanarayana electronic spectroscopy
8. J.O.M. Bokris and A.K.N. Reddy, 1977, Electrochemistry, VoIs1 and 2 Plenum, New York.
9. J. Robbins -1993, Ions in Solution-An Introduction in electrochemistry,

   Clarendon press, Oxford
10. R.K.Prasad, 1992, Quantum Chemistry, Wiley Eastern, New Delhi.
11. D.A. Mcquarrie, 1983, Quantum Chemistry, University Science Books, Mill Valley, Calfornia.

SUGGESTED REFERENCE BOOKS:-

1. R.L. De Koch and H.B. Gray, Chemical Structure and Bonding, Benjamin/Cumming, Menlo Park, California.
2. J.N. Murrell, S.F.A. Kettle and J.M. Tedder, 1985, The Chemical Bond, Wiley.
3. P.W. Atkins, 1983, Molecular Quantum Mechanics, Oxford University Press, Oxford.
4. P.H. Rieger, 1994, Electrochemistry, Chapman and Hall, New York.
5. W. Kemp, 1986, NMR in Chemistry McMilan Ltd.
6. G.W. King, 1964, Spectroscopy and Molecular Structure, Holt Rieneheart and Winston.
7. K.D. Mclauchlan, 1970, Magnetic Resonance, Oxford chemistry Series, Oxford.

8. B.P.Staughan and S.Walker, 1976, Spectroscopy Vol. 1 , 11 and 111, Chapman and Hall.
9. B.W. Cook and K. Jones, 1972, A.Programmed Introduction to Infra red spectroscope, Heydon and Son Ltd.
10. F.A. Rushworth and D.P Tunstal, 1973, Nuclear Magnetic Rewsonance Gorden and Breaqch Science Publishing, New York.
11. J.K. Sanders and B.K.Hunther, 1987, Mordern NMR Spectroscopy, A Guide for Chemists, Oxford University Press, Oxford.
12. J.K.M. Sanders, E.C. Constable and B.K. Huntherm Morden, 1989, NMR Spectroscopy - A World Book of chemical problems, Oxford.

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	S	M	S
CO3	M	S	M	S	M
CO4	S	M	S	M	S
CO5	M	M	M	M	M

KEY: S – Strong, M – Medium, L – Low

FOURTH SEMESTER

BIOORGANIC CHEMISTRY

SEMESTER IV	Subject Title	Subject Code	Total Hours	Credit
	BIOORGANIC CHEMISTRY	**MERBF**	**60**	**3**

COURSE OBJECTIVES: -

This course aims to explain the basic concepts in chemistry and metabolism of carbohydrates, amino acids, proteins and lipids. In addition the student can gain the understanding of various types of nucleic acids and classification of vitamins and enzyme.

COURSE OUTCOME:

1. To understand the chemistry and metabolism of carbohydrates.

2. To learn the classification of amino acids and proteins end group analysis, transamination, deamination and urea cycle.

3. To understand the basic concept, properties and classification of Lipids - Functions and biological importance of cholesterol and lipids.

4. To know about purine, pyrimidine bases, nucleosides, nucleotides and polynucleotides were developed.

5. To understand the occurrence, structure, deficiency diseases and biochemical rule of water soluble and fat-soluble vitamins**.**

UNIT I: CHEMISTRY AND METABOLISM OF CARBOHYDRATES: -

Definition, classification and biological role of carbohydrates.

Monosaccharides linear and ring structures (Haworth formula) of ribose, glucose, fructose and mannose (structural determination not required) physical and chemical properties of glucose and fructose.

Disaccharides: Ring structures (Haworth formula) - occurrence, physical and chemical properties of maltose, lactose and sucrose.

Polysaccharides: Starch, glycogen and cellulose - structure and properties.

Glycolysis of carbohydrates.

UNIT II: CHEMISTRY AND METABOLISM OF AMINO ACIDS AND PROTEINS: -

Amino acids: Various classifications, essential amino acids, physical properties (amphoteric nature and isoelectric point) and reactions.

Proteins: Classifications (based on shape, composition and solubility), physical properties.

Primary structure - End group analysis (N- terminal analysis- Edman's method, dansyl chloride method; C - terminal analysis- hydrazinolysis and bio - chemical methods) Biological functions of proteins, Deamination, transamination reactions, Urea cycle.

UNIT III: CHEMISTRY AND METABOLISM OF LIPIDS: -

Definition, classification- simple lipids (fatty acids), compound lipids and derived lipids. Properties: saponification number and acetyl number.

Cholesterol (structure elucidation not needed), biological importance and chemical properties. Bile acids- functions. Biological functions of lipids.

UNIT IV: NUCLEIC ACIDS: -

Purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides, various types of DNA and RNA structures. Biological functions of DNA and RNA. Genetic code.

UNIT V: VITAMINS: -

Vitamins: Definition, classification- water-soluble vitamins (B_v B_2, B_3, B_6, B_{12} and vitamin-C) and fat-soluble vitamins (A, D, E and K) - occurrence, structure, deficiency diseases, biochemical rules and daily requirements.

SUGGESTED REFERENCE BOOKS: -

1. Biochemistry C.B. Powar and G.R. Chatwal.
2. Elements of Biochemistry Ragunatha Rao
3. Essential Biochemistry U. Sathyanarayanan
4. Essential Biochemistry J.L. JAIN

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	S	S
CO3	M	M	M	M	M
CO4	S	S	S	S	S
CO5	M	M	M	M	M

KEY: S – Strong, M – Medium, L – Low

ELECTIVE PAPER III - ORGANIC CHEMISTRY PRACTICAL II

SEMESTER IV	Subject Title	Subject Code	Total Hours	Credit
	Elective Paper III - Organic Chemistry Practical II	**MER31**	**90**	**3**

COURSE OUTCOME:

1.Double stage preparations were conducted in the practical sessions.

2.Organic estimations were done by the students with efficient knowledge.
they have given enough training to produce results of accuracy.

3. Solved problems in interpretation of organic compounds using spectral data**.**

I. INTERPRETATION OF ORGANIC COMPOUNDS. (UV, IR, PMR AND MASS SPECTRA)

1. 1, 3, 5-trimethylbenzene
2. pinacolone
3. prophyl amine
4. p-methoxybenzyl alcohol
5. benzyl bromide
6. phenyl acetone
7. 2-methoxyethyl acetate
8. acetone
9. isopropyl alcohol
10. acetaldehyde diacetate
11. 2-N, N-dimethylamino ethanol
12. pyridine
13. 4-picoline
14. 1, 3 dibromo-1, 1-dichloropropene
15. cinnamaldehyde.

II. PREPARATION OF THE FOLLOWING (ANY SIX):-

1. Sym-Tribromobenzene from aniline.
2. p-nitro aniline from acetanilide
3. m-Nitrobenzoic acid from methyl benzoate.
4. 2, 4-Dinitrobenzoic acid from p-nitro toluene.
5. m-Nitro benzoic acid from benzaldehyde
6. p-bromoaniline from acetanilide
7. Anthraquionone from phthalic anhydride.
8. Phthalide from phthalic anhydride
9. 2-phenyl indole from phenylhydrazine
10. 2-4, Dinitrophenyl hydrazine from p-nitrochlorobenzene.

III. QUANTITATIVE ESTIMATION OF ORGANIC COMPOUNDS

1. Estimation of aniline
2. Estimation of phenol
3. Estimation of glucose (Bertrands Methods)
4. Saponification of fat or an oil.
5. Iodine value of an oil.
6. Estimation of Ketone.
7. Estimation of amino group.
8. Estimation of amide group
9. Estimation of sulphur in an organic compound.

RECOMMENDED BOOKS:-

1. Arthur I. Vogel, A Text Book of Practical Organic Chemistry.
2. Raj K. Bansal, Laboratory Manual of Organic Chemistry, Wiley Eastern Limited.
3. Mann and Saunders, Laboratory manual of Organic Chemistry

ELECTIVE PAPER IV - INORGANIC CHEMISTRY PRACTICAL II

SEMESTER IV	Subject Title	Subject Code	Total Hours	Credit
	Elective Paper IV - Inorganic Chemistry Practical II	**MER32**	**90**	**3**

COURSE OUTCOME: -

1.Preparation of complexes were done by the students during practical sessions

2. Students were trained in volumetric and gravimetric estimation of metal ions with minimal error.

UNIT I: PREPARATION OF THE FOLLOWING: -

1. Sodium bis(thiosulphato)cuprate (I)
2. Sodium hexanitrocobaltate (III)
3. Chloropentammine cobalt (III) chloride
4. Bis (acetylacetanato) copper (II)
5. Hexaminenickel (II) chloride
6. Bis (thiocynato) pyridine manganese, (II)

UNIT II: QUANTITATIVE ANALYSIS: MIXTURE OF METAL IONS (GRAVIMETRICALLY AND VOLUMETRICALLY)

2.1 magnesium and Iron in the mixture of Iron and magnesium

2.2 Nickel and copper in the mixture of copper and nickel

2.3 Zinc and copper in the mixture of copper and zinc.

2.4 Nickel and Iron in the mixture of iron and Nickel.

UNIT III: ANALYSIS OF ORES AND ALLOYS:-

3.1 Determination of percentage of calcium and magnesium in dolomite.

3.2 Determination of percentage of MnO_2 in pyrolusite.

3.3 Determination of copper and zinc in brass.

TEXT BOOKS:-

1. Vogel, Text book of Inorganic quantitative analysis.
2. Dougles A. Skoog, Principles of Instrumental Analysis, 3rd Edition.

CORE PAPER - XII – ORGANIC CHEMISTRY – IV

SEMESTER IV	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER - XII – ORGANIC CHEMISTRY – IV	**MER4B**	**90**	**4**

COURSE OBJECTIVES: -

This paper introduces the basic methodologies for the synthesis of organic compounds. A brief introduction to biosynthesis of alkaloids and terpenoids is also included.

COURSE OUTCOME: -

1. To understand the synthesis of purine and pyrimidine bases, structure and biological functions of nucleic acids - Biosynthesis of cholesterol, phenanthrene alkaloids and bile acids.
2. To know the synthesis and structural elucidation morphine - Merrifield synthesis - Determination of structure proteins.
3. To understand the synthesis of cyclic and acyclic molecules, formation of C-C, C=C bonds, Reversal carbonyl polarity- Umpolung addition.
4. To understand the retrosynthetic analysis, protection and deprotection of functional groups.
5. To understand the Synthesis & applications novel reagents in organic synthesis.

UNIT I: BIO-ORGANIC CHEMISTRY

Synthesis of Pyrimidines and purines.

Structure and role of nucleic acids. DNA and RNA Genetic code.

Biosynthesis of cholesterol, phenanthrene alkaloids and bile acids.

UNIT II: ALKALOIDS AND PROTEINS

Structural elucidation and total synthesis of morphine.

Peptides and their synthesis (Synthesis of tripeptide using amino acids - Glycine, Alanine, Lysine, Cysteine, Glutamic acid, Arginine). Merrified synthesis, Determination of primary, secondary and tertiary structure of proteins.

UNIT III: MODERN SYNTHETIC METHODOLOGY

Application of synthetic methodology for the synthesis of simple cyclic and acyclic target molecules -synthesis of cubane, 5 - hexenoicacid, bicyclo (4, 1, 0) heptane-2-one., trans 9-methyl-1- decalone, longifolene and onocerin. Concept of Synthones, synthetic equivalents and intermediates. Formation of C-C and C=C bonds. Reversal carbonyl polarity – Umpolung addition.

UNIT IV: RETROSYNTHETIC ANALYSIS, PROTECTION AND DEPROTECTION

Retro synthetic analysis and synthesis of simple organic molecules such as 1,2, 1,3, 1,4 and 1,5 dicarbonyl compounds both acylic and cyclic. Formation of 3, 4, 5 and 6 membered cyclic compounds - Baldwin's rules. Use of standard reactions, like Grignard reactions, Robinson annulations. Protection and deprotection of functional groups (R-OH, RCHO, R-CO-R, R-NH_2 and R-COOH). Use of PTC (Phase-transfer catalyst) and Crown ethers in organic synthesis.

UNIT V: NOVEL REAGENTS IN ORGANIC SYNTHESIS: -

Synthesis and applications of Organolithium, Organomagnesium, Organozinc and Organo Copper and Gilman reagents. Modern synthetic methods: metal mediated C-C coupling reactions: Mechanism and synthetic applications of Heck, Stille, Suznki, Negishi, Sonogashira, McMurray, Metathesis and Carbonylation reactions. Green reactions and reagents.

TEXT BOOKS: -

1. R.K. Mackie and D.M. Smith. 1998, Guide book to organic synthesis, ELBS Publication.
2. I. L. Finar, 1986, Organic Chemistry, 5th Edition, Vol .II, ELBS Publication.
3. L. Smith, Robert L. Hill .1. Robert Lehman, Robert J .IetRowitz, Philp
4. Handler and abrahim white principles of Biochemistry General aspects, 7thEdition, McGraw Hill Int.
5. L. Stryer, Biochemistry, W.H.Freeman and Co., New York.
6. Agarwal, Chemistry of Organic Natural Products, Goel Publishing House.
7. B.l. Smith, 1980, Organic synthesis, Chapman and Hall, NY.

8. Francis.A. Carey, Richard J. Sundbreg, 2001, Advanced Organic Chemistry, 4th Edition, Plenum Press, New York.
9. N.J. Turro, 1978 Modern Molecular Photochemistry, Benjamin, Cummings, California.

WEBSITES:-

1. http://infodome.sdsu,./research/guides!science!orgchemistryblr. html
2. http://www.liv.ac.uklchemistry/links/reactions.html
3. http://orgchem.chem..uconn.edu/namereacVnamed.html
4. www.gcocities.com/chempensoftwar4ee/reactions.html)

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	M	S	M	M
CO3	M	S	M	S	S
CO4	S	S	S	S	M
CO5	M	M	M	M	S

KEY: S – Strong, M – Medium, L – Low

INORGANIC CHEMISTRY – IV

SEMESTER IV	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER XIII – INORGANIC CHEMISTRY – IV	MER4B	90	4

COURSE OBJECTIVES: -

This paper exposes the student to the importance of metal ions in biology and the chemistry of organometallic compounds and their industrial applications.

COURSE OUTCOME:

1. To understand about metal storage, transport and essential metal ion pumps, metalloenzymes and vitamins.

2. To understand the transport proteins – structure and properties of Hemoglobin and Myoglobin – biological redox reactions – role ofchlorophyll.

3. To know about the organometallicchemistry-carbon donors, metallocenes, different types of biological reactions.

4. To learn the industrial applications of organometallic chemistry and related name reactions.

5.To understand the principle of inorganic photochemistry – Photoredox, Photosubstitution, Photosentization reactions.

UNIT I: BIO-INORGANIC CHEMISTRY - I

Metal storage, transport and biomineralisation: ferritin, transferrin. Metal ion pumps - sodium and potassium.

Essential and trace metal ions.

Metalloenzymes – Zinc Enzymes, carboxypeptidase and carbonic anhydrase, Vitamin B_{12}, catalase, peroxidase, superoxide dismutase and blue copper proteins.

UNIT II: BIO-INORGANIC CHEMISTRY – II

Transport Proteins – Oxygen carriers – Haemoglobin, myoglobin – Structure, oxygenation and stereochemistry – Bohr effect, Non-heme oxygen carriers – Hemerthrin and hemocyanin.

Biological redox systems – ruberdoxin and ferrodoxin.

Role of Chlorophylls in photosynthesis

Anti cancer agents, role of metal ion in diagonis and treatment – use of radioisotopes.

UNIT III: ORGANOMETALLIC CHEMISTRY:-

3.1 Carbon donors: Alkyls and aryls, metalation, bonding in carbonyls and nitrosyls, chain and cyclic donors, olefin, acetylene, and allyl systems. Metallocenes: synthesis, structure and bonding.

3.2 Reactions: Association, substitution, addition, elimination, ligand protonation, electrophilic and nucleophilic attack on ligands, carbonylation, decarboxylation and oxidative addition.

UNIT IV: INDUSTRIAL APPLICATIONS OF ORGANO METALLIC COMPOUNDS: -

Catalysis – Hydrogenation of olefins (Wilkinson's catalyst), hydroformylation of olefins using cobalt or rhodium catalyst(Oxo process), oxidation of olefins to aldehydes and ketones(Wacker process):polymerisation(Ziegler-Natta catalyst); Cyclooligomerisation of acetylene using nickel catalyst(Reppe's catalyst), polymer bound catalysts. Ziegler-Natta catalysis (metallocene and Nom-Metallocene type catalyst).

UNIT V: INORGANIC PHOTOCHEMISTRY: -

Principles of Inorganic Photochemistry – Photoredox reactions and photosubstitution reactions in coordination complexes with particular reference to Co(III), Cr(III) and Pt(II) complexes. Photosensitisation reactions of [Ru(bpy)3]2+ complex and its applications in solar energy conversions and DSSC's (Dye Sensitized Solar Cells)

TEXT BOOKS: -

1. N,J,Turro, 1978, molecular photochemistry.
2. K.K.Rohatgi Mukherjee
3. Purcell, K.F. and Kotz, J.C., - Inorganic Chemistry
4. D.F.Shrivers, Atkins.Inorganic Chemistry

5. J.E. Huheey, 1993, Inorganic Chemistry - Principles, Structure and Reactivity; IV Edition, Harper Collins, NY.
6. S. Manku, 1984, Inorganic Chemistry, TMG Co.,
7. Selected Topics in Inorganic Chemistry, U.Malik, G.D.Tuli, R.D.Madan, 1992.
8. Basolo and R.G. Pearson, 1967, Mechanism of Inorganic Reactions, Wiley, NewYork.
9. R.Sarkar, general and Inorganic chemistry, (Parts I and II), New Book Agency, Calcutta

References:-

10. S.F.A. Kettle, 1973, Coordination Chemistry, ELBS
11. G.Coates, M.L.green and K.Wade, Priciples of Organometallic Chemistry, 1988.
12. R.B.Jordan, Reaction Mechanism of Inorganic and Organo Metallic systems – OUP 1991.
13. P.Powell, Principles of Organometakkic chemistry, Chapman and hall 1998.
14. R.C.Mehothra, A.Singh, Organo Metallic Chemistry, Wiley Eastern Comp.2000.
15. V.Balzani&Carrasitti – Photochemistry of coordination compounds.

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	S	S
CO3	M	M	M	M	M
CO4	S	M	S	M	S
CO5	M	S	M	S	M

KEY: S – Strong, M – Medium, L – Low

PHYSICAL CHEMISTRY – IV

SEMESTER IV	Subject Title	Subject Code	Total Hours	Credit
	Core Paper XIV – Physical Chemistry – IV	**MER4C**	**90**	**4**

COURSE OBJECTIVES: -

To learn the principles of photo physics and photochemistry and their applications in organic and inorganic chemistry, energy conversion, Principles and applications of statistical thermodynamics and electrode kinetics are also included in this paper.

COURSE OUTCOME:

1. To learn the principle and theory of photochemical reactions –radiative and non-radiative processes, phosphorescence, fluorescence – stern volmer equation.
2. To know about the techniques of photochemical reactions flash photolysis, radiolysis of biomolecules, photosensitization and chemiluminescence.
3. To understand the electrode-electrolyte interface and various models for electrical double layer, electrocapillary phenomena etc.,
4. To know the concepts and statistics of distribution of distinguishable and non-distinguishable particles, translational, rotational and vibrational partition functions for various types of ideal gases.
5. To learn the basis of heat capacities, non-equilibrium processes, irreversible processes and microscopic irreversibility.

UNIT I: FUNDAMENTALS OF PHOTOCHEMISTRY: -

Absorption and emission of radiation-Franck-Condon Principle- Decay of electronically excited states, Jablonski diagram: radiative and non-radiative processes-fluorescence and phosphorescence-spin forbidden radiative transition internal conversion and intersystem crossing- Einstein coefficient, energy transfer process-excimers and exciplexes-static and dynamic quenching-Stern Volmer analysis.

UNIT II: TECHNIQUES AND PHOTOCHEMICAL REACTIONS: -

Quantum yield and life time measurements, Flash photolysis, Principle and its application, Actinometry. Photo physical process and kinetics of photochemical reactions.

Radiolysis of molecules of biological interest (Carbohydrates, Amino acids, Peptides and Nucleic acid). Photoredox reactions and photosubstitution reactions in coordination chemistry Photoreduction and photocycloreduction in organic chemistry - photovoltaic and photogalvanic cells. photoelectrochemistry, Aspects of solar energy conversion. Photosensitization and chemiluminescence.

UNIT III: ELECTRODE KINETICS: -

Electrode-electrolyte interface - electrical double layer-electrocapillary phenomena - Lippmann equation-structures of double layers – Stern, Helmholtz –Perrin and Guoy- Chapmann models.

Mechanism of electrode reaction - polarization and overpotential, the Butler - Volmer equation for one step and multistep electron transfer reactions- significance of exchange current density and symmetry factor-transfer coefficient and its significance-mechanism of hydrogen and oxygen evolution reactions.

Corrosion and passivation of metals: Pourbaix and Evans diagrams - fuel cells-electrodeposition – principle, applications and anticorrosion techniques.

UNIT IV: THERMODYNAMICS - II: -

Concept of thermodynamic probability - distribution of distinguishable and non-distinguishable particles. Maxwell-Boltzmann, Fermi-Dirac and Bose Einstein statistics - modes of contribution to energy- Partition function - translational, vibrational and rotational partition functions for mono, diatomic and polyatomic ideal gases.

Thermodynamic functions in terms of partition functions, Sackur-Tetrode equation equilibrium constant for isotope exchange and dissociation of diatomic molecules;

UNIT V: THERMODYNAMICS - III: -

Heat capacity of solids (Einstein and Debye Models) ortho and para hydrogen - Planck's radiation law - electrons in metals.

Non equilibrium processes, entropy production in irreversible processes, microscopic reversibility, linear force and flux relations, Onsager’s law, phenomenological equations, Curie’s theorem.

TEXT BOOKS: -

1. J.O.M. Bokris and A.K.N. Reddy, 1977, Electrochemistry, VoIs1 and 2 Plenum, New York.
2. P. Delahay - 1965, Electrode Kinetics and Structure of Double layer, Interscience,

New York.
3. S. Glasstone, 1960, Introduction to Electrochemistry, Affiliated East West Press, New Delhi.
4. D.R. Crow, 1991, Principles and Applications of Electrochemistry, Chapman and Hall.
5. N.J. Turro, 1978, Modern Molecular Photochemistry, Benjamin, Cummings, Menlo Park, California.
6. K.K. Rohatgi Mukherjee, 1978, Fundamentals of Photochemistry, Wiley Eastern Ltd.
7. A. Gilbert & J. Bagesot, Essentials of Molecular Photochemistry Blackwell Scientific (1990)
8. M.C. Gupta, 1990, statistical; thermodynamics, wiley eastern New Delhi
9. B.J. McClelland, 1973, Statistical Thermodynamics, Chapman and Hall, London.

SUGGESTED REFERENCE BOOKS: -

1. J.G. Calvert and J.N. Pitts, 1966, Photochemistry, Wiley, London.
2. R.P. Wayne, 1970, Photochemistry, Butterworths, London.
3. R.P. Cundell and A. Gilbert, 1970, Photochemistry, Thomas Nelson London.
4. 4. R.HASSE, 'Thermodynamics of Irreversivble processes', Addison Wesley, Reading. Mass, 1989.

MAPPING – COURSE OBJECTIVES WITH PROGRAMME OUTCOME

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	M
CO2	S	S	S	S	S
CO3	M	S	M	M	S
CO4	S	M	S	S	M
CO5	M	M	M	M	M

KEY: S – Strong, M – Medium, L – Low

CORE PAPER XV - PHYSICAL CHEMISTRY PRACTICALS II

SEMESTER IV	Subject Title	Subject Code	Total Hours	Credit
	CORE PAPER XV - PHYSICAL CHEMISTRY PARCTICALS II	MER41	120	4

COURSE OUTCOME:

Practical sessions conducted for physical chemistry experiments. The principle behind each experiment was taught well which enabled the learner to complete all experiments with maximum accuracy.

I. CONDUCTOMETRIC EXPERIMENTS: -

1. Determination of equivalent conductance of strong electrolytes and verification of Debye Huckel Onsager equation.
2. Determination of dissociation constant of weak electrolytes by Ostwald dilution law.
3. Conductometric titrations
    a. single and mixture of strong and weak acids against strong base.
    b. single and mixture of halides against silver nitrate.

II. POTENTIOMETRIC EXPERIMENTS: -

1. Determination of pH and pKa
2. Determination of solubility product of a sparingly soluble salt.
3. Potentiometric titrations
    a. single and mixture of strong and weak acids and strong base
    b. Redox titrations by emf measurements.
    c. Precipitation titration of mixture of halides.

DISSERTATION & VIVA VOCE EXAM

SEMESTER IV	Subject Title	Subject Code	Total Hours	Credit
	ELECTIVE PAPER – V – DISSERTATION & VIVA VOCE EXAM	**MER4Q**	**120**	**4**

COURSE OUTCOME:

1. Students select appropriate research methods and techniques suitable for their research field with the guidance of the research guides.

2. In-depth understanding of academic theory and the preparation of high-quality research pertinent to the field of study.

3. Innovative ideas in the field of science enabled the students to synthesise new compounds and their applications for the benefit of the society.

4.Viva enabled students for dialectic communication with the examiner and gains invaluable experience for career interviews.

ASSESSMENT PROCEDURE

- The assessment procedure for all Major and Elective is 25% of Internals (conducted by college) and 75% of External (University Examination).
- The assessment procedure for Practical is 40% of Internals (conducted by college) and 60% of External (University Examination).

CIA ASSESSMENT SPLIT UP (INTERNALS):

ASSESSMENT PROCEDURE		RUBRICS (PARAMETER)	MARKS
THEORY PAPERS	ASSIGNMENT	Creativity, relevance to the topic	5
	SEMINAR	Communication Skills, Way of Presentation	5
	INTERNAL TEST	Students Performance in the written test	10
	ATTENDANCE	Above 95% - 5; 84% to 94% - 4; 75% to 84 % - 3; 65% to 74% -2; less than 65%-1	5
		TOTAL	**25**
ASSESSMENT PROCEDURE		**RUBRICS (PARAMETER)**	**MARKS**
PRACTICALS	RECORD	Record Submission and correction	5
	TEST	Students Performance in the written test	30
	ATTENDANCE	Above 95% - 5; 84% to 94% - 4; 75% to 84 % - 3; 65% to 74% -2; less than 65%-1	5
		TOTAL	**40**
ASSESSMENT PROCEDURE		**RUBRICS (PARAMETER)**	**MARKS**
PROJECT	VIVA VOCE	Students Performance in Viva Voce	20
	PROJECT REPORT	Innovations in projects	60
	INTERNAL TEST	Students Performance in the written test	20
		TOTAL	**100**

EXTERNAL

ASSESSMENT PROCEDURE		MARKS
SECTION A	10 (out of 12) x 1	10
SECTION B	5 (out of 7) x 5	25
SECTION C	4 (out of 5) x 10	40
	TOTAL	75

HOD **PRINCIPAL**

****

SHANTHI RAVICHANDRAN

Digitally signed by SHANTHI RAVICHANDRAN
Date: 2022.11.17 17:08:21 +05'30'