PSGR Krishnammal College for Women

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DEPARTMENT OF CHEMISTRY

CHOICE BASED CREDIT SYSTEM &
OUTCOME BASED EDUCATION SYLLABUS

MASTER OF CHEMISTRY

2023 - 2025

PROGRAMME OUTCOMES

After completion of the programme, the students will have the

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 information and experimentally observed phenomena.

PO3: ability to apply chemical concepts in new situations i.e., ability to predict physical andchemical 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.

PSGR Krishnammal College for Women

DEPARTMENT OF CHEMISTRY

2023-2025

Sem	Subject Code	Title of the paper	Instruction hours/ week	Total Hours		Duration of Examination	Max. Marks			Credits
				Contact Hours	Tutorial Hours		CA	ESE	Total	
I	MCE2301	Paper – I Inorganic Chemistry and solid state chemistry	4	58	2	3	25	75	100	4
	MCE2302	Paper – II Organic Chemistry – I (Organic Reaction Mechanism & Stereochemistry)	5	73	2	3	25	75	100	5
	MCE2303	Paper – III Physical Chemistry – I (Classical & Statistical Thermodynamics)	5	73	2	3	25	75	100	5
	MCE2304	Paper – IV Analytical Techniques in Chemistry *	4	58	2	3	25	75	100	4
	MCE23P1	Practical – I Organic Chemistry Practical - I	4	60	-	-	-	-	-	-
	MCE23P2	Practical – II Inorganic Chemistry Practical –I	4	60	-	-	-	-	-	-
	MCE23P3	Practical – III Physical Chemistry Practical – I	4	60	-	-	-	-	-	-

Sem	Subject Code	Title of the paper		Instruction hours/ week	Total Hours		Duration of Examination	Max. Marks			Credits
					Contact Hours	Tutorial Hours		CA	ESE	Total	
II	MCE2305	Paper V Organic Chemistry-II (Reagents, Rearrangements, PericyclicReactions &Photochemistry)	CC	4	58	2	3	25	75	100	4
	MCE2306	Paper VI PhysicalChemistry-II (GroupTheory&QuantumChemistry)	CC	4	58	2	3	25	75	100	4
II / III	MCE2307	Paper VII-Spectroscopy	CC	3	43	2	3	25	75	100	3
	MCE23CE	Coursera Course (Advanced Physical Chemistry)		3	45	-	-	100	-	100	3
		(or)									
	MCE2308	Paper – VIII Coordination &Organometallic Chemistry	CC	4	58	2	3	25	75	100	4
	MCE21S1	Research Methodology		2	30	-	3	-	100	100	2
	MCE23P1	Practical I Organic Chemistry Practical –I	CC	4	60	-	6	25	75	100	4
	MCE23P2	Practical II Inorganic ChemistryPractical – I	CC	4	60	-	6	25	75	100	4
	MCE23P3	PracticalIII Physical ChemistryPractical – I	CC	4	60	-	6	25	75	100	4
	MCP19A1	IDC-Clinical Microbiology Biochemistry	GE	4	60	-	3	-	100	100	4

SEMESTER-I

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2301	INORGANIC CHEMISTRY PAPER – I (Inorganic Chemistry and Solid State Chemistry)	THEORY	58	2	-	4

Preamble

To make the students to

- gain knowledge about structure and bonding in inorganic chains and rings.
- understand the concepts of isopoly, heteropoly acids , anions and inorganic polymers.
- learn about inorganic crystals and structural determination methods.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand the concepts of inorganic polymers and ionic crystals	K1
CO2	extend the applications of inorganic compounds as rings, clusters, polyacids and solid state crystals	K2
CO2	assess the importance of inorganic compounds as polymeric structures/identify the type and shape of ionic crystals	K3
CO3	distinguish and classify inorganic solids/rings/clusters and their defects	K4
CO4	determine the structures of inorganic polymers/crystals and interpret their structural differences	K5

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	M	M	H	H
CO2	H	H	H	M	M	H	H
CO3	H	H	H	M	M	H	H
CO4	H	H	H	M	H	H	H
CO5	H	H	H	H	H	H	H

H - High; M-Medium; L-Low

INORGANIC CHEMISTRY PAPER – I(MCE2301)

(Inorganic chemistry and solid state chemistry) **(58 Hrs)**

Unit – I **(12 Hrs)**

Chains and Rings

Chain – Catenation. Heterocatenation - Silicate minerals, orthosilicates, pyrosilicates, zeolites-intercalation compounds-preparation and properties.

Rings – Borazines, phosphozenes – Preparation, properties and structure.

Unit – II **(12 Hrs)**

Isopoly and Heteropoly Acids and Anions

Introduction, polymerization of CrO_4^{2-} anion, polymerization of molybdates, tungstates, vanadates, niobates and tantalates.Isopoly anions and isopoly acids of Mo^{6+} and W^{6+}, isopolyvanadates, isopolyniobates and isopolytantalates.Heteropoly anions and heteropoly acids – different types, important reactions of iso and heteropoly anions.

Unit – III **(11 Hrs)**

Inorganic Polymers

Introduction, general properties, glass transition temperature, classification.Nitrides of sulphur - S_4N_4, $S_4N_3^+$, $(SN)_x$– One dimensional conductors-preparation and structure. Silicon based polymers – Preparation, properties and types of silicones.

Unit – IV **(11 Hrs)**

Solid State Chemistry – I

Structure – Types and classification of solids, distinction between crystalline and amorphous solids. Unit cell, Bravais lattice, classification of crystals based on bond type and packing in crystals.Imperfections in crystals – Types of defects, stoichiometric defects – Schottky and Frenkel.Non-stoichiometric defects – Metal excess and metal deficient, consequences of metal deficiency defects.

Unit – V **(12Hrs)**

Solid State Chemistry – II

Inorganic crystals – Coordination number, radius ratio rule and shapes of ionic crystals. Structures of ionic crystals – AX type: CsCl, ZnS (Zinc blende, Wurtzite), AX_2 type: CaF_2, TiO_2, CdI_2. Experimental methods of crystal structure determination: X - ray diffraction, electron diffraction and neutron diffraction. Comparative study of the three diffraction methods.

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	SatyaPrakash, G.D. Tuli, S.K. Basu, R.D. Madan	Advanced Inorganic Chemistry – Vol. I	S.Chand& Co. Ltd.	Reprint 2012
2	Gurdeep Raj	Advanced Inorganic Chemistry – Volume I	Krishna Prakasam Media (P) Ltd.	1999, 25th Edition
3	B.R. Puri, L.R. Sharma, K.C. Khalia	Principles of Inorganic Chemistry	Milestone Publisher	Copyright 2007-2008
4	James E. Huheey, Ellen A. Keiter	Inorganic Chemistry	Pearson	Copyright 2006, 4th Edition

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	F. Albert Cotton and Geoffrey Wilkinson	Advanced Inorganic Chemistry	Wiley Interscience	1999, 6th Edition
2	Anthony R. West	Solid State Chemistry and its Application	Wiley India	2011 Reprint
3	J.D. Lee	Concise Inorganic Chemistry	Wiley India	2010 Reprint

Pedagogy:

Lecture by chalk and talk, power point presentation, e-content, Simulation, group discussion, assignment, quiz, seminar.

Course Designers:

Dr. P. Kanchana

Dr. S. Jone Kirubavathy

Question Paper Pattern
End Semester Examination

SECTION	WORD LIMIT	MARKS	TOTAL
A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	75
B -5 x 5 Marks (Internal Choice at same CLO Level)	300	25	
C – 5x 8 Marks (Internal Choice at same CLO Level)	600-800	40	

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2302	PAPER II – ORGANIC CHEMISTRY – I (Organic Reaction Mechanism & Stereochemistry)	THEORY	73	2	-	5

Preamble

To enable the students to

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

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	identify and analyze the aromaticity, different types of mechanism	K1
CO2	develop skills for identifying the kinetics and stereochemistry of the reactants and products	K2
CO3	predict the stereochemistry and apply the mechanism for synthesizing organic compounds	K3
CO4	analyze and compare the various reaction mechanism	K4
CO5	employ the concepts to design new organic reactions with specific stereochemistry	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	M	M	H	H
CO2	H	H	H	M	L	H	H
CO3	H	H	H	M	L	H	H
CO4	H	H	H	M	L	H	H
CO5	H	H	H	M	M	H	H

H - High; M-Medium; L-Low

PAPER-II- ORGANIC CHEMISTRY – I(MCE2302)

(Organic Reaction Mechanism and Stereochemistry) (73 Hrs)

Unit I (14Hrs)

Aromaticity

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

Reaction Mechanism

Types of reactions and mechanisms, Non kineticmethods- Product analysis, intermediate criteria (isolation, trapping and detection)- Isotopic labeling and cross over experiments- Stereochemical evidence. Kinetic methods- Mechanistic implications of rate law- Isotope effects. Kinetic and thermodynamic control of reactions - Hammonds postulates, linear free energy relationship- Hammett and Taft equations.

Unit II (15 Hrs)

Aliphatic NucleophilicSubstitution

The S_N1, S_N2 $S_Ni$mechanisms. The neighbouring group mechanism, neighbouring group participation by π and σ bonds, anchimeric assistance.

Nucleophilic substitution at an allylic, aliphatic,trigonal and vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis, ambident nucleophiles and ambident substrates. Swain-Scott, Grunwald- Winstein relationship.

Aromatic Nucleophilic Substitution

The S_NAr, S_N1, Benzyne and SR_N1 Mechanisms. Reactivity – Effect of substrate structure, leaving group and attacking nucleophile.

O and S – nucleophiles, Bucherer and Rosenmundreactions, Von Richter rearrangement.

Unit III (15 Hrs)

Aliphatic Electrophilic Substitution

Bimolecular mechanisms – S_E2 (front), S_E2 (back) and S_Ei. Unimolecular mechanism- S_E1 mechanism, substitution by double bond shifts, other mechanisms – addition-elimination and cyclic mechanism.

Hydrogen electrophiles: hydro-dehydrogenation, keto-enoltautomerism.

Halogen electrophiles: Halogenation of aldehydes, ketones and carboxylic acids. Nitrogen electrophiles: aliphatic diazonium coupling. Sulphur electrophiles: sulphonation Carbon electrophiles: acylation, alkylation, Stork-enamine reaction.

Aromatic Electrophilic Substitution

Mechanism, orientation and reactivity, the ortho/para ratio. Reactions involving nitrogen electrophiles: nitration, nitrosation and diazonium coupling, ipso substitution. Sulphur electrophiles: Sulphonation, Jacobsen rearrangement. Carbon electrophiles: Alkylation, acylation, arylation reactions - Scholl reaction, Gattermann reaction, Gattermann-Koch reaction, Reimer- Tiemann reaction, Kolbe-Schmidt reaction, Houben- Hoesch reaction, Vilsmeier- Haack reaction, Hoffmann-Martius reactions.

Unit IV **(14 Hrs)**

Elimination Reactions

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

Unit V **(15 Hrs)**

Stereochemistry

Optical isomerism - Concept of chirality- Stereochemistry of sulphur and nitrogen compounds - Concept of prochirality - Enantiotopic and diastereotopic ligands and faces- Stereospecific and stereoselective reactions. R, S - nomenclature of compounds having one and more than one chiral centres- Axial chirality- (Optical isomerism of biphenyl, allenes and spirens)- Planar chirality (Optical isomerism of ansa compounds and 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 and ketoximes.

Conformational Analysis

Configuration and conformation- Conformation of acyclic compounds- cyclohexane, decalins, perhydrophenanthrenes and carbohydrates.Effect of conformation on reactivity, Curtin Hammett Principle.

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 2009,6th Edition
2	I.L. Finar	Organic Chemistry Vol II	Pearson Education	reprint 2011,5th Edition
3	Jagdamba Singh and Yadav	Advanced Organic Chemistry	PragatiPrakasham	2010, 6th Edition
4	Jerry March	Advanced Organic Chemistry	Wiley Publications	reprint 2010,4th Edition.

5	Stanely H. Pine	Organic Chemistry	Tata MC Graw Hill	2007, 5th Edition
6	Jie Jack Li	Name Reactions	Springer	2004, 2nd 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, 3rd Edition
2	F. A.CareyandSundberg	Advanced Organic Chemistry-Part A	Springer	2010
3	F. A.CareyandSundberg	Advanced Organic Chemistry-Part B	Springer	2007
4	D .Nasipuri	Stereochemistry of Organic Compounds	New Age Publishers	2008, 2nd Edition

Pedagogy:

Lecture by chalk and talk, power point presentation, e-content, group discussion, assignment, quiz, seminar.

Course Designers:

1. Dr. G. Selvi
2. Dr.N.Shyamala Devi
3. Dr. P. Amutha

Question Paper Pattern
End Semester Examination

SECTION	WORD LIMIT	MARKS	TOTAL
A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	75
B -5 x 5 Marks (Internal Choice at same CLO Level)	300	25	
C – 5x 8 Marks (Internal Choice at same CLO Level)	600-800	40	

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2303	Paper-III-PHYSICAL CHEMISTRY PAPER – I (Classical & Statistical Thermodynamics)	THEORY	73	2	-	5

Preamble

To enable the students to

- understand and apply the concept of fugacity, activity and chemical potential.
- acquire knowledge on third law of thermodynamics and probability and ensembles.
- gain knowledge about the distribution laws (classical and statistical) and their applications

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand the concept of fugacity, Third law of Thermodynamics, Maxwell – Boltzmann distribution law	K1
CO2	interpret the physical significance of chemical potential, Ensembles	K2
CO3	calculate the molecular velocities based on Maxwell Boltzmann distribution law, fugacity and activity	K3
CO4	apply thermodynamic concepts to evaluate the relationship between thermodynamic properties, Fermi-Dirac distribution law	K4
CO5	evaluate statistical thermodynamics to the properties of identical indistinguishable particles like electrons, Debye theory, Partition Functions of mono & diatomic ideal gas molecules.	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	M	H	H	H
CO2	H	H	H	M	H	H	H
CO3	H	H	H	M	H	H	H
CO4	H	H	M	M	M	H	H
CO5	H	H	H	M	H	H	H

H - High; M-Medium; L-Low

PAPER III- PHYSICAL CHEMISTRY PAPER – I (MCE2303)

(Classical and Statistical Thermodynamics) (73Hrs)

Unit I (14Hrs)

Classical Thermodynamics

Concept of chemical potential – Fugacity- definition- determination of fugacity of gases by graphical method, from equation of state, approximation method and generalized method- variation of fugacity with temperature. Fugacity and the standard state for non-ideal gases- Fugacity coefficient, fugacity of mixture of non- ideal gases.

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

Unit II (14Hrs)

Third Law of Thermodynamics

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

Probability and Ensembles

Theorems of permutations, combinations and probability. Thermodynamic probability to molecular systems- States of maximum thermodynamic probability of systems involving energy levels.

Distinguishable and indistinguishable particles.Microstates and macrostates. Ensembles – definition- microcannonical, cannonical and grand cannonical ensembles.

Unit III (15 Hrs)

Maxwell Boltzmann Statistics

Stirling's approximation formula, Maxwell Boltzmann distribution law – assumptions, derivation for the system having non- degenerate and 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 and beta in Boltzmann statistics.Evaluation of average velocity, root mean square velocity and most probable velocity from distribution law of molecular velocities, molecular velocities and energies of an ideal gas.

Unit IV **(15Hrs)**

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 and thermodynamic properties E, H, S, A, G, C_V and 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 and 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 and Debye theory, Debye T-cube law, comparison of Maxwell Boltzmann, Bose Einstein, Fermi - Dirac statistics

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Samuel Glassstone	Thermodynamics for Chemists	East West Press	Reprint 2002
2	M.C. Gupta	Statistical Thermodynamics	Wiley Eastern Publications	1990, 1st Edition
3	Ashley	Classical and Statistical Thermodynamics	Pearson Education	2012

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, 1st Edition (Reprint 2005)
2	Gurdeep Raj	Advanced Physical Chemistry	GOEL Publishing House	2002, 27th Edition
3	Peter Atkins & Julio de Paula	Elements of Physical Chemistry	Oxford University	2nd Print 2014,5th Edition
4	F.W. Sears and G.L. Salinger	Thermodynamics, Kinetic & Statistical thermodynamics	Narosa Publishing House	Reprint 2013
5	Frederick.T. Wall	Chemical Thermodynamics	W.H. Freeman & Company	1974, 3rd Edition.

Pedagogy:
Lecture by chalk and talk, power point presentation, e-content, numerical exercises, group discussion, assignment, quiz, seminar.

Course Designers:

1. Dr. D.Nalini
2. Dr.N.Arunadevi
3. Dr. Sowmya Ramkumar

Question PaperPattern
End Semester Examination

SECTION	WORD LIMIT	MARKS	TOTAL
A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	75
B -5 x 5 Marks (Internal Choice at same CLO Level)	300	25	
C – 5x 8 Marks (Internal Choice at same CLO Level)	600-800	40	

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2304	PAPER IV– ANALYTICAL TECHNIQUES IN CHEMISTRY	THEORY	58	2	-	4

Preamble

To enable the students to

- understand and analyze various types of chromatographic techniques.
- acquire knowledge about the configuration and confirmation of organic molecules by ORD and CD
- gain knowledge about the different thermal and electro analytical techniques.
- understand the principle of atomic absorption and Emission spectroscopy

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understanding the principles of various analytical techniques to identify the components	K1
CO2	explain the principle behind chromatographic techniques, ORD, CD, TGA, coulometry, polarography, CV and Atomic Absorption Spectrophotometer	K2
CO3	relate the concepts of chromatographic, analytical & spectral techniques in characterization/purification of different compounds	K3
CO4	analyze the process of column in chromatography, different thermal analytical methods and explain the instrumentation of electro analytical, atomic spectroscopy	K4
CO5	appraise the significance of various analytical and their applications	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	H	H	H	H
CO2	H	H	H	M	H	H	H
CO3	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H

H - High; M-Medium; L-Low

PAPER IV– ANALYTICAL TECHNIQUES IN CHEMISTRY (MCE2304) (58Hrs)

Unit I (12Hrs)

Chromatography

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

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

Super Critical Fluid Chromatography (SFC) - Characteristics of super critical fluids, Comparison of SFC with HPLC & GLC, Applications of SFC

Unit II (11 Hrs)

Analytical Techniques

ORD & CD – Principle, instrumentation - Visual Polarimetry (for ORD) types of ORD curves, axial haloketone rule & octant rule – Applications to determine the configuration & conformation of simple monocyclic & bicyclic ketones.

Unit III (12Hrs)

Thermoanalytical Methods

Principle - Thermogravimetric analysis & differential thermal analysis- discussion of various components with block diagram- TGA & DTA curves of $CuSO_4.5H_2O$, $MgC_2O_4.H_2O$ & $Ca(OOCCH_3)_2.H_2O$ – Simultaneous DTA-TGA curves of $SrCO_3$ in air & $CaC_2O_4.H_2O$ in air & CO_2. Factors affecting TGA & DTA curves.UPS & ESCA- Basic principles, sources, instrumentation, applications.DSC-Principle, Instrumentation and application.

Unit – IV (12 Hrs)

Electro Analytical Techniques

Coulometry: Introduction, Types of colometric methods, Types of coulometers – O_2-H_2, Ag & I_2 coulometer, coulometric titrations- Internal and external generation of titrants, applications.

Polarography: Introduction, apparatus, working, polarographic measurements, interpretation of polarographic waves, equation for polarographic wave, half wave potential, DME - Applications.

Cyclic Voltammetry: Principle, Normal Pulse Voltammetry (NPV), Differential Pulse Voltammetry (DPV)

Unit – V (11 Hrs)

Atomic Spectroscopy

Sources of atomic and emission absorption spectra. Atomic spectroscopy based on flame atomization – flame atomizers, properties of flames, quantitative analysis. Flame Atomic Absorption Spectroscopy – Introduction, sources, instrumentation. Flame emission spectroscopy – Introduction, instrumentation.

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 McGraw Hill	2004, 30th Edition
2.	Dr. H. Kaur	Instrumental Methods of Chemical Analysis	PragatiPrakashan	2008, 4th Edition
3.	Mahinder Singh	Analytical Chemistry- Instrumental Techniques	Dominant Publishers & Distributors NewDelhi	2003, 1st Edition
4.	B. K Sharma	Instrumental Methods of Chemical Analysis	Goel Publications	1996, 15th Edition
5.	H. H Willard, L. L Merritt. and J. A Dean, F.A. Settle	Instrumental Methods of Analysis	CBS Publishers & Distributors	1986, 7th 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, 1st Edition
2.	S. M. Khopkar	Basic Concepts of Analytical Chemistry	Wiley Eastern Ltd	1884, First Edition
3.	D. A Skoog, F.J.Holler and D. M West	Analytical Chemistry- An Introduction	Saunders College Publications	1994, 6th Edition
4.	M.S.Yadav	Instrumental Methods of Chemical Analysis	Campus Book	2006, 1St Edition

Pedagogy: Lecture by chalk and talk, power point presentation, e-content, Simulation, numerical exercises, group discussion, assignment, quiz, seminar.

Course Designers:

1. Dr. E. Kayalvizhy
2. Dr. G. Sathya Priyadarshini

Question Paper Pattern
End Semester Examination

SECTION	WORD LIMIT	MARKS	TOTAL
A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	75
B -5 x 5 Marks (Internal Choice at same CLO Level)	300	25	
C – 5x 8 Marks (Internal Choice at same CLO Level)	600-800	40	

Course Number	Course Name	Category	L	T	P	Credit
MCE23P1	PRACTICAL I - ORGANIC CHEMISTRY PRACTICAL – I	PRACTICAL	-	-	120	4

Preamble

To enable the students to

- separate two components in an organic mixture
- identify the separated components by qualitative tests
- determine the boiling point / melting point of components
- prepare organic compounds

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	determine boiling point /melting point	K1
CO2	identify the nature of the organic compounds	K2
CO3	develop skills in the synthesis of organic compounds	K3
CO4	separate organic mixtures by solvent extraction	K4

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	H	H	H	H
CO2	H	H	H	L	H	H	H
CO3	H	H	H	L	H	H	H
CO4	H	H	H	H	H	H	H

H - High; M-Medium; L-Low

PRACTICAL I - ORGANIC CHEMISTRY PRACTICAL – I (MCE23P1) (120 Hrs)

1.Qualitative Analysis:

Analysis of two component mixtures – Separation, identification of components and determination of melting point/ boiling point of the components.

2. One stage preparations and purification by recrystallization technique

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

3. Characterization of any two of the above compounds by IR spectra

Note: A minimum of five organic mixtures should be done by each student.

Text Book: LAB MANUAL - Prepared by Faculty, Department of Chemistry, PSGR Krishnammal College for Women

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, 2nd Edition.
2	F.G. Mann & B.C. Saunders	Practical Organic Chemistry	Pearson Education	2009, 4th Edition

Pedagogy: Demonstration and hands on practicals

Course Designers:

1. Dr.D.Nalini
2. Dr.E.Kayalvizhy
3. Dr.G.Sathya Priyadarshini

Course Number	Course Name	Category	L	T	P	Credit
MCE23P2	PRACTICAL II – INORGANIC CHEMISTRY PRACTICAL-I	PRACTICAL	-	-	120	4

Preamble

To enable the students to

- separate the common and rare cations in a mixture
- characterize two common and two less familiar cations
- estimate quantitatively magnesium, nickel and zinc by complexometry
- prepare inorganic complexes

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	identify the common and rare cations	K1
CO2	estimate the metal ions in complexes	K2
CO3	interpret IR spectra of metal complexes	K3
CO4	analyse and report cations in a mixture	K4
CO5	develop skill in synthesizing inorganic complexes	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H

H - High; M-Medium; L-Low

PRACTICAL II - INORGANIC CHEMISTRY PRACTICAL – I (MCE23P2) (120 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 Magnesium, Nickel & Zinc.

3. Preparation of Inorganic Complexes

i. Tris(thiourea)copper (I)chloride
ii. Potassium tris(oxalato)ferrate(III)
iii. Hexammine cobalt(III)chloride
iv. Ammonium hexachlorostannate(IV)
v. Tetramminecopper(II)sulphate

4. Characterization of any two of the above complexes by IR spectra

Text Books:LAB MANUAL - Prepared by Faculty, Department of Chemistry, PSGRKrishnammal College for Women

Reference 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 Long man's Ltd	1968, 1st Edition
2	G.Palmer	Experimental Inorganic Chemistry	Cambridge University Press	1964, 3rd Edition.

Pedagogy: Demonstration and hands on practicals

Course Contents and Lecture Schedule

Course Designers:

1. Dr.P. Kanchana
2. Dr.G.Selvi

Course Number	Course Name	Category	L	T	P	Credit
MCE23P3	**PRACTICAL III - PHYSICAL CHEMISTRY PRACTICAL - I**	**PRACTICAL**	-	-	120	4

Preamble

To make the students to

- understand the principle and to carry out the potentiometric titrations.
- determine the pH and pKa values of buffers and acids
- determine the molecular weight of solutes.
- construct the Phase diagram of two components systems.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	set up an electrode to prepare for a potentiometric titration	K1
CO2	infer the molecular weight of chemical compounds from K_f values by Rast micro method	K2
CO3	interpret the strength of the solutions and Ka values by potentiometry	K3
CO4	construct and analyze Phase diagrams	K4

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	H	M	M	M
CO2	H	H	H	H	H	H	H
CO3	H	H	H	M	M	M	M
CO4	H	H	H	M	H	H	H

H - High; M-Medium; L-Low

PRACTICAL III - PHYSICAL CHEMISTRY PRACTICAL – I (MCE23P3)(120Hrs)

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. 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
7. Potentiometric Titrations:
   i. Titration of HCl vsNaOH
   ii. Titration of mixture of acids against a strong base
   iii. Titration of CH_3COOH vsNaOH
   iv. Redox titrations:
      (a) Titration of Ferrous ammonium sulphate against Potassium dichromate
      (b) Titration of Potassium iodide against Potassium permanganate
   v. Determination of solubility product of a sparingly soluble salt (Concentration Cell & Chemical Cell)
   vi. Precipitation titrations:
      (a) Estimation of KI by titration with $AgNO_3$ using KCl as standard
   (b) Titration of mixture of halides against $AgNO_3$ solution

Text Books:

LAB MANUAL-Prepared by Faculty, Department of Chemistry, PSGR Krishnammal College for Women

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, 9th Edition
2	G.Palmer	Experimental Physical Chemistry	Cambridge University Press	1964, 1st Edition
3	B. Viswanathan& P.S. Raghavan	Practical Physical Chemistry	Viva Books	2009,3rd Edition

Pedagogy: Demonstration and hands on practicals

Course Designers

1. Dr.D.Nalini
2. Dr.E.Kayalvizhi
3. Dr .G.Sathyapriyadarshini

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2305	PAPER V -ORGANIC CHEMISTRY –II	THEORY	58	2	-	4

Preamble

To enable the students to

- understand the applications of reagents in organic synthesis
- gain knowledge about the mechanism of molecular rearrangements
- learn the stereochemistry of pericyclic reactions by correlation diagram, FMO and PMO methods
- understand the principles of photochemistry and Retro Synthesis and their applications

Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CO Statement	Knowledge Level
CLO1	understand the use of an organic reagents in organic synthesis, types of rearrangements and pericyclic reactions, requirements for reterosynthesis, nature of interaction of an organic compound with light	K1
CLO2	recognize and analyze the mechanisms of various molecular rearrangements and photoreactions, classify pericyclic reactions and molecular systems, recognize a specific reagent for an organic conversion	K2
CLO3	interpret the product formation in any pericyclic reactions based on the stereochemical methods, interpret a mechanism for a photochemical reaction, identify the various products obtained in a rearrangement reaction	K3
CLO4	apply retro synthesis to design synthetic routes for synthesis of organic compounds, Woodward–Hoffmann rules to explain pericyclic reaction, justify the formation of rearranged product, construct a correlation diagram to predict the feasibility of a pericyclic reaction	K4
CLO5	appreciate the role of organic reagents, rearrangement reactions, various pericyclic reactions, protecting groups and photochemistry and their significant applications in research	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	M	H	H	H
CO2	H	H	H	M	H	H	H
CO3	H	H	H	M	H	H	H
CO4	H	H	H	M	H	H	H
CO5	H	H	H	M	H	H	H

H - High; M-Medium; L-Low

PAPER – V -ORGANIC CHEMISTRY –II (MCE2305)

(Reagents, Rearrangements, Pericyclic Reactions, Retro Synthesis & Photochemistry) (58 Hrs)

Unit I (11Hrs)

Reagents in Organic Synthesis

Use of the following reagents in organic synthesis and functional group transformations - complex metal hydrides, lithium dimethyl cuprate (LDC), lithium diisopropyl amide (LDA), dicyclohexylcarbodimide (DCC), 1,3-dithiane, tri-n-butyl tin hydride,Osmium tetroxide, DDQ, SeO_2

Unit II (12 Hrs)

Molecular Rearrangements

Migration to carbonyl carbon: Neber rearrangement, Rearrangement of electron deficient nitrogen and oxygen: Dienone – Phenol, Favorskii, Fries, Wolf, Benzidine, Steven's, Demzanov, Sommlet-Hauser, Chapmann and Wallach rearrangements.

Unit III (12 Hrs)

Pericyclic Reactions

Molecular orbital symmetry.Classification of pericyclic reactions.Electrocyclic reactions – 4n and 4n+2 systems, Woodward –Hoffmann rules, Correlation diagram, FMO and PMO approach [1, 3-dienes and 1, 3, 5-trienes]

Cycloadditions

Antarafacial and suprafacial additions, 4n and 4n+2 systems, 1, 3- dipolar addition, Diel's Alder reaction.

Sigmatropic Rearrangements

Suprafacial and antarafacial shifts of hydrogen, Cope, Claisen and di-π methane rearrangement.

Unit IV (12 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 and 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 and ketals, protection of carboxylic acid groups- principle – protecting group for carboxylic acid – methyl ester

Unit V (11 Hrs)

Organic Photochemistry

Introductory theory of light absorption, photophysical processes- Jablonski diagram. Photochemical reactions of Ketones –Norrish type I and II, PaternoBuchi reaction, Photoreduction of Ketones, Photochemistry of α, β-unsaturated ketones, Photochemical reactions of olefins – Cis-trans isomerism, Dimerization reactions, photochemistry of butadiene, photooxidation.

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	2013, 4th Edition
2	Jagadamba Singh & L.D.S. Yadav	Advanced Organic Chemistry	PragatiPrakasam	2007, 6th Edition
3	Jerry March	Advanced Organic Chemistry -Reactions, Mechanism & Structure	John Wiley Publications Ltd	2008, 4th Edition.
4	S. M. Mukherji and S.P. Singh	Reaction mechanism in organic chemistry	The macmillan company of India Ltd	1984, 1st Edition.

Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Mary Fieser and Louis Fieser	Reagents in Organic Synthesis	Wiley Interscience	2011, Vol.26
2	J.N.Gurtu and R.Kapar	Organic Reactions and Reagents	S.Chand&Co Pvt., Ltd.,	1988 1st Edition
3	Solomons&Fryhles	Organic Chemistry	John Wiley & Sons	2010, 8th Edition
4	T.L. Gilchrist & R.C. Storr	Organic Reactions & Orbital Symmetry	Cambridge University Press	1975, 1st Edition.
5	Stuart Warren	Organic Synthesis- The Disconnection Approach	John Wiley & Sons	2004, 1st Edition
6	Charles H Depuy, Orville L. Chapman	Molecular reactions and photochemistry	Printice Hall	1976, 1st Edition.
7	Nicholas J. Turro	Modern Molecular photochemistry	The Benjamin/cummings publishing co., Inc	1978, 1st Edition.

Pedagogy:

Lecture by chalk and talk, power point presentation, e-content, numerical exercises, group discussion, assignment, quiz, seminar.

Course Designers:

1. Dr. G.Selvi
2. Dr. P.Amutha

Question Paper Pattern
End Semester Examination

SECTION	WORD LIMIT	MARKS	TOTAL
A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	75
B -5 x 5 Marks (Internal Choice at same CLO Level)	300	25	
C – 5x 8 Marks (Internal Choice at same CLO Level)	600-800	40	

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2306	PAPER VI - PHYSICAL CHEMISTRYII (Group Theory and Quantum Chemistry)	THEORY	58	2	-	4

Preamble

To enable the students to

- study the atomic structure and quantum mechanics with the help of group theory
- acquire knowledge about multiplication table for point groups
- learn the application of group theory in vibrational spectroscopy and determination of hybridization types in nonlinear molecules
- understand the significance of operators and their use in quantum mechanics
- know about the wave nature of particles, derivation of Schrodinger wave equations and their applications.

Course Outcome

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CLO1	identify the point groups, reducible and irreducible representations, failure of classical mechanics and the need for quantum mechanics	K1
CLO2	Explain the Symmetry, groups, point groups, reducible and irreducible representations, failure of classical mechanics and the need for quantum mechanics, normalization of wave functions and separation of variables	K2
CLO3	construct the Group multiplication tables and character table for point groups; associate the postulates of quantum mechanics with Schrodinger Wave Equation and 1D box , harmonic oscillator, Shapes of s and p orbitals	K3
CLO4	Analyze the IR and Raman active vibration modes for molecules, solving SWE for 3D and SHO , wave equation, Approximation, Perturbation and Variation methods	K4
CLO5	relate the types of hybridization in nonlinear molecules based on group theory, Separate the variables for the H-atom problem and predict the radial/probability functions and curves, application of methods of He atom, wave function of many electron atoms.	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	M	M	M	M
CO2	H	H	H	M	M	M	M
CO3	H	H	H	M	H	M	M
CO4	H	H	H	M	M	M	H
CO5	H	H	H	M	H	M	H

H - High; M-Medium; L-Low

PAPER VI- PHYSICAL CHEMISTRY II (MCE2306)

(Group Theory &Quantum Chemistry**)** **(58Hrs)**

Unit I **(12Hrs)**

Symmetry Elements and Symmetry Operations

Definition of identical and equivalent elements – Configurations – Symmetry operations and symmetry elements – Rotation – Axis of symmetry – Reflections – Symmetry planes – Inversion, centre – improper rotations – Rotation- Reflection axis – Effect of performing successive operations (Commutative and non – commutative) – Inverse operations.

Groups and their basic properties

Definition of a group – Basic properties of a group – Definition of Abelian group – Isomorphic group – Similarity transformation and classes – Group multiplication tables-

Symmetry classification of molecules into point groups (Schoenflies symbol only)- Difference between point group and space group.

Matrices

Definition of matrix & its types– Matrix multiplication (Commutative and non-Commutative) determination of inverse of a matrix, block multiplication of matrices – Addition and subtraction of matrices – Matrix notations for symmetry operations of C_{2v} and C_{3v} point groups (use of vectors) construction of character tables for C_{2v} and C_{3v} point groups.

Unit II **(12Hrs)**

Reducible and Irreducible representations

Definition of reducible and irreducible representations – Irreducible representation as orthogonal vectors – Direct product rule – The Great Orthogonality Theorem and its consequences (statement only, proof not needed)- Determination of the characters for irreducible representation of C_{2v} and C_{3v} point groups – using the orthogonality theorem – 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. Type of hybridization of atomic orbitals in acetylene, CH_4 and $[PtCl_4]^{2-}$.

Group theory and Vibrational spectroscopy

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

Unit III **(12Hrs)**

Birth and Postulates of Quantum Mechanics

Failure of classical mechanics- The need for quantum mechanics.

Functions - Real, complex, odd, even, orthogonal and normalized functions.

Operator - linear and non-linear, differential, Hermitian, Hamiltonian, momentum (linear and angular) commutator (Theorems) and non- commutators, Eigen functions and eigen values.

Postulates of quantum mechanics-Statements and Discussion

Schrodinger Wave Equations - (Time dependent and time independent); Requirements of the acceptable wave function (solution not needed).

Unit IV **(11Hrs)**

Quantum Mechanical models/ Applications

Particle in 1D box-quantization of energy, normalization of wave function, orthogonality/ orthonormal set of particle.Particle in 3D box- separation of variables, degeneracy Harmonic Oscillator- wave equation and its solution for diatomic molecule. Rigid Rotor- wave equation and its solution for diatomic molecule (solution not needed).

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Unit V **(11Hrs)**

Application of Quantum Mechanics to Hydrogen and Poly electron atom

H- atom (H – like species) - wave equation, 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 and p orbitals only.Approximation methods- Need for approximation. Perturbation and Variation methods (1^{st} order only) - Applications of the methods to Helium atom. Born-Oppenheimer Approximation method; Hydrogen molecular ion- Treatment of the ground state by LCAO-MO method.Helium atom- Electron spin, Pauli Exclusion Principle, Slater determinants – Approximate wave function of many electron atoms.

Text Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	A.K Chandra	Quantum Chemistry	Tata McGraw Hill Publications	2010
2	R.K. Prasad	Quantum Chemistry	New Age International Publishers	2001, 4^{th} Edition
3	K.V.Raman	Group Theory and its Applications to Chemistry	Tata McGraw-Hill Publications	2002

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	2013
2	Donald. A. Mc. Quarrie	Quantum Chemistry	Viva Books Publications	reprint 2011
3	Ira. N. Levine	Quantum Chemistry	Pearson Publications	2007, 6^{th} Edition

Pedagogy:

Lecture by chalk and talk, power point presentation, e-content, numerical exercises, group discussion, assignment, quiz, seminar.

Course Designers:

1. Dr.N.Muthulakshmi Andal
2. Dr.P.Amutha

Question Paper Pattern

End Semester Examination

SECTION	WORD LIMIT	MARKS	TOTAL
A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	75
B -5 x 5 Marks (Internal Choice at same CLO Level)	300	25	
C – 5x 8 Marks (Internal Choice at same CLO Level)	600-800	40	

COURSE NUMBER	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2307	PAPER- VII – SPECTROSCOPY	THEORY	43	2	-	3

Preamble

To enable the students to

- understand the principles and instrumentation of various spectroscopic techniques
- study the effects of solvents and molecular parameters on UV and IR absorptions
- learn the applications of NMR and ESR spectra
- determine the structure of compounds from various spectral data

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	identify the characteristic values for various spectral methods and recognize the principles of spectroscopic techniques as a qualitative and quantitative method	K1
CO2	distinguish the different isomers, nature of bonding, type of electronic transition based on the spectral data	K2
CO3	relate the g factor, nuclear spin, and hyperfine coupling constant with structure of the complexes and apply the spectral data in determining the structure of unknown sample	K3
CO4	infer the fragmentation pattern, functional group present, nature of proton and carbon present in the molecule	K4
CO5	predict the structure of compound based on spectral data and evaluate the structure of complex molecules using 2D NMR techniques	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H	H	H	H	H	H	H
CO2	H	H	H	M	H	H	H
CO3	H	H	H	M	H	H	H
CO4	H	H	M	M	H	H	H
CO5	H	H	M	M	H	H	H

H - High; M-Medium; L-Low

Paper- VII – SPECTROSCOPY (MCE2307) (43Hrs)

Unit I **(8Hrs)**

UV and Visible Spectroscopy

Electronic excitation, Origin of different bands - Intensity of bands - Selection rules, Laws of photometry, Simple chromophoric groups, Factors affecting transitions - Solvent effect, effect of steric hindrance, effect of conjugation. Woodward's rule for calculating absorption maximum in conjugated dienes, polyenes, α, β - unsaturated carbonyl compounds, benzenoid systems.

Unit II **(8Hrs)**

Infrared Spectroscopy

Principle, the modes of stretching and bending vibrations, bond properties and absorption trends, Factors affecting the vibrational frequencies, Applications of IR spectroscopy, Intra and intermolecular hydrogen bonding, Finger Print region, Far IR region, Metal- ligand stretching vibrations, Application of IR spectroscopy in differentiation of linkage isomers – cyano and isocyano, nitro and nitrito, thiocyanato and isothiocyanato complexes.

Unit III **(9Hrs)**

Proton NMR Spectroscopy

Nuclear spin states, nuclear magnetic moments, absorption of energy, ^{1}H chemical shift, factors affecting chemical shifts, spin-spin coupling,coupling constant - deuterium exchange , first order and non-first order spectra- a review. Chemical and magnetic equivalence, shift reagents.NMR spectrum of ethanol, acetaldehyde, 1,1,2-trichoroethane, cinnamic acid, ethyl acetate, furfuraldehyde and α-chloro propionic acid

Unit IV **(9Hrs)**

Carbon -13 NMR Spectroscopy

^{13}C nucleus, chemical shifts, double resonance techniques - homonuclear and heteronuclear decoupling, broad band decoupling, off resonance decoupling.

2D NMR Spectroscopy

Introduction of 2D techniques: COSY and Hetero – COSY.

ESR Spectroscopy

Theory , derivative curves, ‘g’ shift, hyperfine splitting , zero field splitting and Kramer’s degeneracy , factors affecting the magnitude of the ‘g’ values. EPR spectra of inorganic compounds.

Unit V **(9Hrs)**

Mass Spectrometry

Introduction, principle, ion production (EI, CI, FD and FAB), presentation of spectral data, molecular ions, meta stable ions, molecular ion peak. Nitrogen rule, isotopic abundance analysis. Fragmentation process, symbolism (scission only), even and odd electron ions, scission with rearrangement. Retro Diels Alder rearrangement, Mc Lafferty rearrangement, double bond and/ or ring equivalents implied from a formula. Fragmentation associated with functional groups – aliphatic compounds, aldehydes,

ketones, carboxylic acids, esters, amides, alcohols, amines, aromatic compounds.

Text Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Jag Mohan	Organic Spectroscopy	Narosa Publishing House	2013
2	P.S.Kalsi	Spectroscopy of Organic Compounds	New Age International (P) Ltd	2014, 6th Edition
3	Y. R Sharma	Elementary Organic Spectroscopy	S. Chand Publications	2012, 4th Edition
4	William Kemp	Organic Spectroscopy	Palgrave Publications	2002
5	H. Kaur	Spectroscopy	PragatiPrakashan Publications	2015, 10th 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, 1st Edition.
2	D. L. Pavia, G.M. Lampman, G.S.Kriz and James R.Vyvyan	Spectroscopy	Brooks/Cole Publications	2011, 5th Edition.
3	R.M. Silverstein, F.X. Webster	Spectrometric Identification of Organic Compounds	John Wiley Publications	2009, 6th Edition
4	M. S. Yadav	Molecular Spectroscopy	Arise Publishers & Distributors	2011, 1st Edition.

Pedagogy:

Lecture by chalk and talk, power point presentation, e-content, numerical exercises, group discussion, assignment, quiz, seminar.

Course Designers:

1. Dr. D. Nalini
2. Dr. P. Amutha

Question Paper Pattern
End Semester Examination

SECTION	WORD LIMIT	MARKS	TOTAL
A - 5 x 2 Marks (No Choice)	One or Two Sentences	10	75
B -5 x 5 Marks (Internal Choice at same CLO Level)	300	25	
C – 5x 8 Marks (Internal Choice at same CLO Level)	600-800	40	

Course Number	Course Name	Category	L	T	P	Credit
MCP19A1	IDC –CLINICAL MICROBIOLOGY & BIOCHEMISTRY	THEORY	60	-	-	4

Preamble

To enable the students to

- understand the principles of clinical chemistry
- gain the importance of hypertension and hypotension
- understand the principles and the concepts underlying clinical laboratory tests in clinical chemistry
- differentiate the blotting technique and vaccination types
- acquire knowledge on basic mechanisms involved in the causation and treatment of common disease and their influence on clinical presentation and therapy

Course Outcomes

On the successful completion of the course, students will be able to

CLO Number	CO Statement	Knowledge Level
CLO1	differentiate the clinical specimens	K_3
CLO2	classify the composition of blood, Perform analysis of chemical analytes in blood and other body fluids	K_2 ,K_3
CLO3	calculate the test results and convert them to form meaningful in patient assessment	K_3
CLO4	Compare and contrast the different types of blotting techniques and vaccination.	K_6
CLO5	correlate laboratory results with infectious diseases processes	K_4

Mapping with Programme Outcomes

CLOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO1	H	M	H	M	H	H	M
CLO2	H	H	H	H	L	L	M
CLO3	H	H	M	H	M	M	M
CLO4	H	M	M	M	H	H	M
CLO5	H	M	M	H	H	H	H

H - High; M-Medium; L-Low

INTER DISCIPLINARY COURSE (For M.Sc., Chemistry/ Botany Students)

CLINICAL MICROBIOLOGY & BIOCHEMISTRY (MCP19A1) (60 Hrs)

Unit I (12 Hrs)

Clinical Microbiology

Clinical specimens –Collection- needle aspiration, Incubation, 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 (12Hrs)

Principles of Clinical Biochemical Analysis

Basis of analysis of body fluids for diagnosticprognostic 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 (12Hrs)

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 (12Hrs)

Electrophoresis, Blotting and Vaccination

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, Filarisis&Plague.Air Borne diseases: Diphtheria, Whooping cough, Influenza, Measles mumps, Tuberculosis, Water borne diseases: Cholera, Typhoid, &Dysentry. Common disease of the digestive system- jaundice, respiratory system- asthma, nervous system- epilepsy. Some other common diseases-piles, leprosy. 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.

Text Books:

S.No	Author	Title	Publishers	Year of publication
1	Asim. K. Das	Bioinorganic chemistry 1st edn.	Books & Allied Pvt Ltd.	2007
2	Jayashree Ghosh	Textbook of Pharmaceutical Chemistry3rd edn	S. Chand & Co	2003
3	Jayashree Ghosh	Fundamental concepts of Applied Chemistry1st edn	S. Chand & Co	2006
4	Rana, S.V.S	Bio Techniques. Theory and Practice.	Rastogi Publications, Meerut.	2005
5	AmbikaShanmugam	Fundamentals of Biochemistry for Medical Students	Nagaraj and Company Private Limited	2005
6	MallikarjunaRao, N	Medical Biochemistry 6th edn.	New Age International (P) Limited, Publishers	2006

Reference Books:

S.No	Author	Title	Publishers	Year of publication
1	Lensing M.Prescott, John P, Harley, Donald A Klein.	Microbiology,6th Edition,	Tata mc Graw Hill, New Delhi	2005
2	Keith Wilson, John Walker.	Principles and Techniques of Biochemistry and Molecular Biology, 6thEdn.	Cambridge University Press	2008
3	By Douglas B. Lowrie, Robert G. Whalen	DNA vaccines-methods and protocols	Humana press, Totowa, New Jersey	2000

Pedagogy:

Lecture by chalk and talk, power point presentation, e-content, simulation, numerical exercises, group discussion, assignment, quiz, seminar.

Course Designers:

1. Dr.N.ShyamalaDevi
2. Dr.N.Arunadevi
3. Dr. K. Gajalakshmi
4. Dr.K .S. Tamilselvi

Question Paper Pattern

End Semester Examination

Bloom's Category	Section	Marks	Total
Understand(K_2)	A – 5X5 marks (Either or)	25	100
Apply / Analyse Evaluate (K_3, K_4, K_5)	B – 5 X15marks (Either or)	75	