MASTER OF SCIENCE IN CHEMISTRY
CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES-BASED CURRICULAM FRAMEWORK (LOCF)
SYLLABUS & SCHEME OF EXAMINATION
2025 - 2027 BATCH - SEMESTER I

Sem	Course Code	Title of the Course	Course Type	Instruction hours / week	Contact Hours	Tutorial Hours	Duration of Examination	Examination Marks			Credit
								CA	ESE	Total	
I	MCE2501	Inorganic Chemistry I (Inorganic and Solid State Chemistry)	CC	4	58	2	3	25	75	100	4
	MCE2502	Organic Chemistry I (Organic Reaction Mechanism & Stereochemistry)	CC	5	73	2	3	25	75	100	5
	MCE2503	Physical Chemistry I (Classical & Statistical Thermodynamics)	CC	5	73	2	3	25	75	100	5
	MCE2504	Analytical Techniques in Chemistry	CC	4	58	2	3	25	75	100	4
	MCE25P1	Organic Chemistry Practical I	CC	4	60	-	-	-	-	-	-
	MCE25P2	Inorganic Chemistry Practical I	CC	4	60	-	-	-	-	-	-
	MCE25P3	Physical Chemistry Practical I	CC	4	60	-	-	-	-	-	-
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

CC - Core Courses
ACC - Additional Credit Courses

CA- Continuous Assessment
ESE - End Semester Examination

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)

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 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 marks
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

Criteria for Attendance:

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

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE2501	INORGANIC CHEMISTRY I	THEORY	58	2	-	4

Preamble

To make the students to gain knowledge about structure and bonding in inorganic polymers; learn the theories of isopoly, heteropoly acids, anions and inorganic polymers; study the structural determination of inorganic crystals.

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	K2
CLO2	Extend the applications of inorganic compounds as rings, clusters, polyacidsand solid state crystals	K3
CLO3	Assess the importance of inorganic compounds as polymeric structures/identifythe 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 I (MCE2501)
(Inorganic Chemistry and Solid State Chemistry) (58 Hrs)

Unit – I **(12 Hrs)**

Inorganic Polymers- I

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

Rings- Borazines- Preparation, properties and structure, Phosphazenes – Preparation, properties and structure.

Cages- PS cages, PO cages.

Unit – II **(11 Hrs)**

Inorganic Polymers- II

Introduction, general properties, glass transition temperature, classification. One dimensional conductors- Nitrides of sulphur - S4N4 - Preparation and structure, $S4N_3^+$ - Preparation and structure, (SN)x -Preparation and structure. Silicon based polymers – Preparation, properties and types of silicones.

Unit – III **(12 Hrs)**

Isopoly and Heteropoly Acids and Anions

Introduction, polymerization of CrO^{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 – 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 ofionic crystals - AX type: CsCl, ZnS (Zinc blende, Wurtzite), AX_2 type: CaF_2, TiO_2, CdI_2. X - ray diffraction- Powder Method, Single crystal methods, High temperature powder diffraction- Principle and uses.

Text Books:

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

Reference Books:

S.No	Authors	Title	Publishers	Year & Edition
1	F. Albert Cotton and Geoffrey Wilkinson	Advanced Inorganic Chemistry	Wiley Interscience	1999 6 Edn
2	Anthony R. West	Solid State Chemistry and its Application	Wiley India	2011
3	J.D. Lee	Concise Inorganic Chemistry	Wiley India	2010

Pedagogy:

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

Course Designers:

1. Dr. N.Muthulakshmi Andal
2. Dr. S. Charulatha

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE2502	ORGANIC CHEMISTRY I	THEORY	73	2	-	5

Preamble

To enable the students to understand the concept of aromaticity, mechanism of substitution and elimination reactions in aliphatic and aromatic compounds & stereochemistry of organic 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	K2
CLO2	develop skills for identifying the kinetics and stereochemistry of thereactants and products	K2
CLO3	predict the stereochemistry and apply the mechanism for synthesizing organic compounds	K3
CLO4	analyze and compare the substitution & elimination 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

ORGANIC CHEMISTRY I MCE2502

(Organic Reaction Mechanism and Stereochemistry) (73 Hrs)

Unit I **(15Hrs)**

Aromaticity

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

Reaction Mechanism

Types of reactions and mechanisms, Non kinetic methods- 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, Curtin Hammett Principle, linear free energy relationship- Hammett and Taft equations.

Unit II **(14 Hrs)**

Aliphatic Nucleophilic Substitution

The S_N1, S_N2 & S_Ni mechanisms. The neighbouring group mechanism, neighbouring group participation by π & σ bonds, anchimeric assistance. 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. Oxygen nucleophiles - Williamson reaction

Aromatic Nucleophilic Substitution

The S_NAr, S_N1, Benzyne and SR_N1 Mechanisms. Reactivity – Effect of substrate structure, leaving group and attacking nucleophile. O & S nucleophiles - Bucherer reaction, Rosenmund reaction, Von Richter rearrangement.

Unit III **(15 Hrs)**

Aliphatic Electrophilic Substitution

Bimolecular mechanisms – S_E2 (front), S_E2 (back) and S_E^i. Unimolecular mechanism- S_E1 mechanism, Substitution accompanied by double bond shifts. Hydrogen electrophiles- hydro-dehydrogenation, Halogen electrophiles - Halogenation of aldehydes, ketones and carboxylic acids, Nitrogen electrophiles - aliphatic diazonium coupling, Stork-enamine reaction, Sulphur electrophiles – sulphonation, Carbon electrophiles - acylation, alkylation.

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, syn-anti dichotomy, E1-E2-E1cB spectrum, Elimination vs substitution. Pyrolytic elimination- Chugaev reaction, Hoffmann degradation, Cope elimination.

Unit V **(15 Hrs)**

Stereochemistry

Optical isomerism: Concept of chirality, R, S - nomenclature of compounds having more than one chiral centres.

Topicity and Prochirality: Identification of Homotopic, Enantiotopic, Diastereotopic Ligands and Faces. Prochirality – pro R, pro S, Re and Si faces.

Asymmetric Synthesis - Cram's and Prelog's Rules, Felkin-Ahn modification, Chiral Auxiliaries - Evan Aldol Reaction, Chiral Reagents - Epoxidation (Sharpless' Reaction). Stereospecific and Stereoselective Reactions

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. Stereochemistry of sulphur and nitrogen compounds.

Geometrical Isomerism: Stereoisomerism of cyclic compounds (upto six membered ring) - Aldoximes and ketoximes.

Conformational Analysis: Configuration and conformation. Conformation of cyclic compounds - cyclohexane, decalins, perhydrophenanthrenes. Effect of conformation on reactivity.

Text Books:

S.No	Authors	Title	Publishers	Year & Edition
1	I.L. Finar	Organic Chemistry Vol I	Pearson Education	2009 6 Edn
2	I.L. Finar	Organic Chemistry VolII	Pearson Education	2011 5 Edn
3	Jagdamba Singh and Yadav	Advanced Organic Chemistry	Pragati Prakasham	2010 6 Edn
4	Jerry March	Advanced Organic Chemistry	Wiley Publications	2010 4 Edn
5	E. L Eliel	Stereochemistry of Carbon Compounds	Tata McGraw Hill	2004 30 Edn
6	T.W. Graham Solomons, Craig B. Fryhle	Organic Chemistry	Wiley Publications	2008 9 Edn

Reference Books:

S.No	Authors	Title	Publishers	Year & Edition
1	R.K. Bansal	Organic Reaction Mechanism	Tata McGrawHill Publications	2006 3 Edn
2	F. A. Carey and Sundberg	Advanced Organic Chemistry-Part A	Springer	2010 2 Edn
3	F.A. Carey and Sundberg	Advanced Organic Chemistry-Part B	Springer	2007 2 Edn
4	D. Nasipuri	Stereochemistry of Organic Compounds	New Age Publishers	2008 2 Edn
5	Stanely H. Pine	Organic Chemistry	Tata MC Graw Hill	2007 5 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

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE2503	PHYSICAL CHEMISTRY I	THEORY	73	2	-	5

Preamble

To learn about classical and statistical thermodynamics, understand and apply the concept of fugacity, activity, chemical potential, third law of thermodynamics, probability, ensembles and distribution laws.

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, third law of thermodynamics, Maxwell – Boltzmann distribution law	K2
CLO2	interpret the physical significance of chemical potential and ensembles	K2
CLO3	calculate the molecular velocities based on Maxwell Boltzmann distribution law, fugacity and activity	K3
CLO4	apply thermodynamic concepts to evaluate the relationship between thermodynamic properties, translational, rotational, vibrational and electronic partition functions, Bose Einstein and Fermi-Dirac distribution laws	K4
CLO5	evaluate statistical thermodynamics to the properties of identical indistinguishable particles like electrons, Debye theory	K4

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

PHYSICAL CHEMISTRY PAPER I MCE2503
(Classical and Statistical Thermodynamics) (73Hrs)

Unit I **(14Hrs)**

Classical Thermodynamics

Chemical potential - Gibbs - Duhem equation - determination of partial molar quantities. Clausius - Clapeyron equation and its applications. 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.

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, grand cannonical and average 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

Phase space, 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	Authors	Title	Publishers	Year & Edition
1	Samuel Glassstone	Thermodynamics for Chemists	East West Press	2002
2	M.C. Gupta	Statistical Thermodynamics	Wiley Eastern Publications	1990 1 Edn
3	Ashley	Classical and Statistical Thermodynamics	Pearson Education	2012

Reference Books:

S.No	Authors	Title	Publishers	Year & Edition
1	P.W. Aktins	Physical Chemistry	Oxford University	1978, 1 Edn
2	Gurdeep Raj	Advanced Physical Chemistry	GOEL Publishing House	2002, 27 Edn
3	Peter Atkins Julio de Paula	Elements of Physical Chemistry	Oxford University	2014, 5 Edn
4	F.W. Sears G.L. Salinger	Thermodynamics, Kinetic & Statistical thermodynamics	Narosa Publishing House	2013
5	Frederick.T. Wall	Chemical Thermodynamics	W.H. Freeman & Company	1974, 3 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.N.Arunadevi

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE2504	ANALYTICAL TECHNIQUES IN CHEMISTRY	THEORY	58	2	-	4

Preamble

To enable the students to analyze various chromatographic techniques, determine molecular configuration and conformation using ORD and CD, phase transitions and thermal properties using TGA, DTA, and DSC; understand the principles, instrumentation of electron-ion and atomic spectroscopy techniques like AAS, FES.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	explain the working principles and theoretical concepts of HPLC, GC, SFC, ORD, CD and spectroscopic techniques	K2
CLO2	analyze and compare different analytical methods in terms of their accuracy, sensitivity, and suitability for various chemical and industrial applications	K3
CLO3	interpret chromatograms, spectroscopic data, and thermal analysis curves to identify chemical compounds and assess their properties	K4
CLO4	apply AAS techniques to detect and quantify trace metals in environmental, biological, and industrial samples.	K4
CLO5	analyze the advantages and limitations of different analytical techniques	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	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

ANALYTICAL TECHNIQUES IN CHEMISTRY MCE2504 (58Hrs)

Unit I **(12Hrs)**

Chromatography

High Pressure Liquid Chromatography (HPLC) - Introduction, characteristic features of HPLC, principle,column processes & band broadening, instrumentation and application.

Gas Chromatography (GC) - Introduction, principle, theory, instrumentation, evaluation of gaschromatogram, identification of chromatogram, plate theory and applications.

Super Critical Fluid Chromatography (SFC) - Characteristics of super critical fluids, comparison of SFC with HPLC & GLC and applications.

**Interpretation of chromatogram using caffeine, mixture of aminoacids, aflatoxin in milk, separation of phyto constituents.

Unit II **(11 Hrs)**

Optical Rotatory Dispersion & Circular Dichorism : Introduction, polarised light &chiroptical properties - linearly & circularly polarized light, circular birefringence & circular dichroism. Instrumentation – Automatic recording spectropolarimeters (ORD), Circular dichrometer. ORD and CD curves – plain curves, cotton effect curves. Empirical &Semi empirical rules - Axial haloketone rule, Octant rule, Helicity rule, Lowe's rule. Application of Axial haloketone rule & Octant rule for ketones – absolute configuration, position of functional group, conformation, conformational mobility; Helicity in dienes, Lowe's rule for the configuration of allenes.

Unit III **(12Hrs)**

Thermoanalytical Methods

Thermogravimetric analysis & differential thermal analysis – Principle, various components with block diagram - TGA & DTA curves of $CuSO_4.5H_2O$, $MgC_2O_4.H_2O$ & $Ca(OOCCH_3)_2.H_2O$ Simultaneous DTA-TGA curves of $SrCO_3$ in air & $CaC_2O_4.H_2O$ in air & CO_2. Factors affecting TGA & DTA curves. DSC - Principle, Instrumentation – Power compensated, Heat-flux, Modulated DSC instruments. Applications: glass transition temperatures, reaction kinetics, crystallinity and crystallization rate.

**Interpretation of thermogram using TGDTA (Tris(thiourea)copper (II) chloride, Potassium tris(oxalato)ferrate(III))

Unit – IV **(12 Hrs)**

Electron-Ion Spectroscopy

Introduction – general techniques in surface spectroscopy. Basic principles of electron spectroscopy – photoelectric effect and photoelectron spectroscopy (PES). Phototelelectron spectroscopy and Koopman's theorem. X-ray photoelectron spectroscopy – instrumentation & applications. Principles of Ultraviolet Photoelectron spectroscopy (UPS) and Auger Electron spectroscopy (AES).

**Interpretation of XPS of metal oxides (MnO_2, Co_3O_4 and NiO), metal hydroxides ($Co(OH)_2$, $Ni(OH)_2$) and organic compounds (graphenes and carbon nitrides).

Unit – V **(11 Hrs)**

Atomic Spectroscopy

Atomic Absorption Spectroscopy (AAS) – introduction, principle, procedure, preparation of samples, measurement of atomic absorption, sensitivity, calibration – methods, advantages and disadvantages of atomic absorption, precision and accuracy. Flame Emission – relationship between atomic absorption and Flame Emission Spectroscopy (FES) – advantages of atomic absorption over flame emission. Line widths – instrumentation – sources – monochromators – filters – optical system and detectors - indicators. Flame – profiles – flame atomization – oxidants. Fuels – types of burners, interferences – cation and anion interferences, analytical applications.

**Determination of trace metal ions using AAS from industrial effluents (electroplating, paint and textile industries)

**** Not for examination**

Text Books:

S. No	Authors	Title	Publisher	Year & Edition
1	E.L Eliel	Stereochemistry of Carbon Compounds	Tata McGraw Hill	2004 30 Edn.
2	Dr. H. Kaur	Instrumental Methods of Chemical Analysis	Pragati Prakashan	2008 4 Edn
3	Mahinder Singh	Analytical Chemistry-InstrumentalTechniques	Dominant Publishers & Distributors New Delhi	2003 1 Edn.
4	B. K Sharma	Instrumental Methods of ChemicalAnalysis	Goel Publications	2012 28 Edn.
5	H. H Willard, L. L Merritt, J. A Dean, F.A. Settle	Instrumental Methods of Analysis	CBS Publishers & Distributors	1986 7 Edn.
6	D.A. Skoog, F.J. Holler and S.R. Crouch	Instrumental Analysis	Cengage Learning	2010

Reference Books:

S. No	Authors	Title	Publisher	Year & Edition
1.	S. M. Khopkar	Basic Concepts of Analytical Chemistry	Wiley Eastern Ltd	1884 1 Edn.
2.	D. A Skoog, F.J. Holler and D. MWest	Analytical Chemistry- An Introduction	Saunders College Publications	1994 & 6 Edn.
3.	M.S. Yadav	Instrumental Methods of Chemical Analysis	Campus Book	2006 & 1 Edn.

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. C. Nithya

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE25P1	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 and 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	K2
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
CLO5	analyse the food samples using HPLC	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	S	S	S	S	S
CLO5	S	S	S	S	S	S	S

S - Strong; M-Medium

ORGANIC CHEMISTRY PRACTICAL I MCE25P1 (120 Hrs)

1. Qualitative Analysis:

Analysis of two component mixtures – Separation, identification of components and determination ofmelting 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.

4. Analysis of food samples using HPLC (Group Experiment)

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

Reference books:

S. No	Authors	Title	Publisher	Year & Edition
1	Arthur I. Vogel	Elementary Practical Organic Chemistry (part 2) Qualitative OrganicAnalysis	Pearson Education	2011 2 Edn.
2	F.G. Mann & B.C.Saunders	Practical Organic Chemistry	Pearson Education	2009 4 Edn

Pedagogy: Demonstration and hands on practical

Course Designers:

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

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE25P2	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 and 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	K2
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	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
CLO4	S	S	S	S	S	S	S
CLO5	S	S	S	S	S	S	S

S - Strong; M-Medium

INORGANIC CHEMISTRY PRACTICAL I MCE25P2 (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

5. Preparation of CuO nanoparticles and its characterization using Nano Particle Track Analyzer (Group Experiment)

Text Books: LAB MANUAL - Prepared by Faculty, Department of Chemistry, PSGR Krishnammal Collegefor Women

Reference books:

S. No	Authors	Title	Publisher	Year & Edition
1	Arthur I.Vogel	Macro &Semimicro Qualitative Inorganic Analysis	Orient Long man'sLtd	1968 1 Edn
2	G.Palmer	Experimental InorganicChemistry	Cambridge University Press	1964 3 Edn.

Pedagogy: Demonstration and hands on practical

Course Designers:

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

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
MCE25P3	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 and 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 Kf values by Rast micro method	K2
CLO3	interpret the strength of the solutions and Ka values by potentiometry	K3
CLO4	determine EMF of silver & copper electrode	
CLO5	construct and analyze Phase diagrams	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	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
CLO5	S	S	S	M	S	S	S

S- Strong; M-Medium

PHYSICAL CHEMISTRY PRACTICAL I MCE25P3 (120Hrs)

1. Molecular weight determination by Rast Micro Method
2. Phase study: Simple Eutectic System & Compound Formation
3. Determination of Transition Temperature of Salt Hydrate
4. Viscosity: Variation of viscosity of liquids with temperature
5. Electromotive Force:
   (i) Determination of Standard Potentials (Cu, Ag)
   (ii) Determination of pH & pKa values using Hydrogen & Quinhydrone electrodes
6. Potentiometric Titrations:

Acid Base titrations

i. Titration of HCl vs NaOH
ii. Titration of mixture of acids against a strong base
iii. Titration of CH_3COOH vs NaOH

Redox titrations

iv. Titration of Ferrous ammonium sulphate against Potassium dichromate
v. Titration of Potassium iodide against Potassium permanganate

Precipitation titrations

vi. Estimation of KI by titration with $AgNO_3$ using KCl as standard.
vii. Titration of mixture of halides against $AgNO_3$ solution

7. Determination of solubility product of a sparingly soluble salt (Concentration Cell & Chemical Cell)

Text Books:

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

Reference books:

S. No	Authors	Title	Publisher	Year & Edition
1	B.P. Levitt	Findlay's Practical Physical Chemistry	Longman Publications	1973 & 9 Edn
2	G. Palmer	Experimental PhysicalChemistry	Cambridge University Press	1964 & 1 Edn
3	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. E. Kayalvizhy
3. Dr .G. Sathya Priyadarshini