PSGR Krishnammal College for Women

DEPARTMENT OF CHEMISTRY

CHOICE BASED CREDIT SYSTEM &

OUTCOME BASED CURRICULAR FRAMEWORK

MASTER OF SCIENCE IN CHEMISTRY

2024-2026

DEPARTMENT OF CHEMISTRY
CHOICE BASED CREDIT SYSTEM (CBCS) &LEARNING OUTCOME BASED CURRICULAR FRAMEWORK (LOCF) SYLLABUS &
SCHEME OF EXAMINATION
MASTER OF SCIENCE IN CHEMISTRY – 2024-26 BATCH & ONWARDS
SEMESTER I

Sem	Course Code	Title of the paper	Course Type	Instruction hours/ week	Total Hours		Duration of Examination	Max. Marks			Credit
					Contact Hours	Tutorial Hours		CA	ESE	Total	
I	MCE2301	Paper – I Inorganic Chemistry I	CC	4	58	2	3	25	75	100	4
	MCE2302	Paper – II Organic Chemistry – I (Organic Reaction Mechanism & Stereochemistry)	CC	5	73	2	3	25	75	100	5
	MCE2303	Paper – III Physical Chemistry – I (Classical & Statistical Thermodynamics)	CC	5	73	2	3	25	75	100	5
	MCE2304	Paper – IV Analytical Techniques in Chemistry	CC	4	58	2	3	25	75	100	4
	MCE23P1	Practical – I Organic Chemistry Practical - I	CC	4	60	-	-	-	-	-	-
	MCE23P2	Practical – II Inorganic Chemistry Practical –I	CC	4	60	-	-	-	-	-	-
	MCE23P3	Practical – III Physical Chemistry Practical – I	CC	4	60	-	-	-	-	-	-
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

CC : Core Courses
ACC: Additional Credit Course

PSGR Krishnammal College for Women

DEPARTMENT OF CHEMISTRY
CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOME BASED CURRICULAR FRAMEWORK (LOCF)
SYLLABUS & SCHEME OF EXAMINATION
M.Sc., CHEMISTRY
2024-26 BATCH, SEMESTER II

SEM	Course Code	Title of the course	Course Type	Instruction hours/ week	Total Hours		Duration of Examination	Max. Marks			Credits
					Contact Hours	Tutorial Hours		CA	ESE	Total	
II	MCE2305	Organic Chemistry-II (Reagents, Rearrangements, Pericyclic Reactions & Photochemistry)	CC	4	58	2	3	25	75	100	4
	MCE2306	Physical Chemistry-II (Group Theory & Quantum Chemistry)	CC	4	58	2	3	25	75	100	4
II / III	MCE2307	Spectroscopy	CC	3	43	2	3	25	75	100	3
	MCE23CE	Advanced Physical Chemistry		3	45	-	-	100	-	100	3
		(or)									
	MCE2308	Coordination & Organometallic Chemistry		4	58	2	3	25	75	100	4
	MCE22S1	Research Methodology		2	30	-	3	-	100	100	2
II	MCE23P1	Organic Chemistry Practical –I	CC	4	60	-	6	25	75	100	4
	MCE23P2	Inorganic Chemistry Practical – I	CC	4	60	-	6	25	75	100	4
	MCE23P3	Physical Chemistry Practical – I	CC	4	60	-	6	25	75	100	4
	MCP19A1	IDC - Clinical Microbiology & Biochemistry	GC	4	60	-	3	-	100	100	4
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

CC – Core Courses
GC – General Courses
ACC - Additional Credit Courses

CA – Continuous Assessment
ESE - End Semester Examination

PSGR Krishnammal College for Women

MASTER OF SCIENCE IN CHEMISTRY
CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES-BASED CURRICULAM FRAMEWORK (LOCF)
SYLLABUS & SCHEME OF EXAMINATION
2024 - 2026 BATCH - SEMESTER III

Sem	Course Code	Title of the Course	Course Type	Instruction hours/ week	Contact Hours	Tutorial Hours	Duration of Examination	Examination Marks			Credits
								CA	ESE	Total	
III	MCE2308	Coordination & Organometallic Chemistry	CC	4	58	2	3	25	75	100	4
	MCE2309	Organic Chemistry III (Chemistry of Natural Products)	CC	5	73	2	3	25	75	100	5
	MCE2310/ MCE2311	Physical Chemistry III (Reaction Kinetics & Electrochemistry) / Medicinal Chemistry	DSE	4	58	2	3	25	75	100	4
	MCE23P4	Organic Chemistry Practical – II	CC	4	60	-	6	25	75	100	4
	MCE23P5	Inorganic Chemistry Practical – II	CC	4	60	-	6	25	75	100	4
	MCE23P6	Physical Chemistry Practical – II	CC	5	75	-	6	25	75	100	4
	MCE22S1	Research Methodology	GC	2	30	-	3	-	100	100	2
	MNM22CS2	Cyber Security II	AECC	2	30	-	-	100	-	100	Gr.
	MCE24COM	Comprehensive Examination	GC	-	-	-	-	100	-	100	Gr.
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

CC - Core Courses
CA- Continuous Assessment
DSE - Discipline Specific Elective
AECC - Ability Enhancement Compulsory Courses
GC - General Courses
ESE - End Semester Examination
ACC - Additional Credit Courses

Examination System

Pattern:

Semester system will be followed. A semester consists of a minimum of 90 working days excluding the days of conduct of ESE. There will be Continuous Internal Assessment (CA) to evaluate the performance of students in each course and the End Semester Examination will be held at the end of every semester.

Weightage assigned to various components of Continuous Internal Assessment

Theory

CIA Test : 5 marks **(conducted for 45 marks after 50 days)**
Model Exam : 7 marks **(conducted for 75 marks after 85 days)**
Seminar/Assignment/Quiz : 5 marks
Class Participation : 5 marks
Attendance : 3 marks
Total : 25 Marks

Practical

Lab Performance : 7 marks
Regularity : 5 marks
Model Exam : 10 marks
Attendance : 3 marks
Total : 25 marks

CA Question Paper Pattern and distribution of marks - (First 3 Units)

Core and Elective Courses

CA Question from each unit comprising of

One question with a weightage of 2 Marks :2 x 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 x 3 =15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) :8 x 3 =24
Total :45 Marks

Cyber Security II

Quiz : 60 marks
Case Study : 20 marks
Poster : 20 marks
Total : 100 marks

End Semester Examination – Question Paper Pattern and Distribution of Marks

Core and Elective Courses

ESE Question Paper Pattern: 5 x 15 = 75 Marks

Question from each unit comprising of

One question with a weightage of 2 Marks : 2 x 5=10

One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 x 5 =25

One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 x 5 =40

PG-IDC and Special Course

Section A: 5 questions (Internal choice)	:25 marks
Section B: 5 questions (Internal choice)	:75 marks
Total	**:100 marks**

Research Methodology

Section A - 5 questions (Internal choice) :25 marks

Section B - 5 questions (Internal choice) :75 marks

Total : 100 Marks

Criteria for Attendance:

3 Marks

(Attendance 75% - 80% - 1 Mark, 81% - 90% - 2 Marks, 91% - 100% - 3 Marks)

SEMESTER-I

COURSE CODE	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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	understand the concepts of inorganic polymers and ionic crystals	K1
CLO2	Extend the applications of inorganic compounds as rings, clusters, polyacids and solid state crystals	K2
CLO3	Assess the importance of inorganic compounds as polymeric structures/identify the type and shape of ionic crystals	K3
CLO4	Distinguish and classify inorganic solids/rings/clusters and their defects	K4
CLO5	Determine the structures of inorganic polymers/crystals and interpret their structural differences	K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	M	M	S	S
CLO2	S	S	S	M	M	S	S
CLO3	S	S	S	M	M	S	S
CLO4	S	S	S	M	S	S	S
CLO5	S	S	S	S	S	S	S

S-Strong; M-Medium

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 & Edition
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 Edn
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 Edn

Reference Books:

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication & Edition
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 CODE	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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	identify and analyze the aromaticity, different types of mechanism	K1
CLO2	develop skills for identifying the kinetics and stereochemistry of the reactants and products	K2
CLO3	predict the stereochemistry and apply the mechanism for synthesizing organic compounds	K3
CLO4	analyze and compare the various reaction mechanism	K4
CLO5	employ the concepts to design new organic reactions with specific stereochemistry	K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	M	M	S	S
CLO2	S	S	S	M	M	S	S
CLO3	S	S	S	M	M	S	S
CLO4	S	S	S	M	M	S	S
CLO5	S	S	S	M	M	S	S

S - Strong; M-Medium

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 & Edition
1	I.L. Finar	Organic Chemistry Vol I	Pearson Education	2009 & 6th Edition
2	I.L. Finar	Organic Chemistry Vol II	Pearson Education	2011 & 5thEdition
3	Jagdamba Singh and Yadav	Advanced Organic Chemistry	PragatiPrakasham	2010 & 6th Edition

4	Jerry March	Advanced Organic Chemistry	Wiley Publications	2010 & 4thEdition.
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 & Edition
1	R.K. Bansal	Organic Reaction Mechanism	Tata McGraw Hill Publications	2006 & 3rdEdn
2	F. A.Careyand Sundberg	Advanced Organic Chemistry-Part A	Springer	2010 & 2nd Edn
3	F. A.Careyand Sundberg	Advanced Organic Chemistry-Part B	Springer	2007 & 2nd Edn
4	D .Nasipuri	Stereochemistry of Organic Compounds	New Age Publishers	2008 & 2nd Edn

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 CODE	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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	understand the concept of fugacity, Thermodynamic law, Probability of Ensembles, classical and quantum statistics, partition function	K1
CLO2	identify the significance of classical thermodynamics law, partition functions, quantum statistics	K2
CLO3	solve the problem on Stirling's approximation, molecular velocities, Maxwell Boltzmann distribution & partition functions	K3
CLO4	determine the fugacity, activity by various method, thermodynamic probability of the system, molecular velocities, thermodynamics properties-relating partition functions, entropy of boson & Fermions	K4
CLO5	evaluate thermodynamics properties of degenerate levels, Partition Functions, Maxwell-distribution, Bose-Einstein & Fermi – Dirac statistics	K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	M	S	S	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	M	S	S	S
CLO4	S	S	M	M	M	S	S
CLO5	S	S	S	M	S	S	S

S - Strong; M-Medium

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 & Edition
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 & Edition
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 CODE	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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	understanding the principles of various analytical techniques to identify the components	K1
CLO2	explain the principle behind chromatographic techniques, ORD, CD, TGA, coulometry, polarography, CV and Atomic Absorption Spectrophotometer	K2
CLO3	relate the concepts of chromatographic, analytical & spectral techniques in characterization/purification of different compounds	K3
CLO4	analyze the process of column in chromatography, different thermal analytical methods and explain the instrumentation of electro analytical, atomic spectroscopy	K4
CLO5	appraise the significance of various analytical and their applications	K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	S	S	S	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	S	S	S	S
CLO4	S	S	S	S	S	S	S
CLO5	S	S	S	S	S	S	S

S - Strong; M-Medium

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 SrCLO3 in air & $CaC_2O_4.H_2O$ in air & CLO2. 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 & Edition
1.	E.L Eliel	Stereochemistry of Carbon Compounds	Tata McGrawHill	2004 & 30th Edition
2.	Dr. H. Kaur	Instrumental Methods of Chemical Analysis	Pragati Prakashan	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 & Edition
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 Code	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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	determine boiling point /melting point	K1
CLO2	identify the nature of the organic compounds	K2
CLO3	develop skills in the synthesis of organic compounds	K3
CLO4	separate organic mixtures by solvent extraction	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	S	S	S	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	M	S	S	S
CLO4	S	S	S	S	S	S	S

S - Strong; M-Medium

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 & Edition
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 Code	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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	identify the common and rare cations	K1
CLO2	estimate the metal ions in complexes	K2
CLO3	interpret IR spectra of metal complexes	K3
CLO4	analyse and report cations in a mixture	K4
CLO5	develop skill in synthesizing inorganic complexes	K5

Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	S	S	S	S
CLO2	S	S	S	S	S	S	S
CLO3	S	S	S	S	S	S	S
CLO4	S	S	S	S	S	S	S
CLO5	S	S	S	S	S	S	S

S - Strong; M-Medium

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 & Edition
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 Code	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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	set up an electrode to prepare for a potentiometric titration	K1
CLO2	infer the molecular weight of chemical compounds from K_f values by Rast micro method	K2
CLO3	interpret the strength of the solutions and Ka values by potentiometry	K3
CLO4	construct and analyze Phase diagrams	K4

Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO2	PLO3	PLO4	PLO 5	PLO6	PLO7
CLO1	S	S	S	S	M	M	M
CLO2	S	S	S	S	S	S	S
CLO3	S	S	S	M	M	M	M
CLO4	S	S	S	M	S	S	S

S- Strong; M-Medium

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 & Edition
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

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COURSE CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2305	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, retro synthesis and their applications.

Course Learning Outcomes

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

CLO Number	CLO 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	K2
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	K3
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 Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	M	S	S	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	M	S	S	S
CLO4	S	S	S	M	S	S	S
CLO5	S	S	S	M	S	S	S

S - Strong; M-Medium

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 and 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 rearrangement

Unit III **(12 Hrs)**

Pericyclic Reaction

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). Cycloaddition - Antarafacial and suprafacial additions, 4n and 4n+2 systems, 1, 3- dipolar addition, Diel's Alder reaction. Sigmatropic Rearrangement - 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 and 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, Rakesh Kumar Parashar	Organic Reaction Mechanism	Narosa Publishing House	2013, 5 Edn
2	Dr. Jagadamba Singh Dr. L.D.S. Yadav	Advanced Organic Chemistry	Pragati Prakashan	2016, 6 Edn
3	Jerry March	Advanced Organic Chemistry Reactions, Mechanism & Structure	John Wiley Publications Ltd.,	2016, 4 Edn
4	S. M. Mukherji T. P. Singh S. P. Singh T. Om Prakash	Reaction Mechanism in Organic Chemistry	Trinity	2007

Reference Books

S.No	Name of the Authors	Title of the Book	Publishers	Year of Publication
1	Louis Fieser Mary Fieser	Fieser and Fieser's Reagents in Organic Synthesis Volume 5	Wiley Interscience	2007, Reprint
2	Solomons & Fryhles	Organic Chemistry	John Wiley & Sons	2010, 8 Edn
3	Stuart Warren	Organic Synthesis- The Disconnection Approach	John Wiley & Sons	2004, 1Edn

Pedagogy:

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

Course Designers:

1. Dr. N. Arunadevi
2. Dr. Sowmya Ramkumar

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2306	PHYSICAL CHEMISTRY II (Group Theory and Quantum Chemistry)	THEORY	58	2	-	4

Preamble

To enable the students 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, learn about the wave nature of particles, derivation for Schrodinger wave equations and their applications in one electron and many electron atoms.

Course Learning Outcome

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

CLO Number	CLO Statement	Knowledge Level
CLO1	identify the point groups, reducible and irreducible representations, failure of classical mechanics and the need for quantum mechanics	K2
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 Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	M	M	M	M
CLO2	S	S	S	M	M	M	M
CLO3	S	S	S	M	S	M	M
CLO4	S	S	S	M	M	M	S
CLO5	S	S	S	M	S	M	S

S-Strong; M-Medium;

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. 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).

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	2017 4 Edn
2	R. K. Prasad	Quantum Chemistry	New Age International Publishers	2024 6 Edn
3	K.V. Raman	Group Theory and its Applications to Chemistry	Tata McGraw-Hill Publications	1990 3 Edn

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.,	2017 3 Edn
2	Donald. A. Mc. Quarrie	Quantum Chemistry	Viva Books Publications	2016
3	Ira. N. Levine	Quantum Chemistry	Pearson Publications	2016 7 Edn

Pedagogy:

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

Course Designers:

1. Dr. S. Charulatha
2. Dr.V. S. Angulakshmi

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCE2307	SPECTROSCOPY	THEORY	43	2	-	3

Preamble

To enable the students to understand the principles, instrumentation of various spectroscopic techniques, the effects of solvents and molecular parameters on UV and IR absorptions, the applications of spectral data to predict the structure of compounds.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	identify the characteristic values for various spectral methods and recognize the principles of spectroscopic techniques as a qualitative and quantitative method	K2
CLO2	distinguish the different isomers, nature of bonding, type of electronic transition based on the spectral data	K2
CLO3	relate the g factor, nuclear spin, and hyper fine coupling constant with structure of the complexes and apply the spectral data in determining the structure of unknown sample	K3
CLO4	infer the fragmentation pattern, functional group present, nature of proton and carbon present in the molecule	K4
CLO5	predict the structure of compound based on spectral data and evaluate the structure of complex molecules using 2D NMR techniques	K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	S	S	S	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	M	S	S	S
CLO4	S	S	M	M	S	S	S
CLO5	S	S	M	M	S	S	S

S - Strong; M-Medium;

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 and 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, McLafferty 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 and 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	2022, 2 Edn
2	P.S.Kalsi	Spectroscopy of Organic Compounds	New Age International Pvt., Ltd.,	2016, 7 Edn
3	Y. R Sharma	Elementary Organic Spectroscopy	S. Chand Publications	2012, 4 Edn
4	William Kemp	Organic Spectroscopy	Palgrave Publications	2019, 2 Edn
5	H. Kaur	Spectroscopy	PragatiPrakashan Publications	2021, 17 Edn

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.,	2012
2	D. L. Pavia, E. G.M. Lampman F. G.S.Kriz	Spectroscopy	Cengage Learning	2009
3	R.M. Silverstein, F.X. Webster	Spectrometric Identification of Organic Compounds	John Wiley Publications	2014, 8 Edn
4	M. S. Yadav	Molecular Spectroscopy	Arise Publishers & Distributors	2011, 1 Edn

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. G Selvi
3. Dr G. Sathya Priyadarshini

COURSE CODE	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, learn 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 Learning Outcomes

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

CLO Number	CLO 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 Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	M	S	M	S	S	M
CLO2	S	S	S	S	S	S	M
CLO3	S	S	M	S	M	M	M
CLO4	S	M	M	M	S	S	M
CLO5	S	M	M	S	S	S	S

S - Strong; M-Medium;

IDC - CLINICAL MICROBIOLOGY & BIOCHEMISTRY MCP19A1

(For M.Sc., Chemistry/ Botany Students) (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 diagnostic prognostic and monitoring purposes.

Blood Analysis

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

Unit III (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	Books & Allied Pvt., Ltd.,	2007, 1 Edn
2	Jayashree Ghosh	Textbook of Pharmaceutical Chemistry	S. Chand	2003, 3 Edn
3	Jayashree Ghosh	Fundamental concepts of Applied Chemistry	S. Chand	2006, 1 Edn
4	S. V. S. Rana	Bio Techniques Theory and Practice	Rastogi	2012, 3 Edn
5	Ambika Shanmugam	Fundamentals of Biochemistry for Medical Students	Wolters Kluwer India	2016, 8 Edn
6	N. Mallikarjuna Rao	Medical Biochemistry	New Age International	2006, 3 Edn

Reference Books:

S.No	Author	Title	Publishers	Year of publication
1	Lensing M. Prescott, John P. Harley, Donald A. Klein	Microbiology	Tata Mc Graw Hill Education	2006, 6 Edn
2	Keith Wilson, John Walker	Principles and Techniques of Biochemistry and Molecular Biology	Cambridge University Press	2010, 7 Edn
3	Douglas B. Lowrie, Robert G. Whalen	DNA Vaccines-Methods and Protocols	Humana Totowa	2000

Pedagogy:

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

Course Designers:

1. Dr. P. Amutha
2. Dr. G. Subashini

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE2308	COORDINATION & ORGANOMETALLIC CHEMISTRY	THEORY	58	2	-	4

Preamble

To enable the students to understand the theories of bonding, reactions in complexes & spectral applications, gain knowledge in term symbols and electronic spectra of complexes, acquire knowledge regarding organometallic complexes and their applications as catalysts for chemical reactions.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	define and classify the types of ligands, reaction mechanism of metalcomplexes	K1
CLO2	infer the isomerism of coordination compounds, bonding characteristicsusing VBT, CFT theory	K2
CLO3	examine the spectra of complexes using TS and Orgel diagrams, mechanisms for reactions of transition metal complexes	K3
CLO4	appraise the preparation, properties and uses of metal carbonyls,charge transfer complex and trans effect	K4
CLO5	apply coordination complexes as catalyst for reactions, evaluate the application of Mossbauer spectroscopy in characterization	K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	M	M	S	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	M	S	S	S
CLO4	S	S	S	M	S	S	S
CLO5	S	S	S	M	S	S	S

S-Strong; M-Medium

COORDINATION AND ORGANOMETALLIC CHEMISTRY MCE2308 (58Hrs)

Unit I **(11Hrs)**

Coordination Chemistry

Nomenclature of coordination compounds – isomerism, structural & stereoisomerism – octahedral & square planar complexes. Bonding in complexes-Valence bond theory, Crystal field theory- Crystal field effects in tetrahedral, octahedral & square-planar symmetries. CFSE-Weak & strong field effects-Spectrochemical Series. Magnetic Properties - I row transition metal complexes: comparison of magnetic properties of Oh, Td & square planar Fe (II), Co (II), Ni (II) & Cu (II) complexes. Applications of CFSE. Molecular Orbital Theory- Based on group theoretical approach, MO diagrams of octahedral complexes with/without pi-bonding-Experimental evidence for pi-bonding.

Unit II **(12Hrs)**

Electronic Spectra of Complexes

Characteristics of d-d transitions-selection rules. Energy level diagrams – Orgel diagrams. Sugano –Tanabe diagrams (only for d^2, d^3& d^6 ions), Jahn-Teller tetrahedral distortions. Spin-orbit coupling. Nephelauxetic effect. Charge transfer spectra.

Mossbauer Spectroscopy: Principle, Applications in the characterization of Fe &Sn complexes

Unit III **(12Hrs)**

Reactions of Complexes

Inert and labile complexes- Substitution reactions in square planar and octahedral complexes, SN1CB mechanism, complementary / non-complementary reactions. Trans effect- mechanism and applications. Theories of trans effect. Oxidation – reduction reactions – through atom/group transfer, electron transfer. Mechanism of electron transfer reactions in solution phase – outer sphere and inner sphere mechanism.

Unit IV **(11 Hrs)**

Organometallic Chemistry I

Basics of Organometallic Chemistry –Hapticity- Classification of ligands and its limitations-18 e – rule, Metal carbonyls- Preparation, Structure, bonding and reactions. Metal Nitrosyls – Preparation and Bonding, Dinitrogen complexes- Metal alkenes – Zeise salt – bonding.

Cyclopentadienyl complexes (Ferrocene) – Preparation and properties. Concept of Isolobality and Isolobal analogues- ML_5, ML_4, ML_3 Fragments- Examples- $Mn(CO)_5$, $Fe(CO)_4$, $Co(CO)_3$.

Unit-V **(12Hrs)**

Organometallic Chemistry II

Organometallic reactions - Co-ordinative unsaturation, oxidative addition reaction, Reductive elimination & β – elimination. Insertion reaction, Hydrogenation of alkenes (Wilkinson catalyst), Hydroformylation (Oxo process), Oxidation of Olefins (Wackers process), Carbonylation of Methanol (Monsanto Process), Polymerization of Olefins (Zeigler –Natta catalysts) Metal clusters– Introduction to metal carbonyl cluster - Wade's rule. WGS (Water Gas Shift) – Synthesis. Cyclo-oligomerisation of acetylene (Repps and Wilki's Catalyst)

Text Books:

S. No.	Authors	Title	Publishers	Year & Edition
1	James. E. Huheey, Ellen. A. Keiter, R. Keiter, O.K.Medhi	Inorganic Chemistry-Principles of Structure & Reactivity	Pearson Education	20119 Edn.
2	C. Mehrotra, A. Singh	Organometallic Chemistry-A Unified Approach	New Age Publishers	2007 2 Edn.
3	R.Puri, L. R. Sharma, K.C. Kalia	Principles of Inorganic Chemistry	Milestone Publishers and Distributors	2013 31 Edn.
4	Wahid. U. Malik, G. D. Tuli, R. D. Madan	Selected Topics in Inorganic Chemistry	S. Chand & Co.,	2010 30 Edn.

Reference Books:

S. No.	Authors	Title	Publishers	Year & Edition
1.	F.A. Cotton G. Wilkinson	Advanced Inorganic Chemistry	Wiley Interscience Publishers	2009 6 Edn.
2.	J. D. Lee	Concise Inorganic Chemistry	Chapman and Hall	2009 5 Edn.

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

Course Designers:

1. Dr. P. Kanchana
2. Dr. P. Amutha

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE2309	ORGANIC CHEMISTRY -III (Chemistry of Natural Products)	THEORY	73	2	-	5

Preamble

To enable the students to elucidate structures of terpenoids, alkaloids & steroids, flavones and anthocyanins, acquire knowledge about the structures of nucleic acids and their biological functions and understand the synthesis and reactivity of heterocyclic compounds.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	define and classify terpenes, alkaloids, steroids, flavones and anthocyanins	K1
CLO2	identify the functional groups and analyse the structures of terpenoids,alkaloids, steroids, flavones and anthocyanins	K2
CLO3	sketch out the synthesis of terpenoids, alkaloids, steroids, flavones andanthocyanins	K3
CLO4	integrate the chemistry of nucleic acids and their biological functions	K4
CLO5	compare and discuss the reactivity of O, N and S heterocycles	K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	M	S	M	M	S	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	M	S	S	S
CLO4	S	S	S	M	M	S	S
CLO5	S	S	S	M	S	S	S

S-Strong; M-Medium

ORGANIC CHEMISTRY-III MCE2309

(Chemistry of Natural Products) (73Hrs)

Unit I (15Hrs)

Terpenes

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

Unit II (14Hrs)

Steroids

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

Unit III (15Hrs)

Alkaloids

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

Unit IV (15Hrs)

Nucleic Acids

Structures of RNA & DNA, Structure of nuclecosides - bases present - point of linkage of base & sugar - structure of nucleotides - pairing of bases-biological functions of RNA & DNA-genetic continuity- role of RNA in protein synthesis.

Heterocyclic Compounds

Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms - (O, N, S) Pyrazole group, Imidazole group, Oxazole group and Thiazole group.

Unit V **(14Hrs)**

Flavones & Anthocynanins

Structures, synthesis & reactions of Flavones, Isoflavones &Flavanols- Apigenin, Diadzein, Quercetin. Anthocynanins - Cyanin chloride, Pelargonin chloride, Delphinin chloride, Peonin chloride- Structures & synthesis. Colour reactions of Anthocyanins.

Text Books:

S. No.	Authors	Title	Publishers	Year & Edition
1	O.P. Agarwal	Organic Chemistry Natural Products,Vol. I	Goel Publishers	2013 42 Edn.
2	O.P. Agarwal	Organic Chemistry Natural Products,Vol. II	Goel Publishers	2014 41 Edn.
3	I.L. Finar	Organic Chemistry Vol. II	Pearson Education	2011 5 Edn

Reference Books:

S. No.	Authors	Title	Publishers	Year & Edition
1	V.K. Ahluwalia	Chemistry of Natural Products	Ane Books Pvt., Ltd.,	2006 1 Edn.
2	P.S. Kalsi	Chemistry of Natural Products	Kalyani Publishers	2001 1 Edn.
3	I.L. Finar	Organic Chemistry Vol. I	Pearson Education	2007 6 Edn.
4	K. Nakanishi	Natural Products Chemistry Vol. I & II	Academic Press, Inc	1975 1 Edn.

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. Shyamaladevi

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE2310	PHYSICAL CHEMISTRY – III (Reaction Kinetics & Electrochemistry)	THEORY	58	2	-	4

Preamble

To enable the students to acquire knowledge about theories of electrolytes, know about electrode, chemical kinetics and their applications, learn the concepts of catalysis, adsorption and its mechanisms, understand about corrosion and its control and gain knowledge about batteries and its commercial applications

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	recall of theories of electrolytes, electrode kinetics, catalysis, principle of batteries and fuel cells and corrosion.	K1
CLO2	illustrating the electrode electrolytic interface, effect of salts, pH andtemperature	K2
CLO3	appraise the theories of double layer, irreversibility process in electrochemical reaction, theories of adsorption and corrosion reactions	K3
CLO4	apply the theories of electrode electrolytic interface to various models, to verify the reversibility of electron transfer, influence ofvarious factors on reactions.	K4
CLO5	comparing the models of double layer, theories of batteries, fuel cells, theories of corrosion & its mechanism	K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	M	M	S	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	M	S	S	S
CLO4	S	S	S	M	S	S	S
CLO5	S	S	S	M	S	S	S

S-Strong; M-Medium

PHYSICAL CHEMISTRY – III MCE2310

Reaction Kinetics & Electrochemistry (58 Hrs)

Unit I **(12Hrs)**

Theories of Electrolytes

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

Electrode Electrolytic Interface

Electrical double layer, electrocapillary phenomena- electrocapillary curves - Lippman equation, electro kinetic phenomena. Zeta potential and its applications. Measurements of double layer capacitances. Theoretical models of double layers- Helmholtz model, Gouy Chapmann model- potential of zero charge, Stern model- outer & inner Helmholtz planes

Unit II **(12Hrs)**

Electrode Kinetics

Kinetics ofelectron transfer, Butler Volmer equation, Tafel equation, transfer coefficients, charge transfer resistance, Multistep process. Application of Cyclic voltammetry to test reversibility of electron transfer.

Irreversibility in Electrochemical Reactions

Overvoltage – Hydrogen overvoltage, oxygen overvoltage, measurement of overvoltage, factors affecting and importance of overvoltage.

Unit III **(12 Hrs)**

Chemical Kinetics

Theories of Reaction Rates

The ARRT – Thermodynamic treatment of ARRT- Significance of reaction coordinate- Application of ARRT- Unimolecular& bimolecular processes-Lindemann Christiansen hypothesis, RRKM theory, Potential energy surface- Kinetic isotopic effects- Principles of microscopic reversibility- Steady State Approximation- Third order &termolecular reactions. Primary and secondary salt effects.

Reactions in Solution

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

Unit IV **(11 Hrs)**

Catalysis

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

Adsorption

Differences between physisorption & chemisorptions - Theories of adsorption – Freundlich, Langmuir, BET & Gibb's, Langmuir – Hinshelwood.

Unit V **(11 Hrs)**

Batteries

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

Fuel cells

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

Corrosion

Types & importance of corrosion. Passivation of metals – Pourbaix diagram – Evans diagram. Electrochemical principles of corrosion - Polarisation of the electrodes – Concentration polarization, Activation polarization. Methods to control corrosion.

Electrodeposition: Principle and applications.

Text Books:

S. No.	Authors	Title	Publishers	Year & Edition
1	S. Glasstone	Introduction to Electrochemistry	East West Press Pvt., Ltd.,	2011
2	K.J. Laidler	Chemical Kinetics	Pearson Education Pvt., Ltd.,	2007 3 Edn.
3	B.R. Puri, L.R. Sharma, M.S. Pathania	Principles of Physical Chemistry	Vishal	2011 5 Edn.

Reference Books:

S. No.	Authors	Title	Publishers	Year of Publication & Edition
1	A. Frost & R. G. Pearson	Kinetics & Mechanism	Wiley Eastern Pvt Ltd	1970 2 Edn.
2	Gurdeep Raj	Advanced Physical Chemistry	GOEL Publishing House	2009 35 Edn.
3	John. O. M. Bockris & A.K.N. Reddy	Modern Electrochemistry (Vol I & II)	Plenum Publishing Corporation	2006 2 Edn.
4	Raj Narayanan	An Introduction to Metallic Corrosion & its Prevention	Oxford & IBH Publishing Co., Pvt., Ltd.,	1998 1 Edn.
5	Jain P C and MonikaJain	Engineering Chemistry	Dhanpat Rai PublishingCo.,	2015 16 Edn.

Pedagogy: Lecture by chalk and talk, power point presentation, e-content, exercise, group discussion, assignment, quiz, peer learning, seminar

Course Designers:

1. Dr. D. Nalini
2. Dr. Sowmya Ramkumar

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE2311	MEDICINAL CHEMISTRY (OPTIONAL)	THEORY	58	2	-	4

Preamble

To enable the students to learn about the drug metabolism & their activity, understand about cancer chemotherapy and cardiovascular drugs, gain knowledge about local anti-infective drugs.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	explain the procedures followed in drug design and development ofQSAR	K1
CLO2	interpret pharmacokinetic parameters and appraise the significance ofdrug metabolism in medicinal chemistry	K2
CLO3	classify and integrate the synthesis of antineoplastic drugs to cancer chemotherapy	K3
CLO4	predict the mechanism of action of cardiovascular drugs	K4
CLO5	evaluate the general mode of action and synthesis of local anti-infective drugs	K5

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	M	M	M	M	S
CLO2	S	S	M	M	M	M	S
CLO3	S	S	M	M	M	M	S
CLO4	S	S	M	M	M	M	S
CLO5	S	S	M	M	M	M	S

S-Strong; M-Medium

Medicinal Chemistry (Optional) MCE2311 (58Hrs)

Unit I **(11 Hrs)**

Introduction to Drugs

Sources, absorption, roots of administration of drugs, biotransformation, mechanism of action. Factors prolonging action, excretion & toxicity. Development of new drugs, procedures followed in drug design, concepts of lead compound & lead modification, concepts of prodrugs& soft drugs, Structure Activity Relationship (SAR), factors affecting bioactivity, resonance, inductive effects, isosterism, bio isosterism, and spatial considerations. Theories of drug activity: Occupancy Theory, Rate Theory, induced fit theory. Quantitative Structure Activity Relationship (QSAR) - History & development. Concepts of drug receptors. Elementary treatment of drug receptor interactions.

Unit II **(12Hrs)**

Pharmacokinetics

Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition & in therapeutics. Uses of pharmacokinetics in drug development process.

Pharmacodynamics

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

Unit III **(12Hrs)**

Antineoplastic Agents

Introduction, classification, cancer chemotherapy, special problems, role of alkylating agents & anti metabolites in treatment of cancer. Carcinolytic antibiotics & mitotic inhibitors. Synthesis of mechlorethamine, cyclophosphamide, melphalan, uracil, mustards & 6-mercaptopurine. Recent developments in cancer chemotherapy. Hormone & Natural products.

Unit IV **(11Hrs)**

Cardiovascular Drugs

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

Unit V **(12 Hrs)**

Local Anti-infective Drugs

Introduction & general mode of action. Synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapsone, amino salicylic acid, isoniazide, ethionamide, ethambutal, fluconazole, econozole, griseofulvin, chloroquine & primaquin.

Text Books:

S. No.	Authors	Title	Publishers	Year & Edition
1	Ashutosh Kar	Medicinal Chemistry	New Age International	2007 4 Edn.
2	R.S. Satoskar, S. D. Bharkar	Pharmacology & Pharmatherapeutics Vol. 1 & 2	Popular Prakashan	2015 24 Edn.

Reference Books:

S. No.	Authors	Title	Publishers	Year & Edition
1	G. Patrick	An Introduction to Medicinal Chemistry	Oxford University Press	2009 4 Edn.
2	D. Sriram P. Yogeswari	Medicinal Chemistry	Pearson Education	2010 2 Edn.

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

Course Designers:

1. Dr. E. Kayalvizhy

2. Dr. G. Selvi

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE23P4	ORGANIC CHEMISTRY PRACTICAL II	PRACTICAL	-	-	60	4

Preamble

To enable the students to estimate quantitatively the amount of phenol, aniline, glucose present in the givensolutions & unsaturation of oils, analyze the RM value of butter, saponification / Iodine values of oils, extract the active constituents of milk and tea and prepare organic compounds by a two stage process

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	experiment and estimate quantitatively the amount of phenol,aniline and glucose in the given solution	K1
CLO2	examine the degree of unsaturation in butter and oils	K2
CLO3	prepare organic compounds and determine their melting points	K3

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	S	S	S	S
CLO2	S	S	S	S	S	S	S
CLO3	S	S	S	S	S	S	S

S-Strong; M-Medium

ORGANIC CHEMISTRY PRACTICAL II [MCE23P4] (60 Hrs)

1. Estimations

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

2. Analysis of Oils

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

3. Extraction & Estimation of Active Constituents

Lactose from milk

Caffeine from tea

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

4. Two Stage Preparations

p-nitro acetanilide

1,3,5-tribromo benzene

p-bromo acetanilide

Eosin

p-bromo aniline

m-nitro benzoic acid

Interpretation of FT-IR- carbonyl compounds, azomethine, alcohol, phenol & amine.

Text Book:

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

Reference Books:

S. No.	Authors	Title	Publishers	Year & Edition
1	F.G. Mann B.C. Saunders	Practical Organic Chemistry	Pearson Education	2009 4 Edn.
2	G. H. Jeffery, J. Bassett, J. Mendham R. C. Denney	Vogel's Text Book of Quantitative Chemical Analysis	Pearson Education	2009 6 Edn.

Pedagogy: Demonstration and hands on practicals

Course Designers:

1. Dr. N. Muthulakshmi Andal

2. Dr. N. Shyamala Devi

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE23P5	INORGANIC CHEMISTRY PRACTICAL II	PRACTICAL	-	-	60	4

Preamble

To enable the students to analyze quantitatively the metal ions such as Cu, Ni, Fe, Zn, Ca and Ba in a mixture estimate ferrous ion, oxalic acid and nitrite by Cerimetry, separate the components in ink and flowers by Chromatography

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	separate and estimate the metal ions in a mixture	K1
CLO2	estimate the inorganic components by Cerimetirc method	K2
CLO3	separate the components in natural and commercial products	K3

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	S	S	S	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	M	S	S	S

S-Strong; M-Medium

INORGANIC CHEMISTRY PRACTICAL – II [MCE23P5] (60 Hrs)

Cerimetry

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

Estimation of metal ions in a mixture

1. Estimation of Copper & Nickel
2. Estimation of Iron & Nickel
3. Estimation of Copper & Zinc
4. Estimation of Calcium & Barium
5. Estimation of Copper & Iron

Chromatography

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

Text Book:

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

Reference Books:

S. No.	Authors	Title	Publishers	Year & Edition
1	J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, B. Sivasankar	Vogel's, Text Book of Chemical Analysis	Pearson Publications	2000 6 Edn
2	A.I Vogel	A Text Book of Quantitative Inorganic Analysis	ELBS & Longmann, Green & Co. Ltd.	2011 9 Edn

Pedagogy: Demonstration and hands on Practicals

Course Designers:

1. Dr. E. Kayalvizhy

2. Dr. V. Hemapriya

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE23P6	PHYSICAL CHEMISTRY PRACTICAL II	PRACTICAL	-	-	75	5

Preamble

To enable the students to understand the principle of conductivity experiments and carry out conductometrictitrations, determine the rate constant for acid and base hydrolysis of esters and primary salt effect and learn the kinetics of adsorption of oxalic acid on charcoal.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	experiment and estimate the strength of the solutions by conductivitymethod.	K1
CLO2	experiment and calculate the rate constant for ester hydrolysis andprimary salt effect.	K2
CLO3	apply Freundlich isotherm to study the nature of adsorption of oxalicacid on charcoal	K3

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	S	S	S	S
CLO2	S	S	S	S	S	S	S
CLO3	S	S	S	S	S	S	S

S-Strong; M-Medium

PHYSICAL CHEMISTRY PRACTICAL – II MCE23P6 (75 Hrs)

Conductivity Experiments

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

Kinetics

1. Acid hydrolysis of an ester at room temperature
2. Saponification of ester at room temperature
3. Evaluation of Arrhenius parameters E & A (any two temperatures only)
4. S_2O_8- Study on Primary salt effect & determination of concentration of KNO3
5. Bronsted Catalysis Law

Adsorption

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

Text Book:

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

Reference Books:

S. No.	Authors	Title	Publishers	Year & Edition
1.	A.J. Findlay & Kitchener	Practical Physical Chemistry	Longmann Publication	1973 9 Edn.
2.	B. Viswanathan & P.S. Raghavan	Practical Physical Chemistry	Viva Books	2009 3 Edn.

Pedagogy: Demonstration and hands on practicals

Course Designers:

1. Dr. D. Nalini
2. Dr. N. Arunadevi
3. Dr. G. Sathya Priyadarshini

RESEARCH METHODOLOGY MCE22S1

Special Course

Credit - 2 **(30 Hrs)**

Objectives:

- To acquire knowledge about sampling & errors
- To inculcate basic ideas regarding research, thesis writing
- To gain knowledge about the use of tools and software in research

Unit I **(6 Hrs)**

Errors involved in Chemical Analysis

Classification, minimization of errors, determination of accuracy of results, reliability of results, rounding numbers -Significant figures - Mean standard deviation.

Unit II **(6 Hrs)**

Thesis Writing

Nature and purpose, the components of dissertation, overview, title and title page, abstract, preface and table of contents, introduction, results, discussion, conclusion, experimental section, references and miscellaneous components. Preparation of dissertation

Unit III **(6 Hrs)**

Paper Writing

Title, Abstract, Introduction, Materials and Experimental methods, Results and discussion, Conclusion, Acknowledgement, References.
Impact factor, Citation Index, h-Index, Patent filing.

Unit IV **(6 Hrs)**

Materials, Tools and Methods in Scientific Writing

Writing techniques – Introduction, word processing and page layout, hardware and operating systems, word processing and page layout software, writing and formatting with computer, becoming accustomed to your system

Unit: V **(6 Hrs)**

Research Ethics and Responsible Conduct in Research

The historical and analytical basis of research ethics, responsible conduct in research (Informed Consent, Risk/Benefit Assessment, Honesty in Science: Integrity and Authorship and Conflicts

of Interest, Privacy and Confidentiality), The legal regulation of research ethics in India (From UGC & MHRD), Regulatory requirements relevant to international research.

Text Books:

S. No.	Authors	Title	Publishers	Year of Publication & Edition
1.	S.M. Khopkar	Basic Concepts of AnalyticalChemistry	New Age International Publishers	2008 3 Edn.
2.	D.A. Skoog, D.M. West F. James Holler	Analytical Chemistry – An Introduction	Saunders College Publishing	2000 7 Edn.
3.	Hans F. Ebel, Claus Bliefert	The Art of Scientific Writing	Wiley Publishing	2005 2 Edn.

Reference Books:

S. No.	Authors	Title	Publishers	Year of Publication & Edition
1.	C.R. Kothari	Research Methodology - Methods & Techniques	New Age International Publishers	2011 2 Edn.
2.	D.A. Skoog F.J. Holler	Principles of Instrumental Analysis	Harcourt Brace College Publishers	2007 6 Edn.
3.	Y.K. Singh, R. Nath	Research Methodology	APH Publishing Corporation	2005 1 Edn.
4.	Mark Suckow, Bill Yates	Research Regulatory Compliance	eBook	1 Edn ISBN: (9780124200654)
5.	Mark P. Aulisio, RobertM. Arnold	Role of the Ethics Committee: Helping to Address Value Conflicts or Uncertainties	The American College of Chest Physicians. Published by Elsevier	Chest 2008 August; 134(2): 417-424
6.	Institute of Medicine, National Academy of Engineering, National Academy of Sciences, Committee on Science, Engineering, and Public Policy	On Being a Scientist, AGuide to Responsible Conduct in Research	National Academies	2009 3 Edn. ISBN 0309141354, 9780309141352
Recent research ethics policy from Government of India https:// procedures.pdf				

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MNM22CS2	**CYBER SECURITY II**	**THEORY**	30	-	-	Grade

Preamble

This course provides the classification of cyber security and cyber crime and its laws and data privacy and security in social media

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basic concepts of Cybersecurity and Cybersecurity threatlandscape.	K2
CLO2	Apply the methods to identify the cyber-attacks and crimes.	K3
CLO3	Analyze the legal framework that exists in India for cybercrime and legal frame work followed by other countries.	K4
CLO4	Estimate the data privacy and security issues related to personal data privacy and security.	K5
CLO5	Create a privacy setting on social media platform and register complaints on a social media platform.	K6

CYBER SECURITY MNM22CS2

Unit I **(6 hrs)**

Overview of cyber security: Cyber security terminologies- Cyberspace- Cyber attack- Cyber threats - Cyber terrorism – Cyber warfare.

Unit II **(8 hrs)**

Cyber crimes: Cyber Crimes targeting computer system and mobiles- Online scam frauds: emails Scams- Phishing- Vishing- Smishing- Online job fraud- online sextortion- Debit and credit card fraud- Online payment fraud- cyberbullying. Social Media Scam & Frauda: Impersonation- Identify theft -Job scams- Misinformation- Fake new cyber crime against persons -Cyber grooming -Child pornography - cyber stalking-Cyber police station -Crime reporting produce.

Unit III **(4 hrs)**

Cyber law: Cyber laws and legal and ethical aspects related to new technologies: AI/ML-IoT-Blockchain- Darknet and social media- Cyber law of other countries.

Unit IV **(5hrs)**

Data privacy and Data security: Defining data- Metro-Big data- Non personal data- Data protection- General Data Protection Regulations (GDPR)- 2016 Personal Information Protection and the Electronic document Act(PIPEDA)- Social media Data privacy and Security issues.

Unit V **(7 hrs)**

Social Media Platforms and Cyber Security : Case Study on Platform for reporting Cyber Crimes, Checklist for reporting cyber crimes online, Setting privacy settings on social media platforms, Registering complaints on social media platforms, Do’s and Don’ts for posting content on social media platforms, prepare password policy for computer and mobile device, security controls for computer and mobile phones , digital Forenics, Cyber Bulling, Phishing, Facebook Attack, Cyber Security audit and Compliance and National Security Policies.

Reference Books:

1. Anand Shinde (2021), Introduction to Cyber Security – Guide to the world of Cyber Security, Notion Press Sumit Belapure, Nina Godbole (2011), Cyber security understanding cyber crimes, computer forensics and legal Perspectives, Wiley India Pvt Ltd.

2. Dorothy F. Denning (1998), Information warfare and security, Addison Wesley.

3. Henry A. Oliver, (2014), Security in the digital age: social media security threats and vulnerabilities, Social Wise Media Group Nataraj Venkataramanan, Ashwin Shriram (2016), Data privacy principle and practice. CRC Press

4. W. Krag Brothy (2006), Information security governance guidelines for information security manager, Wiley Publication.

5. Martin Weiss, Michael G. Solomon (2015), Auditing IT Infrastructure for compliance, 2/e, Jones Bartlett Learning.