PSGR Krishnammal College for Women

DEPARTMENT OF CHEMISTRY

CHOICE BASED CREDIT SYSTEM &

OUTCOME BASED CURRICULAR FRAMEWORK

MASTER OF SCIENCE IN CHEMISTRY

2024-2026

PSGR Krishnammal College for Women

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

QUESTION PAPER PATTERN

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

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

End Semester Examination – Question Paper Pattern and Distribution of Marks

Core and Allied 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

Continuous Internal Assessment Pattern

Theory

I Year UG / PG (23 Batch)

CIA Test : 5 marks **(conducted for 45 marks after 50 days)**

Model Exam : 7 marks **(Conducted for 75 marks after 85 days (Each Unit 15 Marks))**

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

ESE Practical Pattern

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.

MAPPING OF POs WITH Cos

COURSE	PROGRAMME OUTCOMES						
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
COURSE - MCE2301							
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
COURSE – MCE2302							
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
COURSE – MCE2303							
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
COURSE - MCE2304							
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
CO5	S	S	S	S	S	S	S
COURSE – MCE23P1							
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
COURSE – MCE23P2							
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
COURSE – MCE23P3							
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

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