FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A++" Grade by NAAC (4th Cycle)

Maryland, Madurai- 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT:CHEMISTRY

NAME OF THE PROGRAMME : M.Sc. CHEMISTRY

PROGRAMME CODE : PSCH

ACADEMIC YEAR : 2023-2024

FATIMA COLLEGE (AUTONOMOUS),

Affiliated to Madurai Kamaraj University
Re-Accredited with 'A++' (CGPA 3.61) by NAAC (Cycle - IV)
Mary Land, Madurai - 625018, Tamil Nadu

DEPARTMENT OF CHEMISTRY

(For the academic year 2023-2024)

PROGRAMME CODE : PSCH

COURSECODE	COURSE TITLE	HRS / WK	CREDIT	CIA Mks	ESE Mks	TOT. MKs
SEMESTER – I (TANSCHE)						
23PG1C1	Organic Reaction Mechanism-I	6	5	40	60	100
23PG1C2	Structure and Bonding in Inorganic Compounds	6	5	40	60	100
23PG1C3	Organic Chemistry Practicals	6	4	40	60	100
23PG1CE1/ 23PG1CE2	Pharmaceutical Chemistry/Nanomaterials and Nanotechnology	5	3	40	60	100
23PG1CE3/ 23PG1CE4	Electro chemistry/Molecular Spectroscopy	5	3	40	60	100
23PG1CAE	Chemistry in Consumer Products (EDC)	2	1	40	60	100
Total		**30**	**21**			

SEMESTER –II (TANSCHE)						
23PG2C4	Organic reaction mechanism-II	6	5	40	60	100
23PG2C5	Physical Chemistry-I	6	5	40	60	100
23PG2C6	Inorganic Chemistry Practicals	6	4	40	60	100
23PG2CE5/ 23PG2CE6	Medicinal Chemistry/Green Chemistry	4	3	40	60	100
23PG2CE7/ 23PG2CE8	Bio Inorganic Chemistry/Material Science	4	3	40	60	100
23PG2CSE1	Chemistry in every day life (EDC)	4	2	40	60	100
Total		**30**	**22**			

SEMESTER – III (OBE)						
19PG3C11	Organic Chemistry-III (Spectroscopy and Pericyclicreactions)	6	5	40	60	100
19PG3C12	Physical Chemistry-III (Group Theory, Surface Chemistry and Macromolecules)	6	5	40	60	100
19PG3C13	Green Chemistry	5	5	40	60	100
19PG3CE1 /19PG3CE2	Material Chemistry / Bio Organic Chemistry	5	4	40	60	100
19PG3C14	Physical Chemistry Practicals-I (Electrical Experiments)	6	4	40	60	100
19PG3SIC1	Internship/Summer Project*	-	3	50	50	100

	Library	2				
Total		**30**	**26**			
SEMESTER – IV (OBE)						
19PG4C15	Inorganic Chemistry-III (Organometallics & Bio-inorganic chemistry)	6	5	40	60	100
19PG4C16	Organic Chemistry-1V (Retrosynthesis, Reactions and Reagents, Natural Products)	6	5	40	60	100
19PG4C17	Physical Chemistry-IV (Spectroscopy, Kinetic Theory of gases, Photochemistry And Radiation chemistry)	6	5	40	60	100
19PG4CE3/ 19PG4CE4	Analytical chemistry / Chemical engineering	4	4	40	60	100
19PG4C18	Physical Chemistry Practicals-II (Non-electrical experiments)	6	4	40	60	100
19PG4CPR	Project*& Viva Voce	-	3	40	60	100
	Library	2				
Total		**30**	**26**			

OFF-CLASS PROGRAMME

ADD-ON COURSES

Course Code	Courses	Hrs.	Credits	Semester in which the course is offered	CIA Mks	ESE Mks	Total Marks
	SOFT SKILLS	40	4	I	40	60	100
23PAD2CA	**COMPUTER APPLICATIONS**	40	4	II	40	60	100
19PAD4CV	**COMPREHENSIVE VIVA** (Question bank to be prepared for all the papers by the respective course teachers)	-	2	IV	-	-	100
	READING CULTURE	15 / Semester	1	I-IV	-	-	-
	TOTAL		11 +				

EXTRA CREDIT COURSE

MOOC COURSES OR SELF LEARNING COURSE

MOOC COURSES:

Course Code	Courses	Hrs.	Credits	Semester in which the course is offered	CIA Mks	ESE Mks	Total Marks
	MOOC COURSES (Department Specific Courses) * Students can opt other than the listed course from UGC-SWAYAM /UGC /CEC	-	Minimum 2 Credits	-	-	-	

SELF LEARNING COURSE: OFFERED BY DEPARTMENT OF CHEMISTRY

COURSE CODE	Course TITLE	Hrs.	Credits	Semesterinwhichthecourseisoffered	CIA Mks	ESE Mks	TotalMarks
21PG2SLC	RESEARCH METHODOLOGY	-	2	II	40	60	100
22PG4SLCP	BATTERIES AND ITS APPLICATIONS	-	2	1V	40	60	100

I M.Sc.,CHEMISTRY

SEMESTER –I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG1C1	ORGANIC REACTION MECHANISM-I	PG Core	6	5

COURSE DESCRIPTION

This paper focuses on all the important aspects of organic chemistry like aromaticity, reaction intermediates and stereochemistry.

COURSE OBJECTIVES

To understand the feasibility and the mechanism of various organic reactions.

To comprehend the techniques in the determination of reaction mechanisms.

To understand the concept of stereochemistry involved in organic compounds.

To correlate and appreciate the differences involved in the various types of organic reaction mechanisms.

To design feasible synthetic routes for the preparation of organic compounds.

UNITS

UNIT –I Methods of Determination of Reaction Mechanism (18HRS.)

Reaction intermediates,The transition state, Reaction coordinate diagrams, Thermodynamic and kinetic requirements of reactions: Hammond postulate. Methods of determining mechanism: non-kinetic methods - product analysis, determination of intermediates-isolation, detection, and trapping. Cross-over experiments, isotopic labelling, isotope effects and stereo chemical evidences. Kinetic methods - relation of rate and mechanism. Effect of structure on reactivity: Hammett and Taft equations. Linear free energy relationship, partial rate factor, substituent and reaction constants.

UNIT –II Aromatic and Aliphatic Electrophilic Substitution (18HRS.)

Aromaticity: Aromaticity in benzenoid, non-benzenoid, heterocyclic compounds and annulenes. Aromatic electrophilic substitution: Orientation and reactivity of di- and polysubstituted phenol, nitrobenzene and halobenzene. Reactions involving nitrogen electrophiles: nitration, nitrosation and diazonium coupling; Sulphur electrophiles: sulphonation; Halogen electrophiles: chlorination and bromination; Carbon electrophiles: Friedel-Crafts alkylation, acylation and arylation reactions. Aliphatic electrophilic substitution Mechanisms: SE2 and SEi, SE1- Mechanism and evidences.

UNIT –III Aromatic and Aliphatic Nucleophilic Substitution (18HRS.)

Aromatic nucleophilic substitution: Mechanisms - SNAr, SN1 and Benzyne mechanisms - Evidences - Reactivity, Effect of structure, leaving group and attacking nucleophile. Reactions: Oxygen and Sulphur-nucleophiles, Bucherer and Rosenmund reactions, von Richter, Sommelet-Hauser and Smiles rearrangements. SN1, ion pair, SN2 mechanisms and evidences. Aliphatic nucleophilic substitutions at an allylic carbon, aliphatic trigonal carbon and vinyl carbon.SN1, SN2, SNi, and SE1 mechanism and evidences,Swain- Scott, Grunwald-Winstein relationship - Ambident nucleophiles.

UNIT –IV Stereochemistry-I (18HRS.)

Introduction to molecular symmetry and chirality – axis, plane, center, alternating axis of symmetry. Optical isomerism due to asymmetric and dissymmetric molecules with C, N, S based chiral centers. Optical purity, prochirality, enantiotopic and diastereotopic atoms, groups, faces, axial and planar chirality, chirality due to helical shape, methods of determining theconfiguration. Racemic modifications: Racemization by thermal, anion, cation, reversible formation, epimerization, mutarotation. D, L system, Cram's and Prelog's rules: R, S-notations, proR, proS, side phase and re phase Cahn-Ingold- Prelog rules, absolute and relative configurations. Configurations of allenes, spiranes, biphenyls, cyclooctene, helicene, binaphthyls, ansa and cyclophanic compounds, exo-cyclic alkylidene-cycloalkanes. Topicity and prostereoisomerism, chiral shift reagents and chiral solvating reagents. Criteria for optical purity: Resolution of racemic modifications, asymmetric transformations, asymmetric synthesis, destruction. Stereoselective and stereospecific synthesis.

UNIT –V Stereochemistry-II (18 HRS.)

Conformation and reactivity of acyclic systems, intramolecular rearrangements, neighbouring group participation, chemical consequence of conformational equilibrium - Curtin-Hammett Principle. Stability of five and six-membered rings: mono-, di- and polysubstitutedcyclohexanes, conformation and reactivity in cyclohexane systems. Fused and bridged rings: bicyclic, poly cyclic systems, decalins and Brett's rule. Optical rotation and optical rotatory dispersion, conformational asymmetry, ORD curves, octant rule, configuration and conformation, Cotton effect, axial haloketone rule and determination ofconfiguration.

REFERENCES:

1.J. March and M. Smith, Advanced Organic Chemistry,

5thedition,John-Wiley and Sons.2001.

2.E. S. Gould, Mechanism and Structure in Organic Chemistry,

Holt,Rinehart and Winston Inc., 1959.

1. P.S.Kalsi, Stereochemistry of carbon compounds, 8th edition, New AgeInternational Publishers, 2015.
2. P. Y. Bruice, Organic Chemistry, 7th edn, Prentice Hall, 2013.
3. J.Clayden, N. Greeves, S. Warren, Organic Compounds, 2nd edition,Oxford University Press, 2014.
4. F.A.CareyandR.J.Sundberg,AdvancedOrganicChemistryPart-Aand B, 5th edition, Kluwer Academic / Plenum Publishers, 2007.
5. D. G. Morris, Stereochemistry, RSC Tutorial Chemistry Text 1, 2001.
6. N.S.Isaacs,PhysicalOrganicChemistry,ELBS,Longman,UK,1987.
7. E.L.Eliel,StereochemistryofCarbonCompounds,Tata-McGrawHill, 2000.
8. I.L.Finar,Organicchemistry,Vol-1&2,6th edition,PearsonEducation Asia, 2004.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 Methods of Determination of Reaction Mechanism				
1.1	Reaction intermediates, The transition state, Reaction coordinate diagrams,	2	Chalk & Talk	Black Board
1.2	Thermodynamic and kinetic requirements of reactions	2	Chalk & Talk	LCD
1.3	Hammond postulate. Methods of determining mechanism: non-	2	Lecture	PPT & White

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	kinetic methods			board
1.4	product analysis, determination of intermediates-isolation, detection, and trapping	3	Lecture	Smart Board
1.5	Cross-over experiments, isotopic labelling, isotope effects and stereo chemical evidences	3	Lecture	Black Board
1.6	Kinetic methods - relation of rate and mechanism	3	Discussion	LCD
1.7	Effect of structure on reactivity: Hammett and Taft equations.	3	Lecture	Smart Board
1.8	Linear free energy relationship, partial rate factor, substituent and reactionconstants.	3	Discussion	Black Board
UNIT -2	**Aromatic and Aliphatic Electrophilic Substitution**			
2.1	Aromaticity: Aromaticity in benzenoid, non-benzenoid, heterocyclic compounds and annulenes	2	Lecture	Green Board
2.2	Aromatic electrophilic substitution: Orientation and reactivity of di- and polysubstituted phenol	2	Chalk & Talk	Green Board
2.3	nitrobenzene and halobenzene.	2	Lecture	Smart

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	Reactions involving nitrogen electrophiles: nitration, nitrosation and diazonium coupling			Room
2.4	Sulphur electrophiles: sulphonation; Halogen electrophiles	3	Chalk & Talk	Black Board
2.5	chlorination and bromination; Carbon electrophiles	2	Discussion	LCD
2.6	Friedel-Crafts alkylation, acylation and arylation reactions	2	Lecture	Black Board
2.7	Aliphatic electrophilic substitution Mechanisms	2	Lecture	Black Board
2.8	SE2 and SEi, SE1- Mechanism and evidences	3	Chalk & Talk	Black Board
UNIT -3Aromatic and Aliphatic Nucleophilic Substitution				
3.1	Aromatic nucleophilic substitution: Mechanisms - SNAr, SN1 and Benzyne mechanisms	2	Chalk & Talk	Green Board
3.2	Evidences - Reactivity, Effect of structure, leaving group and attacking nucleophile	2	Discussion	LCD
3.3	Reactions: Oxygen and Sulphur-	2	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	nucleophiles, Bucherer and Rosenmund reactions		Talk	Board
3.4	von Richter, Sommelet- Hauser and Smiles rearrangements	2	Discussion	LCD
3.5	SN1, ion pair, SN2 mechanisms and evidences	2	Lecture	Black Board
3.6	Aliphatic nucleophilic substitutions at an allylic carbon, aliphatic trigonal carbon and vinyl carbon	2	Lecture	Black Board
3.7	SN1, SN2, SNi, and SE1 mechanism and evidences	3	Chalk & Talk	Black Board
3.8	Swain- Scott, Grunwald-Winstein relationship - Ambident nucleophiles.	3	Chalk & Talk	Green Board
UNIT -4Stereochemistry-I				
4.1	Introduction to molecular symmetry and chirality – axis, plane, center, alternating axis of symmetry. Optical isomerism due to asymmetric and dissymmetric molecules with C, N, S based chiral centers	2	Chalk & Talk	Black Board
4.2	Optical purity, prochirality, enantiotopic and diastereotopic	2	Discussion	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	atoms, groups, faces, axial and planar chirality			
4.3	chirality due to helical shape, methods of determining theconfiguration. Racemic modifications: Racemization by thermal, anion, cation, reversible formation, epimerization, mutarotation	2	Chalk & Talk	Black Board
4.4	D, L system, Cram's and Prelog's rules: R, S-notations, proR, proS, side phase and re phase Cahn-Ingold- Prelog rules, absolute and relative configurations.	2	Discussion	LCD
4.5	Configurations of allenes, spiranes,biphenyls, cyclooctene, helicene, binaphthyls, ansa and cyclophanic compounds, exo-cyclic alkylidene-cycloalkanes	2	Lecture	Black Board
4.6	Topicityandprostereoisomerism, chiral shift reagents and chiral solvating reagents	2	Lecture	Black Board
4.7	Criteria for optical purity: Resolution of racemic modifications, asymmetric transformations, asymmetric	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	synthesis,destruction.			
4.8	Stereoselectiveand stereospecific synthesis.	3	Chalk & Talk	Black Board
UNIT -5Stereochemistry-II				
5.1	Conformation and reactivity of acyclic systems, intramolecular rearrangements, neighbouring group participation, chemical consequence of conformational equilibrium	2	Chalk & Talk	Black Board
5.2	Curtin-Hammett Principle. Stability of five and six-membered rings	2	Lecture	Black Board
5.3	mono-, di- and polysubstitutedcyclohexanes, conformation and reactivity in cyclohexane systems	2	Chalk & Talk	Black Board
5.4	Fused and bridged rings: bicyclic, poly cyclic systems, decalins and Brett's rule.	2	Chalk & Talk	Black Board
5.5	Optical rotation and optical rotatory dispersion	2	Chalk & Talk	Black Board
5.6	conformational asymmetry, ORD curves, octant rule	2	Discussion	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.7	configuration and conformation, Cotton effect	3	Discussion	LCD
5.8	axial haloketone rule and determination ofconfiguration.	3	Lecture	Black Board

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.							5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand,* ***K3****-Apply,* ***K4****-Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To recall the basic principles of organic chemistry.	K1, K2, K3 &K4	PSO1& PSO2
CO 2	To understand the formation and detection of reaction intermediates of organic reactions.	K1, K2, K3 &K4	PSO3
CO 3	To predict the reaction mechanism of organic reactions and stereochemistry of organic compounds.	K1, K2, K3 &K4	PSO5
CO 4	To apply the principles of kinetic and non-kinetic methods to determine the mechanism of reactions.	K1, K2, K3 &K4	PSO2
CO 5	To design and synthesize new organic compound by correlating the stereochemistry of organic compounds.	K1, K2, K3 &K4	PSO3

Mapping of C0s with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	3	3	2	1	1	1	1	1
CO2	2	3	3	1	1	1	1	1
CO3	2	2	3	1	3	1	1	1
CO4	2	1	3	1	3	1	1	1
CO5	2	1	1	1	3	1	3	1

Mapping of C0s with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	3	2	2	2
CO3	3	3	3	3
CO4	3	2	3	3
CO5	3	2	2	3

Note: ♦ Strongly Correlated – **3** ♦ ModeratelyCorrelated – **2**

♦ WeaklyCorrelated -**1**

COURSE DESIGNER:

Dr.M.Priyadharsani

Dr. V.Aruldeepa

Forwarded By

HOD's Signature

I M.Sc CHEMISTRY

SEMESTER –I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG1C2	STRUCTURE AND BONDING IN INORGANIC COMPOUNDS	PG Core	6	5

COURSE DESCRIPTION:

It deals with theories, characterization with spectral studies and determination of structures of main group compounds**.**

COURSE OBJECTIVES:

- To determine the structural properties of main group compounds
- To gain fundamental knowledge on the structural aspects of ionic crystals.
- To familiarize various diffraction and microscopic techniques.
- To study the effect of point defects and line defects in ionic crystals.
- To evaluate the structural aspects of solids.

UNIT-I: Structure of main group compounds: (18 hrs)

VB theory – Effect of lone pair and electronegativity of atoms (Bent's rule)

on the geometry of the molecules; Covalent bonding-Concept of hybridization and resonance-MO theory-MO diagram of diatomic and linear triatomic molecules-bond properties-bond energy-bond order-comparison of VB and MO theories-polarizability-VSEPR theory-shape of molecules.

UNIT-II : Periodic properties-Acids and Bases (18 hrs)

Modern long form of periodic table - Periodic properties of elements - ionic radius ionisation potential - electron affinity –

electronegativity, scales- Bronsted & Lewis concepts Non aqueous solvent - liq.ammonia, anhydrous H2SO4. HSAB principle – Simbiosis – measure and theoretical basis - application.

UNIT-III: Solid state chemistry – I: (18 hrs)

Ionic crystals: Packing of ions in simple, hexagonal and cubic close packing, voids in crystal lattice, Radius ratio, Crystal systems Structural features of the crystal

systems: Rock salt, zinc blende & wurtzite, fluorite and anti-fluorite, rutile and anatase, cadmium iodide and nickel arsenide; and Bravis lattices, Symmetry operations in crystals, glide planes and screw axis; point group and space group; Solid state energetics: Lattice energy – Born-Lande equation -Kapustinski equation, Madelung constant. Spinels -normal and inverse types and perovskite structures. Crystal growth systems-From melt and solution (hydrothermal, sol-gel methods with principles.

UNIT-IV: Techniques in solid state chemistry: (18 hrs)

X-ray diffraction technique: Bragg's law, Powder diffraction method – Principle and Instrumentation; Interpretation of XRD data – JCPDS files, Phase purity, Scherrer formula, lattice constants calculation; Systematic absence of reflections; Electron diffraction technique – principle, instrumentation and application. Electron microscopy – difference between optical and electron microscopy, theory, principle, instrumentation, sampling methods and applications of SEM and TEM.

UNIT-V: Band theory and defects in solids (18 hrs)

Band theory – features and its application of conductors, insulators and semiconductors, Intrinsic and extrinsic semiconductors; Defects in crystals – point defects (Schottky, Frenkel, metal excess and metal deficient) and their effect on the electrical and optical property, laser and phosphors; Linear defects and its effects due to dislocations

REFERENCES:

1. James.E.Huheey, *Inorganic* Chemistry, pearson publications, 4th edition,2008.

2. F.A.Cotton, G.Wilkinson, C.A. Murillo and M.Bochmann, .*Advanced Inorganic Chemistry*;6th ed.; Wiley Interscience: New York,1988.
3. K.F.Purcell and J.C.Kotz, *Inorganic Chemistry*; Saunders: Philadelphia,1976.
4. D.F.Shriver,P.W.Atkins and C.H. Langford;*Inorganic Chemistry*; 3rd ed., Oxford University Press: London,2001.

R. S. Drago, *PhysicaI Methods in Chemistry*; Saunders: Philadelphia,1977.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 STRUCTURE OF MAIN GROUP COMPOUNDS				
1.1	VB theory – Effect of lone pair and electronegativity of atoms	2	Chalk & Talk	Green Board
1.2	(Bent's rule) on the geometry of the molecules;	2	Chalk & Talk	Green Board
1.3	Covalent bonding-Concept of hybridization and resonance-MO theory-	2	Lecture	PPT & White board
1.4	MO diagram of diatomic and linear triatomic molecules	3	Chalk &Talk	Green Board
1.5	Bond properties-Bond energy-Bond order	3	Chalk &Talk	Black Board
1.6	Comparison of VB and MO theories	3	Discussion	Black Board
1.7	polarizability-VSEPR theory-shape of molecules.	3	Chalk &Talk	Black Board
UNIT -2 Periodic properties-Acids and Bases				
2.1	Modern long form of periodic table - Periodic properties of elements	2	Chalk &Talk	Green Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.2	Ionic radius ,Ionisation potential - electron affinity	2	Chalk & Talk	Green Board
2.3	Electronegativity scales	2	Lecture	Green Board
2.4	Bronsted & Lewis concepts	3	Chalk & Talk	Black Board
2.5	Non aqueous solvent - liq.ammonia	3	Discussion	LCD
2.6	Anhydrous H2SO4. HSAB principle	3	Chalk &Talk	Black Board
2.7	Simbiosis – measure and theoretical basis - application.	3	Chalk & Talk	Black Board
UNIT -3 Solid state chemistry – I				
3.1	Ionic crystals: Packing of ions in simple, hexagonal and cubic close packing, voids in crystal lattice.	2	Chalk & Talk	Green Board
3.2	Radius ratio, Crystal systems Structural features of the crystal systems:	2	Discussion	LCD
3.3	Rock salt, zinc blende & wurtzite, fluorite and anti-fluorite, rutile and anatase, cadmium iodide and nickel arsenide;	2	Chalk & Talk	Green Board
3.4	Bravis lattices, Symmetry operations in crystals, glide planes and screw axis; point group and space group	2	Discussion	LCD
3.5	Solid state energetics: Lattice energy – Born-Lande equation.	3	Lecture	Green Board
3.6	Kapustinski equation, Madelung constant.	2	Lecture	Black Board
3.7	Spinels -normal and inverse types	2	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	and perovskite structures.		Talk	Board
3.8	Crystal growth systems-From melt and solution (hydrothermal, sol-gel methods with principles.	3	Chalk & Talk	Green Board
UNIT -4 Techniques in solid state chemistry:				
4.1	X-ray diffraction technique: Bragg's law, Powder diffraction method.	2	Chalk & Talk	Black Board
4.2	Principle and Instrumentation; Interpretation of XRD data	2	Discussion	LCD
4.3	JCPDS files, Phase purity, Scherrer formula, lattice constants calculation;	2	Chalk & Talk	Black Board
4.4	Systematic absence of reflections; Electron diffraction technique	2	Discussion	LCD
4.5	principle, instrumentation and application of diffraction technique	2	Lecture	Green Board
4.6	Electron microscopy – difference between optical and electron microscopy,	2	Lecture	Green Board
4.7	Theory, principle, instrumentation,	3	Chalk & Talk	Green Board
4.8	Sampling methods and applications of SEM and TEM	3	Chalk & Talk	Green Board
UNIT -5 Band theory and defects in solids				
5.1	Band theory – features and its application.	3	Chalk & Talk	Green Board
5.2	Conductors, insulators and semiconductors, Intrinsic and extrinsic semiconductors;	2	Lecture	Green Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.3	Defects in crystals – point defects (Schottky, Frenkel, metal excess and metal deficient)	2	Chalk & Talk	Green Board
5.4	Effect on the electrical and optical property,	2	Chalk & Talk	Green Board
5.5	Effect on laser and phosphors	3	Chalk & Talk	Green Board
5.6	conformational asymmetry, ORD curves, octant rule	3	Discussion	Green Board
5.7	Linear defects and its effects due to dislocations	3	Discussion	Green Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average	Better of W1, W2	M1+M2	MID-SEM TEST				
	5 Mks.	5+5=10 Mks.	15 Mks	5 Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %

K4	**-**	**-**	**3**	**5**	**9**		**9**	**22.5%**
Non Scholastic	**-**	**-**	**-**	-	**9**		**9**	**22.5 %**
Total	**5**	**5**	**10**	**15**	**35**	**5**	**40**	**100 %**

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K1- Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse

EVALUATION PATTERN

SCHOLASTIC				**NON - SCHOLASTIC**	**MARKS**		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Compare the stabilities various compounds	K2, K3, K4 &K5	PSO1& PSO2
CO 2	To describe the theories of compounds Of ionic crystals	K2, K3, K4 &K5	PSO3
CO 3	Investigate the structures of complexes using by XRD techniques	K2, K3, K4 &K5	PSO5
CO 4	Possess a thorough understanding of electronic spectra of complexes by SEM and TEM	K2, K3, K4 &K5	PSO3
CO 5	To gain knowledge of Defect in crystals	K2, K3, K4 &K5	PSO3

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

3 – Strong, 2 – Medium, 1 - Low

COURSE DESIGNER:

1. **Dr.B.Medona**
2. **Dr.J.Jone Celestina**

Forwarded By

B. Medona.

HOD'S Signature

FATIMA COLLEGE (AUTONOMOUS), MADURAI-18

M.Sc. DEPARTMENT OF CHEMISTRY

6Hrs/ Week **No. of Credits: 2**

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG1C3	ORGANIC CHEMISTRY PRACTICALS	LAB	6	4

Course Descriptive: This course gives a hands on experience of qualitatively analyzing organic compounds and to synthesis simple organic compounds.

Course Objective: To develop the skills of students to separate binary organic mixtures into individual compounds, identifying functional groups, confirming it by preparing suitable derivatives.

Course Outcomes:

- To be skilled in the separation of binary organic mixtures
- To gain knowledge on the skills of doing micro level analysis
- . To know the methods of qualitative analysis of organic compounds
- To learn about the preparation of suitable derivative of the organic functional groups
- To prepare organic compounds.

Qualitative Analysis of an organic binary mixture

- Pilot separation
- Bulk separation

Analysis of organic compounds and preparation of derivatives using green reagents

(Instead of Bromo derivative, Benzoyl derivative is introduced).

(Instead of PCl5, Acid derivative is prepared for monoamide using NaOH and HCl)

The functional groups are combined in the following combinations.

- Acidic+ Phenolic compounds
- Basic+Phenoliccompounds
- Acidic+Neutralcompounds
- Basic+Neutralcompounds

The possible functional groups are

Carboxylic acids, Phenols, Amines, Amides, Nitrocompounds, Carbohydrates, Ester & Carbonyl compounds.

I. Double stage Organic preparations:

Preparation of

p-Bromo acetanilide from Acetanilide- Using Green reagent-CAN and KBr (Hazardous bromination is removed and usage of green reagent is introduced)

2-Naphthylbenzoate from2-Napthol

Dibenzalacetone from Benzaldehyde- can be used for starting material for Research work

Reference books:

1. Ganapragasam& Ramamurthy G, Organic Chemistry Lab Manual , 2 nd Ed., S. Vishwanathan Printers and Publishers (P) Ltd., Chennai, 2007.
2. Furniss B S, Hannaford A J, Smith P W G and Tatchell A R, Vogel's
3. Textbook of Practical Organic Chemistry, 5 th Ed., Pearson Publication.
4. Vengataswaran V et al., Basic Principle of Practical Chemistry, Sultan Chand and sons, New Delhi, 1997.
5. W. Kemp, Organic spectroscopy, McMillan, 1991.
6. R. M. Silverstein and F. X. Webster, Spectrometric Identification of organic compounds, John Wiley & Sons, Inc., 6th Ed. 2004
7. P.S.Kalsi, Spectroscopy of organic compounds, New age international publishers, 6th edition, 2009.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	PSOs ADDRESSED
CO 1	To be skilled in the separation of binary organic mixtures	PSO1& PSO2
CO 2	To gain knowledge on the skills of doing micro level analysis	PSO3
CO 3	To know the methods of qualitative analysis of organic compounds	PSO5

CO 4	To learn about the preparation of suitable derivative of the organic functional groups	PSO2
CO 5	To prepare organic compounds.	PSO3

Mapping of C0s with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	3	2	2	1	2	1	1	1
CO2	2	1	3	2	2	1	2	1	1
CO3	2	1	2	2	3	2	1	2	1
CO4	2	2	1	1	2	3	2	1	1
CO5	1	2	1	2	2	2	3	1	1

Mapping of C0s with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	1	1
CO2	2	3	1	1
CO3	3	2	1	1
CO4	2	3	1	1
CO5	3	2	1	1

Note: **Strongly Correlated – 3** **Moderately Correlated – 2**

- Weakly Correlated -**1**

COURSE DESIGNER:

1. Dr.V. Arul Deepa
2. Dr.M.Priyadharsani

Forwarded By

HOD'S Signature

I M.Sc.

SEMESTER –I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	23PG1CE1	Pharmaceutical Chemistry	MAJOR CORE	5Hrs.	3

COURSE DESCRIPTION

This paper focuses on all the important aspects of Physical concepts of Spectroscopy, Kinetic theory of gases and Photochemistry and Radiation Chemistry

COURSE OBJECTIVE:

- To understand the advanced concepts of pharmaceutical chemistry. To recall the principle and biological functions of various drugs.
- To train the students to know the importance as well the consequences of various drugs.
- To have knowledge on the various analysis and techniques. To familiarize on the drug and its structural activities.

UNIT-I Physical properties in Pharmaceuticals **15hrs**

Physical properties of drug molecule: physical properties. Refractive index- Definition, explanation, formula, importance, determination, specific & molar refraction. Optical activity\rotation- monochromatic & polychromatic light, optical activity, angle of rotation, specific rotation examples, measurement of optical activity. Dielectric constant & Induced Polarization- Dielectric constant explanation & determination. Rheology of pharmaceutical systems: Introduction,

Definition, Applications, concept of viscosity, Newton's law of flow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity. Newtonian system, non-Newtonian system- Plastic flow, Pseudoplastic flow, Dilatent flow. Viscosity measurements- selection of viscometer for Newtonian and non-Newtonian system.

UNIT-II Isotopic Dilution analysis **15hrs**

Principle and applications, Neutron activation analysis: Principle, advantages and limitations, Scintillation counters: Body scanning. Introduction to radiopharmaceuticals. Properties of various types of radiopharmaceuticals, Radiopharmaceuticals as diagnostics, as therapeutics, for research and sterilization. Physico Chemical Properties and drug action. Physico chemical properties of drugs (a) Partition coefficient, (b) solubility (c) surface activity, (d) degree of ionization.

UNIT-III Drug dosage and product development **15hrs**

Introduction to drug dosage Forms & Drug .Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms. Drug dosage and product development. Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms.

UNIT-IV Development of new drugs **15hrs**

Introduction, procedure followed in drug design, the research for lead compounds, molecular modification of lead compounds. Structure-Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect,

isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups, theories of drug activity, occupancy theory, rate theory, induced-fit theory,4.3 Quantitative structure activity relationship (QSAR): Development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables.

UNIT-V Computers in Pharmaceutical Chemistry 15hrs

Need of computers for chemistry. Computers for Analytical Chemists-Introduction to computers: Organization of computers, CPU, Computer memory, I/O devices, information storage, software components. Application of computers in chemistry: Programming in high level language (C+) to handle various numerical methods in chemistry – least square fit, solution to simultaneous equations, interpolation, extrapolation, data smoothing, numerical differentiation and integrations.

Reference Books:

1. Physical Chemistry- Bahl and Tuli.
2. Text Book of Physical Pharmaceutics, IInd edition, Vallabh Prakashan-. C.V.S. Subramanyam.
3. Medicinal Chemistry (Organic Pharmaceutical Chemistry), G.R Chatwal, Himalaya Publishing house.
4. Instrumental method of Analysis: Hubert H, Willard, 7th edition.
5. Textbook of Pharmaceutical Chemistry by, Jayshree Ghosh, S. Chand & company Ltd. Pharmaceutical Chemistry by Dr. S.Lakshmi, Sultan chand & Sons.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT –I Physical properties in Pharmaceuticals				
1.1	Physical properties of drug molecule	2	Chalk & Talk	Black Board
1.2	Refractive index- Definition, explanation, formula, importance, determination,	2	Chalk & Talk	Black Board
1.3	specific & molar refraction. Optical activity\rotation	2	Chalk & Talk	Black
1.4	monochromatic & polychromatic light	2	Chalk & Talk	Black Board
1.5	measurement of optical activity	2	Chalk & Talk	Black Board
1.6	Dielectric constant & Induced Polarization. concept of viscosity,	2	Chalk & Talk	Black Board
1.7	Newton's law of flow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity.	2	Chalk & Talk	Black Board

1.8	Newtonian system, non-Newtonian system- Plastic flow, Pseudoplastic flow, Dilatent flow.	1	Chalk & Talk	Black Board
UNIT -2 Isotopic Dilution analysis				
2.1	Principle and applications, Neutron activation analysis	2	Chalk & Talk	Black Board
2.2	Principle, advantages and limitations, Scintillation counters.	2	Chalk & Talk	Black Board
2.3	Body scanning. Introduction to radiopharmaceuticals.	2	Chalk & Talk	Black Board
2.4	Properties of various types of radiopharmaceuticals.	1	Chalk & Talk	Black Board
2.5	Radiopharmaceuticals as diagnostics, as therapeutics, for research and sterilization.	2	Chalk & Talk	Black Board
2.6	Physico Chemical Properties and drug action.	2	Chalk & Talk	Black Board
2.7	Physico chemical properties of drugs (a) Partition coefficient, (b) solubility	2	Chalk & Talk	Black Board
2.8	surface activity,degree of	2	Chalk & Talk	Black Board

	ionization			
UNIT -3 Drug dosage and product development				
3.1	Introduction to drug dosage Forms & Drug.	2	Chalk & Talk	Black Board
3.2	Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies,	2	Chalk & Talk	Black Board
3.3	sources of drug, drug nomenclature, routes of administration of drugs products.	2	Chalk & Talk	Black Board
3.4	need for a dosage form, classification of dosage forms. Drug dosage and product development.	1	Chalk & Talk	Black Board
3.5	Introduction to drug dosage Forms & Drug Delivery system.	2	Chalk & Talk	Black Board
3.6	Common terms. Drug Regulation and control, pharmacopoeias formularies.	1	Chalk & Talk	Black Board
3.7	sources of drug, drug nomenclature.	2	Chalk & Talk	Black Board
3.8	routes of administration of drugs products, need for a dosage form, classification of dosage forms.	2	Chalk & Talk	Black Board

UNIT -4 Development of new drugs				
4.1	Introduction, procedure followed in drug design.	2	Chalk & Talk	Black Board
4.2	the research for lead compounds, molecular modification of lead compounds.	2	Chalk Talk	Black Board
4.3	Structure-Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect, isoterism, bioisosterism, spatial considerations.	2	Chalk &Talk	Black Board
4.4	biological properties of simple functional groups, theories of drug activity, occupancy theory.	2	Chalk & Talk	Black Board
4.5	induced-fit theory,4.3 Quantitative structure activity relationship (QSAR):	1	Chalk & Talk	Black Board
4.6	Development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters.	2	Chalk & Talk	Black Board
4.7	lipophilicity parameters, electronic parameter, ionization constants.	2	Chalk & Talk	Black Board
4.8	steric parameters, chelation parameters, redox potential, indicator-variables.	2	Chalk & Talk	Black Board

UNIT -5 Computers in Pharmaceutical Chemistry				
5.1	Need of computers for chemistry. Computers for Analytical Chemists- Introduction to computers.	2	Chalk & Talk	Black Board
5.2	Organization of computers, CPU, Computer memory.	3	Chalk & Talk	Black Board
5.3	I/O devices, information storage, software components.	2	Chalk & Talk	Black Board
5.4	Application of computers in chemistry.	1	Chalk & Talk	Black Board
5.5	Programming in high level language (C+) to handle various numerical methods in chemistry.	1	Chalk & Talk	Black Board
5.6	least square fit, solution to simultaneous equations.	2	Chalk & Talk	Black Board
5.7	interpolation, extrapolation, data smoothing.	2	Chalk & Talk	Black Board
5.8	numerical differentiation and integrations.	2	Chalk & Talk	Black Board

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.							5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand,* ***K3****-Apply,* ***K4****-Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To identify the suitable drugs for various diseases.	K2,K3, K4 & K5	PSO1, PSO2, PSO3, PSO4, PSO6,PS07& PS08
CO 2	To apply the principles of various drug action and drug design.	K2,K3, K4 & K5	PSO1, PSO2, PSO3, PSO4, PSO6,PS07& PS08
CO 3	To acquire the knowledge on product development based on SAR.	K2,K3, K4 & K5	PSO1, PSO2, PSO3, PSO4, PSO6,PS07& PS08
CO 4	To apply the knowledge on applications of computers in chemistry.	K2,K3, K4 & K5	PSO1, PSO2, PSO3, PSO4, PSO6& PS08

CO 5	To synthesize new drugs after understanding the concepts SAR.	K2, K3, K4& K5	PSO1, PSO2, PSO3, PSO4, PSO6,PS07& PS08

Mapping of C0s with PSOs

CO / PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**	**PSO 9**
CO1	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**1**
CO2	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**1**
CO3	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**1**
CO4	**3**	**3**	**3**	**3**	**1**	**3**	**1**	**3**	**1**
CO5	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**1**

Mapping of C0s with POs

CO / PSO	**PO1**	**PO2**	**PO3**	**PO4**
CO1	**3**	**2**	**3**	**1**
CO2	**3**	**2**	**3**	**1**
CO3	**3**	**2**	**3**	**1**
CO4	**3**	**2**	**3**	**1**
CO5	**3**	**3**	**3**	**1**

Note: □Strongly Correlated – **3** □Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. Dr.K.R.SUBIMOL

Forwarded By

S-Tedora.

HOD'S Signature

PG CHEMISTRY

SEMESTER –I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG1CE2	NANO MATERIALS AND NANO TECHNOLOGY	ELECTIVE	5	3

COURSE DESCRIPTION: This paper provides an extensive study of the Nano materials, their methods of preparation, mechanical properties and their applications.

COURSE OBJECTIVES:

- To understand the concept of nano materials and nano technology.
- To understand the various types of nano materials and their properties.
- To understand the applications of synthetically important nanomaterials.
- To understand the importance of nanoelectronics and nano magnetic
- To design synthetic routes for synthetically used CNTs and Nanosensors.

UNITS

UNITI: Introduction of nanomaterials (15HRS.)

Introduction of nanomaterials and nanotechnologies, Introduction-role of size, classification-0D, 1D, 2D, 3D. Synthesis-Bottom –Up, Top–Down, Nano powders, consolidation of Nano powders- Cold Isostatic pressing, HotIsostatic pressing, sintering under pressure, Spark plasma sintering, Other nanomaterials- Fullerene and Dendrimers. Molecular mimics-Catenanes & rotaxanes and their synthesis.

UNIT-II: Metallic nano particles, synthesis and properties

(15HRS.)

Metallic nanoparticles, Magnetism and magnetic material, Magnetic Nanostructures, Magnetic nano sized materials, Appliations of magnetic nano particles, Synthesis- Physical and chemical methods - inert gas condensation, Plasma arcing, sol-gel, Electro deposition, Ball milling, solvothermal and hydrothermal-CVD-types, Microwave assisted and electrochemical synthesis.

UNIT-III: Nano electronics and nano magnetics **(15HRS.)**

Nano electronics, nanocircuiting, nanoelectronic devices (radio, computer, energy production,medical diogonistics), nanoelectronics applications- MRAM, PCM, MIM, PhC, Flip chip packing, active matrix display, OTFT, Super-RENS and biomedical. Application of semiconductor nanomaterials and devices-Injection laser, optical memories. Nanomagnetics classification of nanomagnetic materials-particulate nanomagnets, geometrical nanomagnets, magneto-resonance, nanomagnetism in technology.

UNIT-IV: Nanosensors and carbon nanotubes **(15HRS.)**

Nanosensors, existing nanosensors, electronic tongue, electronic nose-pattern analysis, silicon nano wire as sensors, noice sensitive nanosensors, nanosensors in space, nanopressure sensors, physical and chemical sensors, biosensors, quantum dot sensors. Carbon nanotubes-types, synthesis, properties and applications of carbon nanotubes.

UNIT-V: Nanofilms and nanocomposites **(15HRS.)**

Application of nanoparticles indifferentfields (nanomedicine, nanobiosensors, nanocatalyst, filtration in energy sector, information and communication and opto-electrinic devices). Nano thin films. Core-shell nanoparticles-types, synthesis (sol-gel method and electrochemical method) and properties. Nanocomposites-metal, ceramic and polymer

matrix composites and their applications. Characterization–SEM,TEM and AFM-principle, instrumentation and applications.

REFERENCES:

1. Rakesh Rathi, Nanotechnology, S.Chand&CompanyLtd, 2009
2. V.Rajendran,Material science, Tata Mc GrawHill EducationP.Ltd, 2013S.
3. T.Pradeep, A text book of Nanoscience and Nanotechnology, Tata Mc GrawHill EducationP.Ltd, 2012
4. Michael Wilson and Kamali Kannagara, Nanotechnology-Basics and emerging Technologies, Champan & Hall/CRC-Press company-Washington,D.C., 2002

COURSE CONTENTS & LECTURESCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-1 INTRODUCTION OF NANOMATERIALS AND NANOPOWDERS (12Hours)				
1.1	Introduction-roleofsize,classification of nanomaterials 0D,1D,2D,3D	2	Chalk & Talk	Black Board
1.2	Synthesis-Bottom –Up, Top–Down	2	Chalk & Talk	LCD
1.3	Features of nanostructures	2	Chalk & Talk	PPT
1.4	Background of nanostructures	2	Lecture	PPT
1.5	consolidation of Nano powders	3	Lecture	Black Boar

				d
1.6	Fullerene and Dendrimers	2	Chalk & Talk	Blac k Boar d
1.7	Fullerene and Dendrimers. Molecular mimics	2	Lecture	Blac k Boar d
UNIT-2 METALLIC NANO PARTICLES, SYNTHESIS AND PROPERTIES (12Hours)				
2.1	Metallic nanoparticles	2	Lecture	Blac k Boar d
2.2	Magnetism and magnetic material	2	Chalk & Talk	Blac k Boar d
2.3	Magnetic Nanostructures, Magnetic nano sized materials	3	Chalk & Talk	Blac k Boar d
2.4	Appliations of magnetic nano particles	2	Chalk & Talk	Blac k Boar d
2.5	Synthesis- Physical and chemical methods	2	Chalk & Talk	Blac k Boar d
2.6	Synthesis- Physical and chemical methods	2	Chalk & Talk	Blac k Boar d

2.7	Synthesis- Physical and chemical methods	2	Chalk & Talk	Black Board
UNIT-3	**NANO ELECTRONICS AND NANO MAGNETICS (12Hours)**			
3.1	Nano electronics, nanocircuiting, nanoelectronic devices.	3	Chalk & Talk	Black Board
3.2	Nanoelectronics applications	3	Chalk & Talk	Black Board
3.3	**A**pplication of semiconductor nanomaterials and devices- Injection laser, optical memories.	3	Chalk & Talk	Black Board
3.4	Nanomagnetics classification of nanomagnetic materials- particulate nanomagnets, geometrical nanomagnets	2	Chalk & Talk	Black Board
3.5	Magneto-resonance	2	Chalk & Talk	Black Board
3.6	Nanomagnetism in technology	2	Chalk & Talk	Black Board

Module No.	**Topic**	**No. of Lectures**	**Teaching Pedagogy**	**Teaching Aids**
UNIT-4 NANOSENSORS AND CARBON NANOTUBES (12Hrs)				
4.1	Nanosensors, existing nanosensors, electronic tongue	2	Chalk & Talk	PPT

4.2	Electronic nose-pattern analysis, silicon nano wire as sensors	3	Chalk & Talk	PPT
4.3	Noice sensitive nanosensors, nanosensors in space, nanopressure, sensors Physical and chemical sensors, biosensors, quantum dot sensors.	3	Chalk & Talk	PPT
4.4	Carbon nanotubes-types, synthesis.	3	Chalk & Talk	PPT
4.5	Properties and applications of carbon nanotubes.	4	Chalk & Talk	PPT
UNIT-5	NANOFILMS AND NANOCOMPOSITES	**(18 Hours)**		
5.1	Application of nanoparticles in differentfields. Nano thin films.	3	Chalk & Talk	Black Board
5.2	Core-shellnanoparticles-types,synthesis,and properties.	3	Chalk & Talk	Black Board
5.3	Nanocomposites-metal-,ceramic-and polymer-matrix composites.	3	Chalk & Talk	Black Board
5.4	SEM and TEM principle, instrumentation and applications.	3	Chalk & Talk	Black Board
5.5	AFM-principle, instrumentation and applications.	3	Chalk & Talk	Black Board

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.							5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**

- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand,* ***K3****-Apply,* ***K4****-Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

COURSE OUTCOME

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED

CO 1	Explain methods of fabricating nanostructures	K2, K3, K4 &K5	PSO1& PSO2
CO 2	Relate the unique properties of metallic nanoparticles with other nanomaterials.	K2, K3, K4 &K5	PSO3
CO 3	Discuss the electrical and magnetic properties of nano materials.	K2, K3, K4 &K5	PSO5
CO 4	Distinguish various types of nanosensors and carbon nanotubes.	K2, K3, K4 &K5	PSO3
CO 5	Explain Nanocomposites and core/shell nanoparticles.	K2, K3, K4 &K5	PSO3

Mapping of COs with PSOs

CO / PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**	**PSO 9**
CO1	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**
CO2	**2**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**
CO3	**2**	**1**	**1**	**1**	**3**	**1**	**1**	**1**	**1**
CO4	**2**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**
CO5	**2**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**

Mapping of COs with POs

CO / PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	2	3	2	2
CO3	2	2	3	2
CO4	3	2	2	2
CO5	3	2	2	2

Note: Strongly Correlated–**3** Moderately Correlated
Weakly Correlated-**1**

COURSE DESIGNER:

1. **Dr. Sr. ARULMARY**
2. **Dr.K.R.SUBIMOL**

Forwarded By

HOD's Signature

M.Sc., Chemistry

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG1CE3	Electro Chemistry	Elective-II	5	3

COURSE DESCRIPTION: It deals with concepts of electrochemistry in various aspects like interionic effect, electrode kinetics, redox reactions batteries and fuel cells.

COURSEOBJECTIVES:

- To understand the behavior of electrolytes in terms of conductance, ionic atmosphere,interactions.
- To familiarize the structure of the electrical double layer of different models.
- To compare electrodes between current density and over potential.
- To discuss the mechanism of electrochemical reactions.
- To highlight the different types of over voltages and its applications in electro analytical techniques

UNITS

UNIT-I: Ionics **(15 Hours)**

Arrhenius theory -limitations, Van't Hoff factor and its relation to

colligative properties. specific, equivalent and Molar conductance and their variation on dilution, Kohlrausch's law and its applications, Ionic activity, mean ionic activity and concept of ionic strength, Debye Huckel theory of strong electrolytes, Determination of activity coefficient from conductance measurements, ion solvent and ion-ion interactions. . Debye-Huckel Bjerrum model for ion association, Debye-Huckel limiting law ,modifications and applications . Ion association and triple ion formations.

UNIT-II: Electrode-electrolyte interface (15 Hours)

Interfacial phenomena - Evidences for electrical double layer, polarizable and non-polarizable interfaces, Electrocapillary phenomena - Lippmann equation electro capillary curves. Electro-kinetic phenomena electro-osmosis, electrophoresis, streaming and sedimentation potentials, colloidal and poly electrolytes. Structure of double layer: Helmholtz -Perrin, Guoy- Chapman and Stern models of electrical double layer. Zeta potential . Applications and limitations.

UNIT-III: Electrode Reactions: (15 Hours)

Thermodynamics of Reversible cells and reversible electrodes, EMF and equilibrium constant, Nernst equation. Liquid junction potential, applications of EMF measurements –Determination of solubility product constants, - & determination of pH. Polarographic cell Assembly, Ilkovic equation, Fick's law of diffusion, Half-wave potential, Applications of polarography.

Kinetics of electrode reactions – Butler-Volmer equation- significance of exchange current density, net current density and symmetry factor. Low and high field approximations. Tafel equations and Tafel plots.

UNIT-IV: Electrodics of Multistep Multi Electron System: (15 Hours)

Rates of multi-step electrode reactions, Butler - Volmer equation for a equilibrium and non equilibrium reaction. Rate determining step, electrode

polarization and depolarization. Transfer coefficients, its significance and determination. Corrosion-Electro-chemical reaction involving in corrosion-rate expressions, and surface coverage of corroded particles. Overvoltage - and concentration over potentials. Evolution of oxygen and hydrogen at different pH. Pourbiax and Evan's diagrams.

UNIT-V: Concentration Polarization, Batteries and Fuel cells (15 Hours)

Modes of Transport of electro active species - Diffusion, migration and hydrodynamic modes. Role of supporting electrolytes. Cyclic voltammetry-anodic and cathodic stripping voltammetry and differential pulse voltammetry. Capacitors- mechanism of energy storage. Energy production systems: Fuel Cells: classification, alkaline fuel cells, phosphoric acid fuel cells, high temperature fuel cells Sodium and lithium-ion batteries and redox flow batteries.

Recommended Text Books:

1. D. R. Crow, Principles and applications of electrochemistry, 4thedition, Chapman & Hall/CRC,2014.
2. J. Rajaram and J.C. Kuriakose, Kinetics and Mechanism of chemical transformations MacmillanIndia Ltd., New Delhi, 2011.
3. S. Glasstone, Electro chemistry, Affiliated East-West Press, Pvt.,Ltd., New Delhi, 2008.
4. B. Viswanathan, S. Sundaram, R. Venkataraman, K. Rengarajan and P.S. Raghavan, Electrochemistry-Principles and applications, S. Viswanathan Printers, Chennai,2007.
5. Joseph Wang, Analytical Electrochemistry, 2nd edition, Wiley, 2004.
6. Principles of Physical chemistry. Puri,Sharma & Pathania

Reference Books

1. J.O.M. Bockris and A.K.N. Reddy, Modern Electro chemistry, vol.1 and 2B, Springer, PlenumPress, New York, 2008.
2. J.O.M. Bockris, A.K.N. Reddy and M.G. Aldeco Morden Electro chemistry, vol. 2A, Springer,Plenum Press, New York, 2008.
3. Philip H. Rieger, Electrochemistry, 2nd edition, Springer, NewYork, 2010.
4. L.I. Antropov, Theoretical electrochemistry, Mir Publishers, 1977.
5. K.L. Kapoor, A Text book of Physical chemistry, volume-3,Macmillan, 2001

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-I	**Ionics**			**(15 Hrs.)**
1.1	Arrhenius theory limitations, Van't Hoff factor and its relation to colligative properties.	2	Chalk & Talk	Black Board
1.2	Specific, equivalent and Molar conductance and their variation on dilution.	3	Chalk & Talk	Black Board
1.3	Kohlrausch's law and its applications, Ionic activity, mean ionic activity and concept of ionic	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	strength, Debye Huckel theory of strong electrolytes.			
1.4	Determination of activity coefficient from conductance measurements, ion solvent and ion-ion interactions. ,	2	Chalk & Talk	Black Board
1.5	Debye-Huckel Bjerrum model for ion association, Debye-Huckel limiting law, modifications and applications . Ion association and triple ion formations.	3	Chalk & Talk	Black Board
UNIT-II: Electrode-electrolyte interface				**(15 Hours)**
2.1	Interfacial phenomena - Evidences for electrical double layer, polarizable and non-polarizable interfaces, Electrocapillary phenomena.	3	Chalk & Talk	Black Board
2.2	Lippmann equation electro capilla curves. Electro-kinetic phenome electro-osmosis, electrophoresis,	5	Chalk & Talk	Black Board
2.3	Streaming and sedimentation potentials, colloidal and poly	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	electrolytes. Structure of double layer: Helmholtz -Perrin,			
2.4	Guoy- Chapman and Stern models of electrical double layer. Zeta potential . Applications and limitations.	5	Chalk & Talk	Black Board
UNIT III - Stability and Magnetic property of the complexes (15 Hrs.)				
3.1	Thermodynamics of Reversible cells and reversible electrodes, EMF and equilibrium constant, Nernst equation.	3	Chalk & Talk	Black Board
3.2	Liquid junction potential, applications of EMF measurements –Determination of solubility product constants, - & determination of pH.	4	Chalk & Talk	Black Board
3.3	Polarographic cell Assembly, Ilkovic equation, Fick's law of diffusion, Half-wave potential, Applications of polarography.	4	Chalk & Talk	Black Board
3.4	Kinetics of electrode reactions – Butler-Volmer equation	2		

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	significance of exchange current density.			
3.5	Net current density and symmetry factor. Low and high field approximations. Tafel equations and Tafel plots.	2	Chalk & Talk	Black Board
UNIT IV	**Electrodics of Multistep Multi Electron System (15 Hours)**			
4.1	Rates of multi-step electrode reactions, Butler - Volmer equation for a equilibrium and non equilibrium reaction.	4	Chalk & Talk	Black Board
4.2	Rate determining step, electrode polarization and depolarization.	3	Chalk & Talk	Black Board
4.3	Transfer coefficients, its significance and determination. Corrosion-Electro-chemical reaction involving in corrosion	4	Chalk & Talk	Black Board
4.4	Rate expressions, and surface coverage of corroded particles. Overvoltage - and concentration over potentials. Evolution of oxygen and	4		

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	hydrogen at different pH. Pourbiax and Evan's diagrams.			
UNIT V Concentration Polarization, Batteries and Fuel cells (15 Hours)				
5.1	Modes of Transport of electro active species. Diffusion, migration and hydrodynamic modes.	3	Chalk & Talk	Black Board
5.2	Role of supporting electrolytes. Cyclic voltammetry, anodic and cathodic stripping voltammetry	4	Chalk & Talk	Black Board
5.3	Differential pulse voltammetry. Capacitors. Mechanisms of energy storage. Energy production systems:	4	Chalk & Talk	Black Board
5.4	Photo-isomerisation reactions in complexes and their applications.	3	Chalk & Talk	Black Board

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.							5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand****, K3****-Apply****, K4****-Analyse, K5 - Evaluate***

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To understand the behaviour of electrolytes in solution and compare the structures of electrical double layer of different models.	K1,K3 & K4	PSO1& PSO2
CO 2	To predict the kinetics of electrode reactions applying Butler-Volmer and Tafel equations	K1 & K2	PSO2 &PSO7
CO 3	To study different thermodynamic mechanism of corrosion,	K1, K2 , K3& K4	PSO6
CO 4	To discuss the theories of electrolytes, electrical double layer, electrodic and activity coefficient of electrolytes	K1, K2 & K4	PSO1
CO 5	To have knowledge on storage devices and electrochemical reaction mechanism.	K1,K2&K3	PSO4 & PSO5

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Course designer

Dr. A. Rajeswari and Dr. J. Belinda Asha

HOD'S Signature

PG CHEMISTRY

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	23PG1CE4	MOLECULAR SPECTROSCOPY	ELECTIVE	4	3

- **COURSE DESCRIPTION:**This paper provides an extensive study of the rotatioal, vibrational spectroscopy, Raman spectroscopy, ESR spectroscopy, NMR spectroscopy and correlation techniques such as COSY, HETCOR, NOESY.

COURSEOBJECTIVES:

- To understand the influence of rotation and vibrations on the spectra of the polyatomic molecules.
- To study the principle of Raman spectroscopy, ESR spectroscopy, EPR spectroscopy and fragmentation patterns in Mass spectroscopy.
- To highlight the significance of Franck-Condon principle to interpret the selection rule, intensity and types of electronic transitions.
- To interpret the first and second order NMR spectra in terms of splitting and coupling patterns using correlation techniques such as COSY, HETCOR, NOESY.
- To carry out the structural elucidation of molecules using different spectral techniques.

UNITS

UNITI: Rotational and Raman Spectroscopy: (12HRS.)

Rotational spectra of diatomic and polyatomic molecules. Intensities of rotational spectral lines, effect of isotopic substitution. Non-rigid rotators. Classical theory of the Raman effect, polarizability as a tensor, polarizability ellipsoids, quantum theory of the Raman effect, Pure rotational Raman spectra of linear and asymmetric top molecules, Stokes and anti-Stokes lines. Vibrational Raman spectra, Raman activity of vibrations, rule of mutual exclusion, rotational fine structure-O and S branches, Polarization of Raman scattered photons

UNIT-II: Vibrational Spectroscopy: (12HRS.)

Vibrations of molecules, harmonic and anharmonic oscillators- vibrational energy expression, energy level diagram, vibrational wave functions and their symmetry, selection rules, expression for the energies of spectral lines, computation of intensities, hot bands, effect of isotopic substitution. Diatomic vibrating rotor, vibrational-rotational spectra of diatomic molecules, P, R branches, breakdown of the Born-Oppenheimer approximation. Vibrations of polyatomic molecules – symmetry properties, overtone and combination frequencies. Influence of rotation on vibrational spectra of polyatomic molecule, P, Q, R branches, parallel and perpendicular vibrations of linear and symmetric top molecules.

UNIT-III: UNIT-III: Electronic spectroscopy: (12HRS.)

Electronic Spectroscopy: Electronic spectroscopy of diatomic molecules, Frank-Condon principle, dissociation and predissociation spectra. $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$ transitions and their selection rules. Photoelectron Spectroscopy: Basic principles, photoelectron spectra of simple molecules, Xray photoelectron spectroscopy (XPS). Lasers: Laser action, population

UNIT-IV: NMR and ESR spectroscopy: (12HRS.)

Chemical shift, Factors influencing chemical shifts: electronegativity and electrostatic effects; Mechanism of shielding and deshielding. Spin systems: First order and second order coupling of AB systems, Simplification of complex spectra. Spin-spin interactions: Homonuclear coupling interactions - AX, AX2, AB types. Vicinal, germinal and long-range coupling-spin decoupling. Nuclear Overhauser effect (NOE), Factors influencing coupling constants and Relative intensities. 13CNMR and structural correlations, Satellites. Brief introduction to 2D NMR – COSY, NOESY. Introduction to 31P, 19F NMR. ESR spectroscopy Characteristic features of ESR spectra, line shapes and line widths; ESR spectrometer. The g value and the hyperfine coupling parameter (A), origin of hyperfine interaction. Interpretation of ESR spectra and structure elucidation of organic radicals using ESR spectroscopy; Spin orbit coupling and significance of g-tensors, zero/non-zero field splitting, Kramer's degeneracy, application to transition metal complexes (having one to five unpaired electrons) including biological molecules and inorganic free radicals. ESR spectra of magnetically dilute samples.

UNIT-V: Mass Spectrometry, EPR and Mossbauer Spectroscopy: (12HRS.)

Ionization techniques- Electron ionization (EI), chemical ionization (CI), desorption ionization (FAB/MALDI), electrospray ionization (ESI), isotope abundance, molecular ion, fragmentation processes of organic molecules, deduction of structure through mass spectral fragmentation, high resolution. Effect of isotopes on the appearance of mass spectrum. EPR spectra of anisotropic systems - anisotropy in g- value, causes of anisotropy, anisotropy in hyperfine coupling, hyperfine splitting caused by quadrupole nuclei. Zero-field splitting (ZFS) and Kramer's degeneracy. Applications of EPR to organic and inorganic systems. Structural elucidation of organic compounds by combined spectral techniques. Principle of Mossbauer

spectroscopy: Doppler shift, recoil energy. Isomer shift, quadrupole splitting, magnetic interactions. Applications: Mossbauer spectra of high and low-spin Fe and Sn compounds

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REFERENCES:

1. C. N. Banwell and E. M. McCash, *Fundamentals of Molecular Spectroscopy*, 4th Ed., Tata McGraw Hill, New Delhi, 2000.
2. R. M. Silverstein and F. X. Webster, *Spectroscopic Identification of Organic Compounds*, 6th Ed., John Wiley & Sons, New York, 2003.
3. W. Kemp, *Applications of Spectroscopy*, English Language Book Society, 1987.
4. D. H. Williams and I. Fleming, *Spectroscopic Methods in Organic Chemistry,* 4th Ed., Tata McGraw-Hill Publishing Company, New Delhi, 1988.

   R. S. Drago, *Physical Methods in Chemistry*; Saunders: Philadelphia, 199
5. P.W. Atkins and J. de Paula, *Physical Chemistry*, 7th Ed., Oxford University Press, Oxford, 2002.

COURSE CONTENTS & LECTURESCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-1	**Rotational and Raman Spectroscopy (12Hours)**			
1.	Rotational spectra of diatomic and polyatomic molecules	1	Chalk &	Blac

1			Talk	k Boar d
1.2	Intensities of rotational spectral lines, effect of isotopic substitution. Non-rigid rotators.	2	Chalk & Talk	LCD
1.3	Classical theory of the Raman effect, polarizability as a tensor, polarizability ellipsoids	2	Chalk & Talk	PPT
1.4	quantum theory of the Raman effect, Pure rotational Raman spectra of linear and asymmetric top molecules, Stokes and anti-Stokes lines.	2	Lecture	PPT
1.5	Vibrational Raman spectra, Raman activity of vibrations	3	Lecture	Blac k Boar d
1.6	rule of mutual exclusion, rotational fine structure-O and S branches, Polarization of Raman scattered photons	2	Chalk & Talk	Blac k Boar d
UNIT-2	**Vibrational Spectroscopy (12Hours)**			
2.1	Vibrations of molecules, harmonic and anharmonic oscillators-vibrational energy expression, energy level diagram	2	Lecture	Blac k Boar d
2.2	vibrational wave functions and their symmetry, selection rules, expression for the energies of	1	Chalk & Talk	Blac k

	spectral lines			Board
2.3	computation of intensities, hot bands, effect of isotopic substitution.	1	Chalk & Talk	Black Board
2.4	Diatomic vibrating rotor, vibrational-rotational spectra of diatomic molecules, P, R branches	2	Chalk & Talk	Black Board
2.5	breakdown of the Born-Oppenheimer approximation. Vibrations of polyatomic molecules	2	Chalk & Talk	Black Board
2.6	symmetry properties, overtone and combination frequencies	2	Chalk & Talk	Black Board
2.7	Influence of rotation on vibrational spectra of polyatomic molecule, P, Q, R branches, parallel and perpendicular vibrations of linear and symmetric top molecules	2	Chalk & Talk	Black Board
UNIT-3	**Electronic spectroscopy (12Hours)**			
3.1	Electronic Spectroscopy: Electronic spectroscopy of diatomic molecules	2	Chalk & Talk	Black Boar

				d
3.2	Frank-Condon principle, dissociation and predissociation	2	Chalk & Talk	Blac k Boar d
3.3	spectra. π→π*, n→π* transitions and their selection rules	2	Chalk & Talk	Blac k Boar d
3.4	Photoelectron Spectroscopy: Basic principles, photoelectron spectra of simple molecules	2	Chalk & Talk	Blac k Boar d
3.5	Xray photoelectron spectroscopy (XPS).	2	Chalk & Talk	Blac k Boar d
3.6	Lasers: Laser action, population	2	Chalk & Talk	Blac k Boar d

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-4S NMR and ESR spectroscopy (12Hrs)				
4.1	Chemical shift, Factors influencing chemical shifts: electronegativity	1	Chalk & Talk	PPT

	and electrostatic effects; Mechanism of shielding and deshielding.			
4.2	Spin systems: First order and second order coupling of AB systems, Simplification of complex spectra. Spin-spin interactions	1	Chalk & Talk	PPT
4.3	Homonuclear coupling interactions - AX, AX2, AB types. Vicinal, germinal and long-range coupling-spin decoupling. Nuclear Overhauser effect (NOE), Factors influencing coupling constants and Relative intensities.	2	Chalk & Talk	PPT
4.4	13CNMR and structural correlations, Satellites. Brief introduction to 2D NMR – COSY, NOESY	3	Chalk & Talk	PPT
4.5	Introduction to 31P, 19F NMR. ESR spectroscopy Characteristic features of ESR spectra, line shapes and line widths; ESR spectrometer. The g value and the hyperfine coupling parameter (A), origin of hyperfine interaction.	3	Chalk & Talk	PPT
4.6	Interpretation of ESR spectra and structure elucidation of organic radicals using ESR spectroscopy; Spin orbit coupling and significance of g-tensors, zero/non-zero field splitting, Kramer's degeneracy, application	2	Chalk & Talk	PPT

	to transition metal complexes			
UNIT-5 Mass Spectrometry, EPR and Mossbauer Spectroscopy (12 Hours)				
5.1	Ionization techniques- Electron ionization (EI), chemical ionization (CI), desorption ionization (FAB/MALDI)	2	Chalk & Talk	Blac k Boar d
5.2	electrospray ionization (ESI), isotope abundance, molecular ion, fragmentation processes of organic molecules, deduction of structure through mass spectral fragmentation, high resolution.	2	Chalk & Talk	Blac k Boar d
5.3	Effect of isotopes on the appearance of mass spectrum. EPR spectra of anisotropic systems - anisotropy in g- value, causes of anisotropy, anisotropy in hyperfine coupling, hyperfine splitting caused by quadrupole nuclei.	3	Chalk & Talk	Blac k Boar d
5.4	Zero-field splitting (ZFS) and Kramer's degeneracy. Applications of EPR to organic and inorganic systems. Structural elucidation of organic compounds by combined spectral techniques	3	Chalk & Talk	Blac k Boar d
5.5	Principle of Mossbauer spectroscopy: Doppler shift, recoil energy. Isomer shift, quadrupole	2	Chalk & Talk	Blac k Boar

	splitting, magnetic interactions. Applications: Mossbauer spectra of high and low-spin Fe and Sn compounds			d

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+ M 2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.							5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand,* ***K3****-Apply,* ***K4****-Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To understand the importance of rotational and Raman spectroscopy	K2, K3, K4 &K5	PSO1& PSO2
CO 2	To apply the vibrational spectroscopic techniques to diatomic and polyatomic molecules	K2, K3, K4 &K5	PSO3
CO 3	To evaluate different electronic spectra of simple molecules using electronic spectroscopy	K2, K3, K4 &K5	PSO5
CO 4	To outline the NMR, ^{13}C NMR, 2D NMR – COSY, NOESY, Introduction to ^{31}P, ^{19}F NMR and ESR spectroscopic techniques.	K2, K3, K4 &K5	PSO3
CO 5	To develop the knowledge on principle, instrumentation and structural elucidation of simple molecules using Mass Spectrometry, EPR and Mossbauer Spectroscopy techniques	K2, K3, K4 &K5	PSO3

to:

Mapping of COs with PSOs

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9
CO1	3	3	2	1	1	1	1	1	1
CO2	2	1	3	1	1	1	1	1	1
CO3	2	1	1	1	3	1	1	1	1
CO4	2	1	3	1	1	1	1	1	1
CO5	2	1	3	1	1	1	1	1	1

Mapping of COs with POs

CO / PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	2	3	2	2
CO3	2	2	3	2
CO4	3	2	2	2
CO5	3	2	2	2

Note: Strongly Correlated–**3**Moderately Correlated –Weakly Correlated-**1**

COURSE DESIGNER:

1. **Dr.K.R.SUBIMOL**

Forwarded By

HOD's Signature

I M.SC CHEMISTRY

SEMESTER –I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG1CAE	Chemistry in Consumer Products	Ability Enhancement	2	2

COURSE DESCRIPTION: It deals with concepts of cosmetics, preparation of the house hold products and its importance

COURSEOBJECTIVES:

- To know the various ingredients in the preparation of cosmetics and house hold products
- Preparation of soaps, shampoos and other cosmetic items.
- To know the preparation of lipstics, body lotion
- To understand the preparation of other house hold products like sanitizers, sambrani, etc.

UNIT – 1 – Preparation of Cosmetics and stationeries (6 hrs.)

a) Preparation of Talcum powder – Lipstick – varnishing creams – Hair dye, body lotion, sun screen

b) Preparation of Chalk Piece, Inks, Soaps, Shampoos, Shaving Creams

UNIT 2– Personal Care Products and its Preparation (6 hrs.)

Preparation of shampoos, baby shampoo, anti-dandruff shampoo, anti-lice shampoo, Preparation of soaps, classification of soaps, washing soaps, bath soap, sanitizers – synthetic importance – Preparation of Antiseptics and disinfectants – uses.

UNIT 3 Basic Concepts Involved in the Preparation of House Hold Items (6 hrs.)

Preparation of Phenoyl – Black phenoyl – white phenoyl – synthetic importance – Preparation of Ink – Synthetic importance and Preparation of Detergent Powder – Cleaning powder -– Synthetic importance – Preparation of candles – Chalk crayons – Computer Sambrani.

UNIT 4 Hands-on Training on the Preparation of House Hold Products (6 hrs)

Candles, Black phenoyl, White phenoyl, Sanitizers, Computer sambrani, Detergent powder, Floor cleaning agents

Unit 5 Perfumes (6 hrs)

Classification - Natural – plant origin – parts of the plant used, chief constituents; animal origin – amber gries from whale, civetone from civet cat, musk from musk deer; synthetic – classification emphasizing characteristics – esters – alcohols – aldehydes – ketones

CONTENTS & LECTURESCHEDULE

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-1 Preparation of Cosmetics (6 hrs.) – – –				
1.1	Preparation of Talcum powder.	1	Chalk & Talk	Black Board
1.2	Lipstick	1	Chalk & Talk	Black Board
1.3	varnishing creams	2	Lecture	Black Board
1.4	Hair dye, body lotion, sun screening	2	Lecture	Black Board
UNIT-2 Personal Care Products and its Preparation (6 hrs.)				

2.1	Preparation of shampoos, baby shampoo,	1	Lecture	Black Board
2.2	Anti-dandruff shampoo, anti-lice shampoo, Preparation of soaps, classification of soaps	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.3	washing soaps, bath soap, sanitizers – synthetic importance	2	Chalk & Talk	Black Board
2.4	Preparation of Antiseptics and disinfectants – uses.	1	Chalk & Talk	Black Board
UNIT-3 Basic Concepts Involved in the Preparation of House Hold Items (6 hrs.)				
3.1	Preparation of Phenoyl, Black phenoyl white phenoyl, synthetic importance	2	Chalk & Talk	Black Board
3.2	Preparation of Ink – Synthetic importance and Preparation of Detergent Powder – Cleaning powder	2	Chalk & Talk	Black Board
3.3	Synthetic importance – Preparation of candles	1	Chalk & Talk	Black Board
3.4	Chalk crayons – Computer Sambrani .	1	Chalk & Talk	Black Board
UNIT-4 Hands-on Training on the Preparation of House Hold Products (6 hrs) ➢				

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.1	Candles, Black phenoyl	2	Chalk & Talk	Black Board
4.2	White phenoyl, Sanitizers	2	Chalk & Talk	Black Board
4.3	Computer sambrani, Detergent powder Floor cleaning agents	2	Chalk & Talk	Black Board
UNIT-5 Hands on Training to the Preparation of Common Products (6 hrs)				
5.1	Chalk Piece, Inks	3	LCD	LCD
5.2	Soaps, Shampoos	3	PPT	PPT
5.3	Shaving Creams , Lipstick	3	Chalk & Talk	Black Board

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+ M 2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.							5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand****, K3****-Apply****, K4****-Analyse, K5 - Evaluate***

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

Course Learning Outcomes (for Mapping with POs and PSOs)

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To understanding the preparation of cosmetics	K2, K3, K4&K5	PSO1& PSO2
CO 2	To know the preparation of some personal care products like soap and shampoos	K2, K3, K4&K5	PSO3
CO 3	To explore the preparation methods of house hold products	K2, K3, K4&K5	PSO5
CO 4	Hands-on training on the preparation of the house hold products		PSO3
CO 5	Hands-on training on the preparation of some common products		PSO3

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**S**

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

COURSE DESIGNER

1.Dr.J.Belinda Asha

2.Dr.J.Jone Celestina

Forwarded By

HOD's Signature

I M.Sc.,CHEMISTRY

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG2C4	ORGANIC REACTION MECHANISM-II	PG Core	6	5

COURSE DESCRIPTION

This paper focuses on all the important aspects of organic chemistry like aromaticity, reaction intermediates and stereochemistry.

COURSE OBJECTIVES

To understand the feasibility and the mechanism of various organic reactions.

To comprehend the techniques in the determination of reaction mechanisms.

To understand the concept of stereochemistry involved in organic compounds.

To correlate and appreciate the differences involved in the various types of organic reaction mechanisms.

To design feasible synthetic routes for the preparation of organic compounds.

UNITS

UNIT-I: Elimination and Free Radical Reactions: **(18 hrs)**

Mechanisms: E2, E1, and E1cB mechanisms. Syn- and anti-eliminations. Orientation of the double bond: Hoffmann and Saytzeff rules. Reactivity: Effect of substrate, attacking bases, leaving group and medium. Stereochemistry of eliminations in acyclic and cyclic systems, pyrolytic elimination. Long lived and short-lived radicals – Production of radicals by thermal and photochemical reactions, Detection and stability of radicals, characteristics of free radical reactions and free radical, reactions of radicals; polymerization, addition, halogenations, aromatic substitutions, rearrangements. Reactivity: Reactivity on aliphatic, aromatic substrates, reactivity in the attacking radical, effect of solventconstants.

UNIT-II: Oxidation and Reduction Reactions: (18hrs)

Mechanisms: Direct electron transfer, hydride transfer, hydrogen transfer, displacement, addition-elimination, oxidative and reductive coupling reactions. Mechanism of oxidation reactions: Dehydrogenation by quinones, selenium dioxides, ferricyanide, mercuric acetate lead tetraacetate, permanganate, manganese dioxide, osmium tetroxide, oxidation of saturated hydrocarbons, alkyl groups, alcohols, halides and amines. Reactions involving cleavage of C-C bonds - cleavage of double bonds, oxidative decarboxylation, allylic oxidation, oxidation by chromium trioxide-pyridine, DMSO-Oxalyl chloride (Swern oxidation) and Corey-Kim oxidation, dimethyl sulphoxide- dicyclohexyl carbodiimide (DMSO-DCCD). Mechanism of reduction reactions: Wolff-Kishner, Clemmenson, Rosenmund, reduction with Trialkyl and triphenyltin hydrides, McFadyen-Steven's reduction, Homogeneous hydrogenation, Hydroboration with cyclic systems, MPV and Bouveault-Blanc reduction.

UNIT-III: Rearrangements: (18 hrs)

Rearrangements to electron deficient carbon: Pinacol-pinacolone and semi-pinacolone rearrangements -applications and stereochemistry, Wagner-Meerwein, Demjanov, Dienone-phenol, Baker-Venkataraman, Benzilic acid and Wolff rearrangements. Rearrangements to electron deficient nitrogen: Hofmann, Curtius, Schmidt, Lossen, Beckmann and abnormal Beckmann rearrangements. Rearrangements to electron deficient oxygen: Baeyer-

Villiger oxidation and Dakin rearrangements. Rearrangements to electron rich atom: Favorskii, Quasi-Favorskii, Stevens, [1,2]-Wittig and [2,3]-Wittig rearrangements. Fries and Photo Fries rearrangement. Intramolecular rearrangements – Claisen, abnormal Claisen, Cope, oxy-Cope Benzidine rearrangements.

UNIT-IV: Addition to Carbon Multiple Bonds: (18hrs)

Mechanisms: (a) Addition to carbon-carbon multiple bonds- Addition reactions involving electrophiles, nucleophiles, free radicals, carbenes and cyclic mechanisms-Orientation and reactivity, hydrogenation of double and triple bonds, Michael reaction, addition of oxygen and Nitrogen; (b) Addition to carbon-hetero atom multiple bonds: Mannich reaction, acids, esters, nitrites, addition of Grignard reagents, Wittig reaction, Prins reaction. Stereochemical aspects of addition reactions. Addition to Carbon-Hetero atom Multiplebonds: Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Mechanism of condensation reactions involving enolates –Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

UNIT-V: Reagents and Modern Synthetic Reactions: (18hrs)

Lithium diisopropylamine (LDA), Azobisisobutyronitrile (AIBN), Sodium cyanoborohydride ($NaBH_3CN$), *meta*-Chloroperbenzoic acid (m-CPBA), Dimethyl aminiopyridine (DMAP), n-Bu_3SnD, Triethylamine (TEA), Diazobicyclo[5.4.0]undec-7-ene (DBU), Diisopropylazodicarboxylate (DIAD), Diethylazodicarboxylate (DEAD), *N*-bromosuccinimide (NBS), Trifluoroacetic acid (TFA), Tetramethyl piperiridin-1-oxyl (TEMPO), Phenyltrimethylammonium tribromide (PTAB). Diazomethane and Zn-Cu, Diethyl maleate (DEM), Copper diacetylacetonate ($Cu(acac)_2$), $TiCl_3$, $NaIO_4$, Pyridinium chlorochromate (PCC), Pyridinium dichromate (PDC), Meisenheimer complex**.** Suzuki coupling, Heck reaction, Negishi reaction, Baylis-Hillman reaction.

REFERENCES:

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5th edition,John-Wiley and Sons.2001.

2.E. S. Gould, Mechanism and Structure in Organic Chemistry, Holt,Rinehart and Winston Inc., 1959.

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4. P. Y. Bruice, Organic Chemistry, 7th edn, Prentice Hall, 2013.

5. J.Clayden, N. Greeves, S. Warren, Organic Compounds, 2nd edition,Oxford University Press, 2014.

6. F.A.CareyandR.J.Sundberg,AdvancedOrganicChemistryPart-Aand B, 5th edition, Kluwer Academic / Plenum Publishers, 2007.

7. D. G. Morris, Stereochemistry, RSC Tutorial Chemistry Text 1, 2001.

8. N.S.Isaacs,PhysicalOrganicChemistry,ELBS,Longman,UK,1987.

9. E.L.Eliel,StereochemistryofCarbonCompounds,Tata-McGrawHill, 2000.

10. I.L.Finar,Organicchemistry,Vol-1&2,6th edition,PearsonEducation Asia, 2004.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 Methods of Determination of Reaction Mechanism				
1.1	Reaction intermediates, The transition state, Reaction coordinate diagrams,	2	Chalk & Talk	Black Board
1.2	Thermodynamic and kinetic requirements of reactions	2	Chalk & Talk	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
1.3	Hammond postulate. Methods of determining mechanism: non-kinetic methods	2	Lecture	PPT & White board
1.4	product analysis, determination of intermediates-isolation, detection, and trapping	2	Lecture	Smart Board
1.5	Cross-over experiments, isotopic labelling, isotope effects and stereo chemical evidences	2	Lecture	Black Board
1.6	Kinetic methods - relation of rate and mechanism	2	Discussion	LCD
1.7	Effect of structure on reactivity: Hammett and Taft equations.	3	Lecture	Smart Board
1.8	Linear free energy relationship, partial rate factor, substituent and reactionconstants.	3	Discussion	Black Board
UNIT -2	**Aromatic and Aliphatic Electrophilic Substitution**			
2.1	Aromaticity: Aromaticity in benzenoid, non-benzenoid, heterocyclic compounds and annulenes	2	Lecture	Green Board
2.2	Aromatic electrophilic substitution: Orientation and reactivity of di- and	2	Chalk & Talk	Green Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	polysubstituted phenol			
2.3	nitrobenzene and halobenzene. Reactions involving nitrogen electrophiles: nitration, nitrosation and diazonium coupling	2	Lecture	Smart Room
2.4	Sulphur electrophiles: sulphonation; Halogen electrophiles	2	Chalk & Talk	Black Board
2.5	chlorination and bromination; Carbon electrophiles	2	Discussion	LCD
2.6	Friedel-Crafts alkylation, acylation and arylation reactions	2	Lecture	Black Board
2.7	Aliphatic electrophilic substitution Mechanisms	3	Lecture	Black Board
2.8	SE2 and SEi, SE1- Mechanism and evidences	3	Chalk & Talk	Black Board
UNIT -3Aromatic and Aliphatic Nucleophilic Substitution				
3.1	Aromatic nucleophilic substitution: Mechanisms - SNAr, SN1 and Benzyne mechanisms	2	Chalk & Talk	Green Board
3.2	Evidences - Reactivity, Effect of structure, leaving group and	2	Discussion	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	attacking nucleophile			
3.3	Reactions: Oxygen and Sulphur-nucleophiles, Bucherer and Rosenmund reactions	2	Chalk & Talk	Black Board
3.4	von Richter, Sommelet- Hauser and Smiles rearrangements	3	Discussion	LCD
3.5	SN1, ion pair, SN2 mechanisms and evidences	2	Lecture	Black Board
3.6	Aliphatic nucleophilic substitutions at an allylic carbon, aliphatic trigonal carbon and vinyl carbon	2	Lecture	Black Board
3.7	SN1, SN2, SNi, and SE1 mechanism and evidences	2	Chalk & Talk	Black Board
3.8	Swain- Scott, Grunwald-Winstein relationship - Ambident nucleophiles.	3	Chalk & Talk	Green Board
UNIT -4Stereochemistry-I				
4.1	Introduction to molecular symmetry and chirality – axis, plane, center, alternating axis of symmetry. Optical isomerism due to asymmetric and dissymmetric molecules with C,	2	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	N, S based chiral centers			
4.2	Optical purity, prochirality, enantiotopic and diastereotopic atoms, groups, faces, axial and planar chirality	2	Discussion	LCD
4.3	chirality due to helical shape, methods of determining theconfiguration. Racemic modifications: Racemization by thermal, anion, cation, reversible formation, epimerization, mutarotation	2	Chalk & Talk	Black Board
4.4	D, L system, Cram's and Prelog's rules: R, S-notations, proR, proS, side phase and re phase Cahn-Ingold- Prelog rules, absolute and relative configurations.	2	Discussion	LCD
4.5	Configurations of allenes, spiranes,biphenyls, cyclooctene, helicene, binaphthyls, ansa and cyclophanic compounds, exo-cyclic alkylidene-cycloalkanes	2	Lecture	Black Board
4.6	Topicityandprostereoisomerism, chiral shift reagents and chiral solvating reagents	2	Lecture	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.7	Criteria for optical purity: Resolution of racemic modifications, asymmetric transformations, asymmetric synthesis,destruction.	3	Chalk & Talk	Black Board
4.8	Stereoselectiveand stereospecific synthesis.	3	Chalk & Talk	Black Board
UNIT -5Stereochemistry-II				
5.1	Conformation and reactivity of acyclic systems, intramolecular rearrangements, neighbouring group participation, chemical consequence of conformational equilibrium	2	Chalk & Talk	Black Board
5.2	Curtin-Hammett Principle. Stability of five and six-membered rings	2	Lecture	Black Board
5.3	mono-, di- and polysubstitutedcyclohexanes, conformation and reactivity in cyclohexane systems	2	Chalk & Talk	Black Board
5.4	Fused and bridged rings: bicyclic, poly cyclic systems, decalins and Brett's rule.	3	Chalk & Talk	Black Board
5.5	Optical rotation and optical	3	Chalk &	Black

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	rotatory dispersion		Talk	Board
5.6	conformational asymmetry, ORD curves, octant rule	2	Discussion	LCD
5.7	configuration and conformation, Cotton effect	2	Discussion	LCD
5.8	axial haloketone rule and determination ofconfiguration.	2	Lecture	Black Board

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-							5	12.5 %

Scho.								
Total	**5**	**10**	**15**	**5**	**35**	**5**	**40 mks.**	**100 %**

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand,* ***K3****-Apply,* ***K4****-Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				**NON - SCHOLASTIC**	**MARKS**		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSE
CO 1	To understand the concept of aromaticity in benzenoid, non-benzenoid, heterocyclic and annulene compounds.	K1, K2, K3 &K4	PSO1& PSO
CO 2	To understand the mechanism involved in various types of organic reactions with evidences.	K1, K2, K3 &K4	PSO3
CO 3	To understand the applications of synthetically important reagents.	K1, K2, K3 &K4	PSO5
CO 4	To correlate the reactivity between aliphatic and aromatic compounds.	K1, K2, K3 &K4	PSO2
CO 5	To design synthetic routes for synthetically used organic reactions.	K1, K2, K3 &K4	PSO3

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

COURSE DESIGNER:

Dr.M.Priyadharsani

Dr. V.Aruldeepa

Forwarded By

Forwarded By

HOD's Signature

PG CHEMISTRY

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG2C5	Physical chemistry-I (Chemical Kinetics & Thermodynamics)	MAJOR CORE	6	5

COURSE DESCRIPTION:

This paper provides an extensive study of the topics such as Chemical kinetics and Thermodynamics.

COURSEOBJECTIVES:

This course gives a detailed study of, chemical thermodynamics, statistical thermodynamics, reversible thermodynamics, kinetics of complex and fast reactions and theories of molecular reactions.

UNITS

UNIT-I: Classicalthermodynamics **(18HRS.)**

Partial molar properties- Chemical potential, Gibb's-Duhem equation-binary and ternary systems. Determination of partial molar quantities-method of slope and method of intercept. Thermodynamics of real gases-Fugacity-determination of fugacity by graphical and equation of state methods-dependence of temperature and pressure. Thermodynamics of ideal and non-ideal binary mixtures, Duhem-Margulus equation applications of ideal and non-ideal mixtures. Activity and activity coefficients- standard states

determination- vapour pressure, EMF and freezing point methods

UNIT-II: Statisticalthermodynamics (18HRS.)

Introduction of statistical thermodynamics concepts of thermodynamic and mathematical probabilities- distribution of distinguishable and non-distinguishable particles. Assemblies, microstate and macrostate, ensembles-micro canonical, canonical and grand canonical ensembles. Maxwell-Boltzmann, Fermi Dirac & Bose-Einstein Statistics- comparison and applications. Partition functions- evaluation of translational, vibrational and rotational partition functions. Thermodynamic functions in terms of partition functions- Statistical approach to Thermodynamic properties-pressure, internal energy, entropy, enthalpy ,Gibb's function, Helmholtz function, work function. Calculation of equilibrium constant from partition function.

UNIT-III: Statistical approach to heat capacity & irreversible thermodynamics: (18HRS.)

Heat capacity of solids- Dulong and Petit law- Heat capacity of solids-Einstein and Debye models-Debye T Cubed law of heat capacity of crystals.

Theories of conservation of mass and energy entropy production in open systems by heat, matter. force and flux concepts. Onsager theory- validity and verification-Onsager reciprocal relationships. Electrokinetic and thermo mechanical effects-Application of irreversible thermodynamics to biological systems.

UNIT-IV: Kinetics of reactions (18HRS.)

Theories of reaction rate -effect of temperature on reaction rates, collision theory of reaction rates, Unimolecular reactions- Lindeman and Christiansen hypothesis- limitations of Lindemann theory. molecular beams, collision cross sections, effectiveness of collisions. Transition state theory-evaluation of thermodynamic parameters of activation-applications of ARRT to reactions between atoms and molecules, Hinshel wood theory. Factors determine the reaction rates in solution –influence of ionic strength on reacton rate- primary salt effect and secondary salt effect, Homogeneous catalysis-acid-base catalysis-mechanism of acid base catalyzed reactions- enzyme catalysis-Michelis-Menton catalysis.

UNIT-V: **Kinetics of complex and fast reactions:** **(18HRS.)**

Kinetics of complex reactions, reversible reactions, consecutive reactions, parallelreactions, chainreactions. Chain reactions-chain length, kinetics of H_2– Cl_2 & H_2– Br_2 reactions (Thermal and Photochemical reactions) -Rice Herzfeld mechanism. Study of fast reactions-relaxation methods-temperature and pressure jump methods -stopped flow flash photolysis methods and pulse radiolysis. Kinetics of polymerization- free radical, cationic, anionic polymerization –Poly-condensation.

REFERENCES:

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4. K.J.Laidler, Chemical Kinetics,3rdedition,Pearson,Reprint-2013.

J.Rajaramand J.C. Kuriokose, Kinetics and Mechanisms of chemical transformation, Macmillan India Ltd, Reprint – 2011

COURSE CONTENTS & LECTURESCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-1	**CLASSICALTHERMODYNAMICS (18Hours)**			
1.1	Partial molarproperties-Chemical potential	2	Chalk & Talk	Black Board
1.2	Gibb's-Duhem equation-binary and ternary systems	3	Chalk & Talk	LCD
1.3	Determination of partial molar quantities- method of slope and method of intercept.	2	Chalk & Talk	PPT
1.4	Thermodynamics of real gases Fugacity-determination of fugacity by graphical and equation of state methods-dependence of temperature and pressure.	2	Lecture	PPT
1.5	Thermodynamics of ideal and non-ideal binary mixtures,	2	Lecture	Black Board
1.6	Duhem-Margulus equation applications of ideal and non-ideal mixtures	2	Chalk & Talk	Black Board
1.7	Activity and activity coefficients-standardstates	3	Lecture	Black Board
1.8	Determination of activity-vapour pressure and freezing point methods	2	Chalk & Talk	Black Board

UNIT-2 STATISTICALTHERMODYNAMICS (18Hours)				
2.1	Introduction of statistical thermodynamics concepts of thermodynamic and mathematical probabilities-distribution of distinguishable and non-distinguishable particles.	2	Lecture	Black Board
2.2	Assemblies, ensembles, canonical particles. Maxwell-Boltzmann, Statistics.	3	Chalk & Talk	Black Board
2.3	Fermi Dirac & Bose-Einstein Statistics comparison and applications	4	Chalk & Talk	Black Board
2.4	Partition functions-evaluation of translational, vibrational and rotational partition functions	3	Chalk & Talk	Black Board
2.5	Thermodynamic functions in terms of partition functions.	2	Chalk & Talk	Black Board
2.6	Statistical approach to thermodynamic properties: pressure, internal energy, entropy, enthalpy, Gibb's function, Helm holtz function.	2	Chalk & Talk	Black Board
2.7	Equilibrium constants calculation.	2	Chalk & Talk	Black Board
UNIT-3 STATISTICAL APPROACH TO HEAT CAPACITY & IRREVERSIBLE THERMODYNAMICS (18Hours)				
3.1	Heat capacity of solids- Dulong and Petit law.	2	Chalk & Talk	Black Board
3.2	Heat capacity of solids-Einstein and Debye models	3	Chalk & Talk	Black Board

3.3	Theories of conservation of mass and energy. Entropy production in open systems by heat and matter	3	Chalk & Talk	Black Board
3.4	Flow, force and flux concepts Onsager theory-validity and verification-Onsager reciprocal relationships	4	Chalk & Talk	Black Board
3.5	Electro kinetic and thermo mechanical effects	3	Chalk & Talk	Black Board
3.6	Application of irreversible thermodynamics to biological systems	3	Chalk & Talk	Black Board

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-4	**KINETICS OF REACTIONS (18Hrs)**			
4.1	Theories of reactions-effect of temperature on reaction rates	2	Chalk & Talk	PPT
4.2	Collision theory of reaction rates, uni-molecular reactions-Lindeman and Christiansen hypothesis	4	Chalk & Talk	PPT
4.3	Molecular beams, collision cross sections, effectiveness of collisions	3	Chalk & Talk	PPT
4.4	Transition state theory-evaluation of thermodynamic parameters of activation-applications of ARRT to reactions between atoms and molecules.	2	Chalk & Talk	PPT

4.5	Factors determine the reaction rates in solution -primary salt effect and secondary salt effect	3	Chalk & Talk	PPT
4.6	Homogeneous catalysis-acid-base catalysis-mechanism of acid base catalyzed reactions,	2	Chalk & Talk	PPT
4.7	Enzyme catalysis-Michelis-Menton catalysis.	2	Chalk & Talk	PPT
UNIT-5	**KINETICS OF COMPLEX AND FASTREACTIONS**			**(18 Hours)**
5.1	Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions. Chain reactions-chain length	4	Chalk & Talk	Black Board
5.2	Kinetics of H_2– Cl_2 & H_2– Br_2 reactions	3	Chalk & Talk	Black Board
5.3	Rice Herzfeld mechanism. Study of fast reactions-relaxation methods-temperature and pressure jump methods	3	Chalk & Talk	Black Board
5.4	Electric and magnetic field jump methods-stopped flow flash photolysis methods and pulse radiolysis	4	Chalk & Talk	Black Board
5.5	Kinetics of polymerization-free radical, cationic, anionic polymerization –Poly-condensation.	4	Chalk & Talk	Black Board

CIA COMPONENTS

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session-wise Average 5 Mks.	Better ofW1, W2 5+5=10 Mks.	M1+M2 15Mks	MID-SEM TEST 5Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA	
Scholastic	35
Non Scholastic	5
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**

- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for PG are:**

  K1-Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse, **K5** - Evaluate

- ✓ **The I PG course teachers are requested to start conducting S1, W1,M1,**

EVALUATIONPATTERN

SCHOLASTIC				NON – SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Average of Two Session Wise Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Best of Two Weekly Tests

C5 – Non – Scholasti

COURSE OUTCOME

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED

CO 1	Determine partial molar quantities and assess partition functions.	K2, K3, K4 &K5	PSO1& PSO2
CO 2	Categorize and compare various partition functions - translational, rotational, vibrational and electronic partition functions and distinguish various Statistics	K2, K3, K4 &K5	PSO3
CO 3	Deduce Onsagar's theory and its validity.	K2, K3, K4 &K5	PSO5
CO 4	Deduce the rate of chemical reactions to understand mechanism involved in reactions.	K2, K3, K4 &K5	PSO3
CO 5	Examine the kinetics of complex and fast reactions.	K2, K3, K4 &K5	PSO3

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

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9
CO1	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**
CO2	**2**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**
CO3	**2**	**1**	**1**	**1**	**3**	**1**	**1**	**1**	**1**
CO4	**2**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**
CO5	**2**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	2	3	2	2
CO3	2	2	3	2
CO4	3	2	2	2
CO5	3	2	2	2

Note:

Strongly Correlated–**3** Moderately Correlated –2 Weakly Correlated-**1**

COURSE DESIGNER:

1. **Dr.S.SUKUMARI**
2. **Dr.K.R.SUBIMOL**

Forwarded By

HOD'S Signature

FATIMA COLLEGE (AUTONOMOUS), MADURAI-18

M.Sc. DEPARTMENT OF CHEMISTRY

6Hrs/ Week **No. of Credits:4**

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG2C6	INORGANIC CHEMISTRY PRACTICALS	LAB	6	4

Course Descriptive: This course gives a hands on experience of qualitatively analyzing inorganic compounds and to do complexometric titrations.

Course Objective: To understand and enhance the visual observation as an analytical toolfor the qualitative and quantitative estimation of ions.
To recall the principle and theory in preparing standard solutions.
To train the students for improving their skill in estimating the amountof ion accurately present in the solution
To estimate metal ions, present in the given solution accurately without using instruments.

Course Outcomes:

- To identify the anions and cations present in a mixture of salts
- To apply the principles of semi micro qualitative analysis to categorize acid radicalsand basic radicals.
- To acquire the qualitative analytical skills by selecting suitable confirmatory tests andspot tests.
- To choose the appropriate chemical reagents for the detection of cations.

- To synthesize coordination compounds in good quality.

Analysis of mixture of cations: Analysis of a mixture of four cations containing two common cations and two rare cations. Cations tobe tested.

- Group-I : W, Tl and Pb.
- Group-II : Se, Te, Mo, Cu, Bi and Cd.
- Group-III : Tl, Ce, Th, Zr, V, Cr, Fe, Ti and U
- Group-IV : Zn, Ni, Co and Mn.
- Group-V : Ca, Ba and Sr.
- Group-VI : Li and Mg.

Preparation of metal complexes: Preparation of inorganiccomplexes:

a. Preparation of tristhioureacopper(I)sulphate
b. Preparation of tetramminecopper(II) sulphate
c. Preparation of hexathioureacopper(I) chloridedihydrate
d. Preparation of hexathiourealead(II) nitrate

Complexometric Titration:

1. Estimation of zinc.
2. Estimation of nickel.
3. Estimation of magnesium.

REFERENCE BOOKS:

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
2. G. Marr and B. W. Rockett, Practical Inorganic Chemistry ,VonNostrand Reinhold Co., London (1972).
3. J. Bassett, G. H. Jeffery and J. Mendham, and R. C. Denny, Vogel's text book of Quantitative Chemical Analysis, 5th Edition, Longman Scientific and Technical (1999).

NO.	COURSE OUTCOMES	PSOs ADDRESSED
CO 1	Describe the principle and procedure of quantitative analysis	PSO1, PSO2, PSO3, PSO6&PSO7
CO 2	Identify thesuitable complexing agents for the given metal ions	PSO1, PSO2, PSO3, PSO6&PSO7
CO 3	Draw the structure of various ligands and complexes	PSO1, PSO2, PSO3, PSO6&PSO7
CO 4	Distinguish volumetric analysis and gravimetic analysis	PSO1, PSO2, PSO3, PSO6&PSO7
CO 5	Apply the expressions of various terms in calculations	PSO1, PSO2, PSO3, PSO6&PSO7

Mapping of C0s with PSOs

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	3	3	1	1	3	3	2	1
CO2	3	3	3	1	1	3	3	2	1
CO3	3	3	3	1	1	3	3	2	1
CO4	3	3	3	1	1	3	3	2	1
CO5	3	3	3	1	1	3	3	2	1

Mapping of C0s with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	3	2	1
CO2	3	3	2	1
CO3	3	3	2	1
CO4	3	3	2	1
CO5	3	3	2	1

Note: □Strongly Correlated – 3 □Moderately Correlated – **2**

- Weakly Correlated -**1**

COURSE DESIGNER:

1. Dr.V. Arul Deepa
2. Dr.M. Priyadharsani

Forwarded By

HOD'S Signature

IM.Sc.

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	23PG2CE5	Medicinal chemistry	Elective	4Hrs.	3

COURSE DESCRIPTION

This paper focuses on all the important aspects of Physical concepts of Spectroscopy, Kinetic theory of gases and Photochemistry and Radiation Chemistry

COURSE OBJECTIVES

- To study the chemistry behind the development of pharmaceutical materials.
- To gain knowledge on mechanism and action of drugs.
- To understand the need of antibiotics and usage of drugs.
- To familiarize with the mode of action of diabetic agents and treatment of diabetes.
- To identify and apply the action of various antibiotics.

UNIT-I Introduction to receptors 12hrs

Introduction, targets, Agonist, antagonist, partial agonist. Receptors, Receptor types, Theories of Drug – receptor interaction, Drug synergism, Drug resistance, physicochemical factors influencing drug action

UNIT-II Antibiotics 12 hrs

Introduction, Targets of antibiotics action, classification of antibiotics, enzyme-based mechanism of action, SAR of penicllins and tetracyclins, clinical application of penicillins, cephalosporin.Current trends in antibiotic therapy.

UNIT-III Antihypertensive agents 12 hrs

Classification of cardiovascular agents, introduction to hypertension, etiology, types, classification of antihypertensive agents, classification and mechanism of action of diuretics, Furosemide, Hydrochlorothiazide, Amiloride.

UNIT-IV Diuretics 12 hrs

Classification of diureticxs, introduction to hypertension, etiology, types, classification of diuretics, mechanism of action of diuretics, Furosemide, Hydrochlorothiazide, Amiloride.

UNIT-V Analgesics, Antipyretics and Anti-inflammatory Drugs 12 hrs

Introduction, Mechanism of inflammation, classification and mechanism of action and paracetamol, Ibuprofen, Diclofenac, naproxen, indomethacin, phenylbutazone and meperidine. Medicinal Chemistry of Antidiabetic Agents Introduction, Types of diabetics, Drugs used for the treatment, chemical classification, Mechanism of action, Treatment of diabetic mellitus. Chemistry of insulin, sulfonyl urea.

Reference Books:

1. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry,
2. Wilson, Charles Owens: Beale, John Marlowe; Block, John H, Lipincott William, 12th edition, 2011.
3. Graham L. Patrick, An Introduction to Medicinal Chemistry, 5th edition, Oxford University Press, 2013. Jayashree Ghosh, A text book of Pharmaceutical Chemistry, S. Chand and Co. Ltd, 1999, 1999 edn.
4. O. LeRoy, Natural and synthetic organic medicinal compounds, Ealemi, 1976.

S. Ashutosh Kar, Medicinal Chemistry, Wiley Eastern Limited, New Delhi, 1993, New edn

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT –I Introduction to receptors				
1.1	Introduction, targets.	2	Chalk & Talk	Black Board
1.2	Agonist, antagonist.	2	Chalk & Talk	Black Board
1.3	partial agonist. Receptors, Receptor types.	2	Chalk & Talk	Black
1.4	Theories of Drug.	2	Chalk & Talk	Black Board
1.5	interaction, Drug synergism.	2	Chalk & Talk	Black Board
1.6	Drug resistance.	1	Chalk & Talk	Black Board
1.7	physicochemical factors influencing drug action	1	Chalk & Talk	Black Board
UNIT -2 Antibiotics				
2.1	Introduction.	2	Chalk & Talk	Black Board
2.2	Targets of antibiotics action.	2	Chalk & Talk	Black Board

2.3	classification of antibiotics, enzyme-based mechanism of action.	2	Chalk & Talk	Black Board
2.4	SAR of penicllins and tetracyclins.	2	Chalk & Talk	Black Board
2.5	clinical application of penicillins, cephalosporin.	2	Chalk & Talk	Black Board
2.6	Current trends in antibiotic therapy.	2	Chalk & Talk	Black Board
UNIT -3 Antihypertensive agents				
3.1	Classification of cardiovascular agents.	2	Chalk & Talk	Black Board
3.2	introduction to hypertension.	2	Chalk & Talk	Black Board
3.3	etiology, types, classification of antihypertensive agents.	2	Chalk & Talk	Black Board
3.4	classification and mechanism of action of diuretics.	2	Chalk & Talk	Black Board
3.5	Furosemide, Hydrochlorothiazide.	2	Chalk & Talk	Black Board
3.6	Amiloride.	2	Chalk & Talk	Black Board
UNIT -4 Diuretics				

4.1	Classification of DIURETICS	2	Chalk & Talk	Black Board
4.2	Classification.	2	Chalk &	Black
			Talk	Board
4.3	mechanism of action of diuretics.	2	Chalk &Talk	Black Board
4.4	Furosemide.	2	Chalk & Talk	Black Board
4.5	Hydrochlorothiazide.	2	Chalk & Talk	Black Board
4.6	Amiloride.	2	Chalk & Talk	Black Board
UNIT -5 Analgesics, Antipyretics and Anti-inflammatory Drugs				
5.1	Introduction, Mechanism of inflammation.	2	Chalk & Talk	Black Board
5.2	classification and mechanism of action and paracetamol,.	2	Chalk & Talk	Black Board
5.3	Ibuprofen, Diclofenac, naproxen, indomethacin.	2	Chalk & Talk	Black Board
5.4	phenylbutazone and meperidine. Medicinal Chemistry of Antidiabetic Agents.	2	Chalk & Talk	Black Board
5.5	Types of diabetics, Drugs used for the treatment, chemical classification,	2	Chalk & Talk	Black Board

5.6	Mechanism of action, Treatment of diabetic mellitus. Chemistry of insulin, sulfonyl urea	2	Chalk & Talk	Black Board

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.							5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand****, K3****-Apply****, K4****-Analyse, K5 - Evaluate***

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Predict a drugs properties based on its structure.	K2,K3, K4 & K5	PSO1, PSO2, PSO4, PSO6,PS07 & PS08
CO 2	Describe the factors that affect its absorption, distribution, metabolism, and excretion, and hence the considerations to be made in drug design.	K2,K3, K4 & K5	PSO1, PSO2, PSO3, PSO4, PSO6,PS07 & PS08
CO 3	Explain the relationship between drug's chemical structure and its therapeutic properties.	K2,K3, K4 & K5	PSO1, PSO2, PSO3, PSO4, PSO6,PS07 & PS08
CO 4	Designed to give the knowledge of different theories of drug actions at molecular level.	K2,K3, K4 & K5	PSO1, PSO2, PSO3, PSO4, PSO6& PS08
CO 5	To identify different targets for the development of new drugs for the treatment of infectious and GIT.	K2, K3, K4& K5	PSO1, PSO2, PSO3, PSO4, PSO6,PS07 & PS08

Mapping of C0s with PSOs

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9
CO1	3	3	3	3	1	3	3	3	1
CO2	3	3	3	3	1	3	3	3	1
CO3	3	3	3	3	1	3	3	3	1
CO4	3	3	3	3	1	3	1	3	1
CO5	3	3	3	3	1	3	3	3	1

Mapping of C0s with POs

CO / PSO	PO1	PO2	PO3	PO4
CO1	3	2	3	1
CO2	3	2	3	1
CO3	3	2	3	1
CO4	3	2	3	1
CO5	3	3	3	1

Note: □Strongly Correlated – 3 □Moderately Correlated – 2

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr.K.R.Subimol**

Forwarded By

S-Tedona.

HOD'S Signature

I PG CHEMISTRY

SEMESTER –II

(For those who joined in 2023 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG2CE6	GREEN CHEMISTRY	ELECTIVE	4	3

COURSE DESCRIPTION: This paper provides an extensive study of thegoals of green chemistry, principles of green chemistry,green reagents and green synthesis.

COURSE OBJECTIVES:

- To discuss the principles of green chemistry.
- To propose green solutions for chemical energy storage and conversion.Propose green solutions for industrial production of Petroleum and Petrochemicals.
- Propose solutions for pollution prevention in Industrial chemical and fuel production, Automotive industry and Shipping industries.
- Propose green solutions for industrial production of Surfactants,Organic and inorganic chemicals

UNITS

UNIT-I: INTRODUCTION TO GREEN CHEMISTRY (12HRS.)

Introduction - Need for Green Chemistry. Goals of Green Chemistry. Limitations / of Green Chemistry. Chemical accidents, terminologies, International green chemistry organizations and Twelve principles of Green Chemistry with examples.

UNIT-II: GREEN REAGENTS (12HRS.)

Choice of starting materials, reagents, catalysts and solvents in detail, Green chemistry in day today life. Designing green synthesis-green reagents: dimethyl carbonate. Green solvents: Water, Ionic liquids - criteria, general methods of preparation, effect on organic reaction. Super critical carbon dioxide - properties, advantages, draw backs and a few examples of organic reactions in $scCO_2$. Green synthesis - adipic acid and catechol.

UNIT-III: GREEN CATALYSIS (12HRS.)

Environmental pollution, Green Catalysis – Acid catalysts, Oxidation catalysts, Basic catalysts, Polymer supported catalysts-Poly styrene aluminium chloride, polymeric super acid catalysts, Poly supported photosensitizers.

UNIT-IV: GREEN SYNTHESIS (12HRS.)

Phase transfer catalysis in green synthesis – oxidation using hydrogen peroxide, crown ethers - esterification, saponification, anhydride formation, Elimination reaction, Displacement reaction. Applications in organic synthesis.

UNIT-V: SONO CHEMISTRY (12HRS.)

Microwave induced green synthesis - Introduction, Instrumentation, Principle and applications. Sono chemistry – Instrumentation, Cavitation theory – Ultra sound assisted green synthesis and Applications.

REFERENCES:

1. Ahluwalia, V.K. and Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005.
2. W.L.Mc Cabe, J.C. Smith and P.Harriott, Unit Operations ofChemical Engineering, 7^{th} edition, McGraw-Hill, NewDelhi, 2005.
3. J.M. Swan and D.St.C. Black, Organo metallics in Organic Synthesis, Chapman Hall, 1974.
4. V.K. Ahluwalia and R. Aggarwal, Organic Synthesis: Special Techniques, Narosa Publishing House, New Delhi, 2001.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-1	**INTRODUCTIONTO GREEN CHEMISTRY(12Hours)**			
1.1	Introduction- Need for Green Chemistry.	2	Chalk & Talk	Black Board
1.2	Goals of Green Chemistry. Limitations/ of green chemistry.	2	Chalk & Talk	LCD
1.3	Chemical accidents, terminologies,	3	Chalk & Talk	PPT
1.4	International green chemistry organizations	2	Lecture	PPT
1.5	Twelve principles of Green Chemistry with examples	3	Lecture	Black Board
UNIT-2	**GREEN REAGENTS(12Hours)**			
2.1	Choice of starting materials, reagents, catalysts and solvents	2	Lecture	Black Board
2.2	Green chemistry in day today life. Designing green synthesis.	1	Chalk & Talk	Black Board
2.3	Green reagents: dimethyl carbonate. Green solvents: Water and Ionic liquids	1	Chalk & Talk	Black Board
2.4	General methods of preparation, effect on organic reaction.	2	Chalk & Talk	Black Board
2.5	Super critical carbon dioxide - properties, advantages, drawbacks	2	Chalk & Talk	Black Board

2.6	Few examples of organic reactions in scCO2.	2	Chalk & Talk	Black Board
2.7	Green synthesis-adipic acid and catechol	2	Chalk & Talk	Black Board
UNIT-3	**GREEN CATALYSIS(12Hours)**			
3.1	Environmental pollution	2	Chalk & Talk	Black Board
3.2	Green Catalysis –Acid catalysts, Oxidation catalysts, Basic catalysts	3	Chalk & Talk	Black Board
3.3	Polymer supported catalysts	1	Chalk & Talk	Black Board
3.4	Poly styrene aluminum chloride,	2	Chalk & Talk	Black Board
3.5	Polymeric super acid catalysts.	2	Chalk & Talk	Black Board
3.6	Poly supported photo sensitizers	2	Chalk & Talk	Black Board
UNIT-4GREEN SYNTHESIS (12Hrs)				
4.1	Phase transfer catalysis in green synthesis.	1	Chalk & Talk	PPT
4.2	Oxidation using hydrogen peroxide	1	Chalk & Talk	PPT
4.3	Crown ethers, esterification, saponification.	2	Chalk & Talk	PPT
4.4	Anhydride formation, Elimination reaction.	4	Chalk & Talk	PPT

4.5	Displacement reaction . Applications in organic synthesis	4	Chalk & Talk	PPT
UNIT-5 SONO CHEMISTRY (18 Hours)				
5.1	Micro wave induced green synthesis-	2	Chalk & Talk	Black Board
5.2	Introduction, Instrumentation, Principle and applications. Sonochemistry.	4	Chalk & Talk	Black Board
5.3	Cavitation theory-	2	Chalk & Talk	Black Board
5.4	Ultra sound assisted green synthesis.	2	Chalk & Talk	Black Board
5.5	ApplicationsofUltrasoundassistedgreensynthesis.	2	Chalk & Talk	Black Board

CIA Evaluation Pattern

Levels	**C1**	**C2**	**C3**	**C4**	**Total Scholastic Marks**	**Non Scholastic Marks C5**	**CIA Total**	**% of Assessment**
	Better of W1, W2 5	**M1+M2 5+5=10**	**Mid-Sem.Test 15**	**Once in a Sem. 5**			**40**	**-**
K1	-	-	-	**-**	**-**		**-**	**-**

K2	-	2	3	**-**	**5**		**5**	**12.5 %**
K3	5	3	4	**-**	**12**		**12**	**30 %**
K4	-	5	4	**-**	**9**		**9**	**22.5%**
K5	-	-	4	5	**9**		**9**	**22.5 %**
Non-Scho.							**5**	**12.5 %**
Total	**5**	**10**	**15**	**5**	**35**	**5**	**40 mks.**	**100 %**

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand,* ***K3****-Apply,* ***K4****-Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				**NON - SCHOLASTIC**	**MARKS**		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 – Best of Two Weekly Tests
C2 – Average of Two Monthly Tests
C3 - Mid Sem Test
C4 – Seminar (Once in a Sem.)
C5 – Non – Scholastic

COURSE OUTCOME

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Recallthebasicchemicaltechniquesused inconventionalindustrialpreparationsa nd in green innovations	K2, K3, K4 &K5	PSO1& PSO2
CO 2	Understand the various techniques used in chemical industries and in laboratory	K2, K3, K4 &K5	PSO3
CO 3	Comparetheadvantagesoforganicreact ionsassistedbyrenewableenergysourc esand non-renewable energy sources	K2, K3, K4 &K5	PSO5
CO 4	ApplytheprinciplesofPTC, ionicliquid,microwaveandultrasonicas sisted organicsynthesis.	K2, K3, K4 &K5	PSO3
CO 5	Design and synthesize new organic compounds by green methods	K2, K3, K4 &K5	PSO3

Mapping of COs with PSOs

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9
CO1	3	3	2	1	1	1	1	1	1
CO2	2	1	3	1	1	1	1	1	1
CO3	2	1	1	1	3	1	1	1	1
CO4	2	1	3	1	1	1	1	1	1
CO5	2	1	3	1	1	1	1	1	1

Mapping of COs with POs

CO / PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	2	3	2	2
CO3	2	2	3	2
CO4	3	2	2	2
CO5	3	2	2	2

Note: Strongly Correlated–3Moderately Correlated –Weakly Correlated-1

COURSE DESIGNER:

1. Dr.S. Sukumari
2. Dr.M.Priyadharsani

Forwarded By

S-Tedona.

M.Sc., Chemistry

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG2CE7	Bio-Inorganic Chemistry	Elective	4	3

COURSE DESCRIPTION: It deals with concepts of bioinorganic chemistry in various aspects like biological importance of metal ions, significance of haemoglobin, myoglobin, chlorophyll , metallo enzymes, nitrogen and toxicity of metals etc.

COURSE OBJECTIVES:

To understand the role of trace elements.

To understand the biological significance of iron, sulpur.

To study the toxicity of metals in medicines.

To have knowledge on diagnostic agents.

UNIT-I: Essential trace elements **(12hrs)**

Essential elements in biology-macro nutrients, micronutrients - the role of metallic elements in biochemistry-the alkali and alkaline earth metals-sodium, potassium, calcium & magnesium-metalophorphyrins –chlorophyll - Hemeproteins-hemoglobin and myoglobin

UNIT-II: Transport Proteins **(12hrs)**

Iron-sulphur proteins-Ruberdoxins-Ferredoxins- Other Hemeprotiens

–cytochromes -peroxidases and catalases - Iron supply and transport-metalloenzymes- copper metallo enzymes

UNIT-III: Nitrogen fixation **(12hrs)**

Introduction, types of nitrogen fixing microorganisms. Dinitrogen complexes and its activation. Nitrogenase in biological nitrogen fixation. Composition of nitrogenase Metal clusters in nitrogenase- Reduction of N_2 to ammonia.

UNIT-IV: Metals in medicine **(12hrs)**

Metal Toxicity of Hg, Cd, Pb, As. Therapeutic Compounds: Vanadium-Based Diabetes Drugs; Platinum-Containing Anticancer Agents.Chelation therapy; Cancer treatment. Diagnostic Agents: Technetium Imaging Agents; Gadolinium MRI Imaging Agents.

UNIT-V: Enzymes **(12hrs)**

Introduction and properties -nomenclature and classification. Enzyme kinetics, free energy of activation and the effects of catalysis. Michelis - Menton equation - Effect of pH, temperature on enzyme reactions. Factors contributing to the efficiency of enzyme. Metallo coenzyme- Vitamine B12

Recommended Text Books:

1. F.A.Cotton, G.Wilkinson, C.A. Murillo and M.Bochmann, Advanced Inorganic Chemistry; GeofreyWilinson& Carlos,6th Edition'2003(unit-1 & 2)
2. Bioinorganic chemistry by Asim K. Das (unit-3 & 4)
3. Bioorganic, bioinorganic and Supramolecular chemistry, 3rd edition by P. S. Kalsi and J P Kalsi. (Unit 5)

Reference Books

1. K.F. Purcell and Kotz., Inorganic chemistry, WB Saunders Co., USA.
2. G.N. Mugherjea and Arabinda Das, Elements of Bioinorganic Chemistry - 1993.
3. R. Gopalan, V. Ramalingam, *Concise Coordination Chemistry*, S. Chand, **2001**.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-I: Essential trace elements (12hrs)				
1.1	Essential elements in biologymacro nutrients, micronutrients the role of metallic elements in biochemistry	2	Chalk & Talk	Black Board
1.2	The alkali and alkaline earth metals, sodium, potassium, calcium & magnesium	3	Chalk & Talk	Black Board
1.3	Metalophorphyrins, chlorophyll	3	Chalk & Talk	Black Board
1.4	Hemeproteins-hemoglobin	3	Chalk & Talk	Black Board
1.5	Myoglobin	3	Chalk & Talk	Black Board
UNIT-II: Transport Proteins				**(12hrs)**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
2.1	Iron-sulphur proteins, Ruberdoxins	3	Chalk & Talk	Black Board
2.2	Ferredoxins, Other Hemeprotiens cytochromes.	3	Chalk & Talk	Black Board
2.3	Peroxidises and catalases.	3	Chalk & Talk	Black Board
2.4	Iron supply and transport. Metalloenzymes, copper metallo enzymes	3	Chalk & Talk	Black Board
UNIT-III: Nitrogen fixation				**(12hrs)**
3.1	Introduction, types of nitrogen fixing microorganisms.	3	Chalk & Talk	Black Board
3.2	Dinitrogen complexes and its activation. Nitrogenase in biological nitrogen fixation.	3	Chalk & Talk	Black Board
3.3	Composition of nitrogenase Metal clusters in nitrogenase	3	Chalk & Talk	Black Board
3.4	Reduction of N_2 to ammonia.	3		
UNIT-IV: Metals in medicine				**(12hrs)**

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
4.1	Metal Toxicity of Hg, Cd, Pb, As. Therapeutic Compounds:	3	Chalk & Talk	Black Board
4.2	Vanadium-Based Diabetes Drugs, Platinum-Containing Anticancer Agents.	3	Chalk & Talk	Black Board
4.3	Chelation therapy, Cancer treatment. Diagnostic Agents.	3	Chalk & Talk	Black Board
4.4	Technetium Imaging Agents; Gadolinium MRI Imaging Agents.	3	Chalk & Talk	Black Board
UNIT-V Enzymes				**(12hrs)**
5.1	Introduction and properties - nomenclature and classification.	3	Chalk & Talk	Black Board
5.2	Enzyme kinetics, free energy of activation and the effects of catalysis.	3	Chalk & Talk	Black Board
5.3	Michelis - Menton equation - Effect of pH, temperature on enzyme reactions	3	Chalk & Talk	Black Board
5.4	Factors contributing to the efficiency of enzyme. Metallo coenzyme- Vitamine B12	3	Chalk & Talk	Black Board

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	**5**		**5**	**12.5 %**
K3	5	3	4	-	**12**		**12**	**30 %**
K4	-	5	4	-	**9**		**9**	**22.5%**
K5	-	-	4	5	**9**		**9**	**22.5 %**
Non-Scho.							**5**	**12.5 %**
Total	**5**	**10**	**15**	**5**	**35**	**5**	**40 mks.**	**100 %**

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand****, K3****-Apply****, K4****-Analyse, K5 - Evaluat***

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	The students will be able to analyses trace elements.	K1,K3 & K4	PSO1& PSO2
CO 2	Students will be able to explain the biological redox systems.	K1 & K2	PSO2

			&PSO7
CO 3	Students will gain skill in analyzing the toxicity in metals.	K1, K2 , K3& K4	PSO6
CO 4	Students will have experience in diagnosis.	K1, K2 & K4	PSO1
CO 5	Learn about the nitrogen fixation and photosynthetic mechanism.	K1,K2&K3	PSO4 & PSO5

CO-PO Mapping (Course Articulation Matrix)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**S**

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
WeightedpercentageofCourse Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

Course designer

Dr. A. Rajeswari and Dr. J. Belinda Asha

HOD'S Signature

CBCS Curriculum for M.Sc. Chemistry

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS /WEEK	CREDITS
PSCH	23PG2CE8	MATERIAL CHEMISTRY	ELECTIVE	4	3

OBJECTIVE: This course deals with study of synthesis, properties, structure and applications of nanoparticles.

COURSE DESCRIPTION

This paper deals with synthesis, properties and applications of nanomaterials. This paper also provides information about instrumentation techniques for characterising the nanomaterials.

Course outcome

After completion of the course the students should be able :

- To gain knowledge about the basic principles of nanochemistry and classification of nanomaterials.
- To describe several synthesis of inorganic nanoparticles, one-dimensional nanostructures (nanotubes, nanorods, nanowires), thin films, nanoporous materials, and nanostructured bulk materials**,**
- To criticize the importance of various instrumentation techniques such as NMR, IR, UV, X-ray diffraction, ESR etc., for elucidating the structures of nanomaterials.
- To depict the structure of carbon nanoatructures, organic nanopolymers and supra molecular structures
- To recognize the important role of nanomaterials in various fields.

UNITI:BASICS OF NANOMATERIALS **(12 HRS)**

Introduction – Basic concepts-quantum confinement effect, surface properties of nanoparticles. Classification of nanomaterials-one dimentional, two dimentional and three dimentional nanostructures. Carbon nanostructures- carbon molecules-carbon nanotubes- nanopolymers- nanocrystals.

Self-study: supra molecular structures

UNITII: SYNTHETIC METHODS OF NANOMATERIALS **(12HRS)**

Synthesis of semiconductors – sol gel synthesis & sono chemical approach and synthesis of ceramics. synthesis of carbon nanotubes - by carbon arc method and laser ablation method. Synthesis of fullerenes- by Pyrolysis of hydrocarbons, partial combustion of hydrocarbons and arc discharge method.

Self-study: Purificationcarbonnanotubes

UNIT III: PROPERTIES OF NANOMATERIALS **(12 HRS)**

Properties of carbon nanotubes, Thermal conductivity, Kinetic property, Elecrical and electronic, mechanical and vibrational properties and tensile strength. Properties of fullerenes-physical and chemical properties. Metal nanoclusters, rare gas and molecular clusters.

Self-study-Properties of semi conducting nanoparticles

UNITIV: CHARACTERIZATION TECHNIQUES (12 HRS)

Microscopy, Atomic force microscope (AFM),scanning electron microscope (SEM), transmission electron microscope(TEM), scanning probe microscope(SPM),scanning tunneling microscope(STM).Spectroscopy-UV-visible spectroscopy, Infra-red spectroscopy, Nuclear magnetic resonance spectroscopy, Raman spectroscopy and Photoelectron spectroscopy.

Self-study: X-ray diffraction technique (XRD).

UNITV: APPLICATIONS OF NANOMATERIALS **(12 HRS)**

Nanosensors:Applications of optical nanosensors, chemical nanosensors,

electrochemical nanosensors, micro-electro mechanical sensors and biosensors

Nanocatalyst:

Applications Of platinum, palladium, silver,cobalt nanoparticles, CNTs and polymer naomaterials as catalyst.

Nanomedicine: Nanomaterials in drug delivery, photodynamic therapy, molecular imaging, cancer treatment, molecular motors, neuro-electronic interfaces and tissue engineering

Self-study-Applications of nanodevices.

References

1. Charles P. Poole, Jr., Frank J. Owens, Introduction to nanotechnology, John Wiley & Sons-India,2010.
2. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Publishing Company Limited, 2007.
3. A.S.Bhatia, Dr.S.M .Ishtiaque, Nanoscience and Carbon Nanotubes,Deep & Deep Publications Pvt.Ltd.
4. Mark Ratner, DanielRatner, Nanotechnology, A Gentle Introduction To The Next Big Idea, Pearson Education, 5th Edn, 2009.
5. Dr.S.Shanmugam, Nanotechnology, MJP Publishers, 2010.

COURSE CONTENTS & LECTURESCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT I : BASICS OF NANOMATERIALS				
1 1	Basic concepts	2	Chalk & Talk	Black Board
1.2	surface properties of nanoparticles	2	Chalk & Talk	Black Board
1.3	classification of nanomaterials - one dimentional,twodimentional and three dimentional nanostructures	2	Chalk &Talk	Black Board
1.4	Carbon nanostructures-carbon molecules	2	Chalk & Talk	PPT & White board
1.5	carbon nanotubes	2	Chalk & Talk	Black Board

1.6	Nanopolymers	1	Chalk & Talk	LCD
1.7	Nnocrystals	1	Chalk & Talk	Blac k Boar d
UNIT II : SYNTHETIC METHODS OF NANOMATERIALS				
2.1	Synthesis of semiconductors.	2	Chalk & Talk	Blac k Boar d
2.2	synthesis of ceramics.	3	Chalk & Talk	Blac k Boar d
2.3	synthesis of carbon nanotubes	3	Chalk & Talk	PPT& Whit e boar d
2.4	Synthesis of fullerenes	4	Chalk & Talk	Blac k Boar d
UNIT III :PROPERTIES OF NANOMATERIALS				

3.1	Properties of carbon nanotubes –Thermal conductivity and Kineticproperty	2	Chalk & Talk	Blac k Boar d
3.2	Elecrical and electronical properties of CNT	2	Chalk & Talk	Blac k Boar d
3.3	Mechanical properties of CNT	1	Chalk & Talk	LCD
3.4	Electrical and electronic properties of CNT	1`	Chalk & Talk	Blac k Boar d
3.5	Vibrational properties and tensile strength	1	Chalk & Talk	Blac k Boar d
3.6	Physical properties of fullerene	1	Chalk & Talk	Blac k Boar d
3.7	Chemical properties of fullerenes	2	Chalk & Talk	Blac k Boar d
3.8	Inert gas cluster and rare gasclusters.	2	Chalk & Talk	Blac k Boar

				d
UNITIV : CHARACTERIZATION TECHNIQUES				
4.1	Microscopy-Atomic force microscope(AFM), scanning electronmicroscope(SEM)	3	Chalk & Talk	Black Board
4.2	Transmission electron microscope(TEM), scanning probe microscope(SPM), scanning tunelling microscope (STM)	2	Chalk & Talk	Black Board
4.3	Spectroscopy-UV-visible	2	Chalk & Talk	Black Board
4.4	Nuclear magnetic resonance spectroscopy	1	Chalk & Talk	Black Board
4.5	Raman spectroscopy	1	Chalk & Talk	Black Board
4.6	Photo electron spectroscopy.	1	Chalk & Talk	Black Board
4.8	Infra-red spectroscopy,	2	Chalk & Talk	Black Board
UNITV : APPLICATIONS OF NANOMATERIALS				
5.1	Applications of optical nanosensors	2	Chalk & Talk	Black Board

	chemical nanosensors,			
5.2	Electrochemical nanosensors,	1	Chalk & Talk	Black Board
5.3	Biosensors	1	Chalk & Talk	PPT & White board
5.4	micro-electro mechanical sensors,	1	Chalk & Talk	Black Board
5.5	platinum,palladium,silver,cobalt nanoparticles as nanocatalyst	2	Chalk & Talk	Black Board
5.6	CNTs and polymeric naomaterials as nanocatalyst	1	Chalk & Talk	Black Board
5.7	Nanomaterials in drug delivery,photodynamictherapy, molecular imaging	2	Chalk & Talk	PPT & White board
5.8	Cancer treatment,molecularmotors,neuro- electronic interfaces and tissue engineering	2	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Seminar 5 Mks.	Better ofW1, W2 5+5=10 Mks.	M1+M2 15Mks	MID-SEM TEST 5Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA

Scholastic	35
Non Scholastic	5
	40

✓**All the course outcomes are to be assessed in the various CIA components.**

✓**The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2-Understand, **K3**-Apply, **K4**-Analyse, **K4**-Evaluate

✓**The I PG course teachers are requested to start conducting S1, W1, M1**

EVALUATIONPATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Seminar

C2 – Average of Two Monthly Tests

C3 - Mid SemTest

C4 – Best of Two Weekly Tests

C5 – Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Distinguish between bulk material and nanomaterials	K2, K3, K4 &K5	PSO1& PSO2
CO 2	Choose the suitable synythetic methods to prepare particular nanomaterials	K2, K3, K4 &K5	PSO3
CO 3	Interpret the structure of nanomaterials using various characterisation techniques	K2, K3, K4 &K5	PSO5
CO 4	Catagorize and identify thedifferent types Carbon nano structures	K2, K3, K4 &K5	PSO4
CO 5	Summarise the uses of nanomaterials in various fields	K2, K3, K4 &K5	PSO5

Mapping of C0s with PSOs

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9
CO1	3	3	2	1	1	1	1	1	1
CO2	2	1	3	1	1	1	1	1	1
CO3	2	1	1	1	3	1	1	1	1
CO4	2	1	1	3	1	1	1	1	1
CO5	2	1	1	1	3	1	1	1	1

Mapping of C0s with POs

CO / PSO	PO1	PO2	PO3	PO4
CO 1	3	2	2	2
CO2	2	3	2	2
CO3	2	2	3	2
CO4	3	2	2	2
CO5	3	2	2	2

Note: □Strongly Correlated-3 □Moderately Correlated-2

- ♦ Weakly Correlated-**1**
- ♦ **COURSE DESIGNER:**

1. Mrs. RM.Nagalakshmi

2. Dr.B.SUGANTHANA

Forwarded By

HOD'S Signature

I PG Chemistry

SEMESTER – II

For those who joined from 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	23PG2CSE1	Chemistry in everyday life	Skill Enhancement	4	3

COURSE DESCRIPTION

This paper focuses on all the important aspects of theory about soil, water, food chemistry, cosmetics and oil.

COURSE OBJECTIVES

- To understand the concepts of soil texture, water analysis.
- To acquire the basic knowledge about food colour, food additives and food and adulterants.
- To learn sources of oil, analysis of oil and adulterant in oil.

UNITS

UNIT –I SOIL (9 HRS.)

Composition of soil: Organic and Inorganic constituents. Soil acidity : buffering capacity of soils. Liming of soil. Absorption of cations and anions: availability of soil nutrients to plants.

UNIT –II WATER (9 HRS.)

Importance of water.Natural water.Sources of water. Drinking water – making water fit to drink – chlorination. Water pollution- Chemicals causing water contamination – contamination by fertilizers, soaps and detergents and their effect.

UNIT –III FOOD CHEMISTRY (9HRS.)

Food- composition of food -Color- Natural colouring matters – chlorophylls – carotenoids - Synthetic colours – permitted colours-banned colours - FPO, FSSAC, Agmark – Flavors - Food additives-Food adulterants and their detection in various food items.

UNIT –IV COSMETICS (9HRS.)

Dental preparations-Tooth paste-Ingredients, their characteristic functios-Soap-hard soap and soft soap- Hair care preparations-Shampoo Shampoos –different kinds of shampoos –anti dandruff, anti-lice, herbal and baby shampoos -Hair dye –manufacture of conditioners -skin preparation –skin powder, nail polish, lipsticks.

UNIT –V OIL (9 HRS.)

Natural sources of oils and fats, oils rich in palmitic acid and stearic acid- processing of fats and oils- analysis of oils- technical refining of oils for industrial uses- detoxification- shelf life prediction test- adulterants in oils.

REFERENCES:

1. G.T. Austin : shreve's Chemical Process Industries, 5th edition, Mc-Graw-Hill, 1984
2. Lakshmi, S. Pharmaceutical Chemistry, S. Chand and Sons, New Delhi, 1995.
3. A.K. De, Environmental Chemistry, New Age International Publishers, 2018.
4. JayashreeGhosh, Fundamental concepts of Applied chemistry, S.Chand publications, New Delhi (2013).
5. J.V.Simons, Science and Beauty Business Vol-1, Macmilan Education Ltd, 1989

COURSE CONTENTS & LECTURE SCHEDULE

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 TITLE - SOIL				
1.1	Composition of soil	1	Chalk & Talk	Black Board
1.2	Organic and Inorganic constituents	1	Chalk & Talk	Black Board
1.3	Soil acidity	1	Chalk & Talk	Black Board

1.4	buffering capacity of soils	1	Chalk & Talk	PPT & White board
1.5	Liming of soil	1	Chalk & Talk	Black Board
1.6	Absorption of cations	1	Chalk & Talk	Black Board
1.7	Absorption of anions:	2	Chalk & Talk	PPT & White board
1.8	availability of soil nutrients to plants.	1	Chalk & Talk	Black Board
UNIT - 2	**TITLE -WATER**			
2.1	Importance of water. -	1	Chalk & Talk	Black Board
2.2	Naturalwater	1	Chalk & Talk	Black Board
2.3	Sources of water	1	Chalk & Talk	Black Board
2.4	Drinking water	1	Chalk & Talk	Black Board
2.5	Making water fit to drink – chlorination	1	Chalk & Talk	PPT & White board
2.6	Water pollution	1	Chalk & Talk	Black Board
2.7	Chemicals causing water contamination –	1	Chalk & Talk	Black Board
2.8	contamination by fertilizers, soaps and detergents and their effect	2	Demonstration	Various raw materials
UNIT - 3	**TITLE -FOOD CHEMISTRY**			
3.1	Food- composition of food	1	Chalk & Talk	Black Board
3.2	Food colour	1	Chalk & Talk	Black Board
3.3	Natural colouring matters chlorophylls – carotenoids	1	Chalk & Talk	Black Board
3.4	Synthetic colours	1	Chalk & Talk	Black Board

3.5	permitted colours	1	Chalk & Talk	Black Board
3.6	banned colours - FPO, FSSAC, Agmark – Flavors	1	Chalk & Talk	Black Board
3.7	Food additives	1	Chalk & Talk	Black Board
3.8	Food adulterants and their detection in various food items.	2	Chalk & Talk	Black Board
UNIT -4 TITLE-COSMETICS				
4.1	Dental preparations-Tooth paste-Ingredients, their characteristic functios	1	Chalk & Talk	Black Board
4.2	Soap-hard soap and soft soap	1	Chalk & Talk	LCD
4.3	Hair care preparations-Shampoo different kinds of shampoos –anti dandruff and anti-lice	2	Chalk & Talk	Black Board
4.4	herbal and baby shampoos	1	Chalk & Talk	Black Board
4.5	Hair dye –manufacture of conditioners	1	Chalk & Talk	Black Board
4.6	skin preparation –skin powder	1	Chalk & Talk	Black Board
4.7	nail polish	1	Chalk & Talk	Black Board
4.8	lipsticks	1	Chalk & Talk	Black Board
UNIT - 5 TITLE -OILS				
5.1	Natural sources of oils and fats	1	Chalk & Talk	Black Board
5.2	oils rich in palmitic acid and static acid	1	Chalk & Talk	LCD

5.3	processing of fats and oils	1	Chalk & Talk	Black Board
5.4	analysis of oils	2	Chalk & Talk	Black Board
5.5	technical refining of oils for industrial uses	1	Chalk & Talk	Black Board
5.6	detoxification	1	Chalk & Talk	Black Board
5.7	shelf life prediction test	1	Chalk & Talk	Black Board
5.8	adulterants in oils	1	Chalk & Talk	Black Board

CIA Evaluation Pattern

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	**5**		**5**	**12.5 %**
K3	5	3	4	-	**12**		**12**	**30 %**
K4	-	5	4	-	**9**		**9**	**22.5%**
K5	-	-	4	5	**9**		**9**	**22.5 %**
Non-Scho.							**5**	**12.5 %**
Total	**5**	**10**	**15**	**5**	**35**	**5**	**40 mks.**	**100 %**

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are** ***K2****-Understand,* ***K3****-Apply,* ***K4****-Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non – Scholastic

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Analyse the buffering capacity of soil, p H, cation exchange capacity, nutrient availability of soil, fertility status of soil.	K1	PSO1
CO 2	Analyze the p H of water, hardness of water and acquire knowledge of advanced water purification techniques (and water treatment)	K1, K2	PSO2
CO 3	Identify different types of food colour,additives and food adulterants	K1	PSO2
CO 4	Learn the ingredients required for the preparation of the various types of shampoos,skin powder and nail polish	K2	PSO4
CO 5	Analyze and Detect the presence of adulderants in oils and to compare the physical and chemical refining of oils	K3	PSO5

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**S**

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

COURSE DESIGNER

1.Dr.J.Jone Celestina

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CBCS Curriculum for M.Sc. Chemistry

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	**19PG3C11**	**Organic chemistry-III (Spectroscopy and Pericyclic reactions)**	**MAJOR CORE**	**6**	**5**

COURSE DESCRIPTION: This course provides the study of different aspects of 1D and 2D NMR spectral techniques and mass spectroscopy. This paper enable the students to understand the concept and reactivity of organic reactions under photochemical conditions

COURSE OBJECTIVES: This paper provides an elaborate study of organic spectroscopy and their applications in structural elucidation of organic compounds. This paper also deals with reactions that are taking place under photochemical conditions and pericyclic reactions.

COURSE OUTCOMES: On the successful completion of the course, students will be able :

- To acquire a complete knowledge of the basic principles of 1H-NMR, 13C-NMR and Mass spectroscopy
- To be acquainted with complete knowledge of photochemistry of ketone & cyclo addition reactions and to develop an understanding of the significance of the number, and splitting of signals in NMR
- To be competent to assign structures to simple molecules on the basis of nuclear magnetic resonance spectra
- To distinguish the similarities and differences of Pericyclic reactions and Cyclo addition and sigmatropic reactions
- To apply the Spectral concepts to solve the problems, to elucidate the structures of

simple organic compounds using the data from all the spectral techniques

UNITS

UNIT I-^{1}H -NMR SPECTROSCOPY (18 HRS)

i) Introduction – Relexation process – Instrumentation(not required) – Chemical shift – Factors influencing chemical shift – Inductive effect, Vanderwaalsdeshielding, anisotropic effects, Hydrogen bonding, solvent effects.

ii)H^{1}-NMR spectroscopy-coupling constant J-factors influencing coupling constant J-classification (ABX, AMX,& A2B2) Geminal,Vicinal and long range coupling- Shift reagents -NOE.

UNIT II-^{13}C- NMR SPECTROSCOPY & 2D-NMR SPECTROSCOPY (18 HRS)

C^{13}-Spectroscopy–introduction-chemical shifts(aliphatic, olefinic, alkyne, aromatic)-coupling constants. Broad band decoupling, Off-resonance decoupling.

2D NMR techniques such as HOMOCOR, HETEROCOR, NOESY, DEPT, INEPT, APT, INADEQUATE. Instrumentation(not required)

UNIT –III MASS SPECTROSCOPY (18 HRS.)

Mass Spectroscopy-Introduction –ion production-EI,CI, FD and FAB- factors affecting fragmentation, Fragmentation of organic compounds-molecular ion peak,meta stable peak-Mc Lafferty rearrangement-Nitrogen rule-Retro diels-Alder reaction.

UNIT –IV ORGANIC PHOTOCHEMISTY (18HRS.)

Photochemistry of alkenes, intramolecular reactions of olefinic bond- geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes (di-pi-methane rearrangement)

Photochemistry of carbonyl compounds- dimerisation and Paterno-Buchi reaction-intramolecular reaction- saturated, cyclic and acyclic α,β-unsaturated compounds- Barton reaction, Norrish Type I and Type II reactions photoreduction of ketones

UNIT –V :PERICYCLIC REACTIONS (18HRS.)

Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatrienes classification of pericyclic reactions- FMO and PMO approaches (excluding Correlation diagram method) –

Electrocyclicreactitons- conrotatory and disrotatory motions- 4n, 4n+2- Cycloaddition- suprafacial and antarafacial additions, (2+2) and (4+2) cycloadditions, Cheleotropicreactitons- Sigmatropic rearrangement- 3,3 and 5,5-sigmatropic rearrangements, Claisen, Cope rearrangements

REFERENCES:

1. R. E. Ireland, Organic synthesis, Prentice-Hall of India Privated Ltd., 1988.

2. Norman and J. M. Coxon, Principles of organic synthesis, ELBS, 3rd Ed., 1993.

3. Jagdamba Singh, Photochemistry and Pericyclic Reactions, New age international publishers, 2009.

4. K. K. Rohatgi-Mukherjee, fundamentals of photochemistry, New age international publishers, 2006.

5. lan Fleming, Pericyclic reactions, oxford Publishers, 2009.

6. W. Kemp, Organic spectroscopy, McMillan, 1991.

7. R. M. Silverstein and F. X. Webster, Spectrometric Identification of organic compounds, John Wiley & Sons, Inc., 6th Ed. 2004

8. P.S.Kalsi, Spectroscopy of organic compounds, New age international publishers, 6th edition, 2009.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**^{1}H -NMR SPECTROSCOPY**		**(15 Hours)**	
1.1	Introduction - Relexation process	2	Chalk & Talk	Black Board
1.2	Chemical shift - Factors influencing chemical shift	4	Chalk & Talk	LCD

1.3	Hydrogen bonding, solvent effects.	1	Lecture	PPT
1.4	coupling constant J-factors influencing coupling constant	2	Lecture	PPT
1.5	J-classification (ABX, AMX, ABC & A2B2)	3	Lecture	Black Board
1.6	Shift reagents	2	Discussion	Black Board
1.7	NOE.	1	Lecture	Black Board
UNIT -2 ^{13}C- NMR SPECTROSCOPY & 2D-NMR SPECTROSCOPY (15 Hours)				
2.1	C^{13}-Spectroscopy-introduction	1	Lecture	Black Board
2.2	Chemical shifts(aliphatic, olefinic, alkyne, aromatic)- coupling constants.	3	Chalk & Talk	Black Board
2.3	Broad band decoupling, Off-resonance decoupling.	2	Chalk &	Black
2.4	2D NMR techniques - HOMOCOR & HETEROCOR	3	Chalk & Talk	Black Board
2.5	NOESY&DEPT	3	Chalk & Talk	Black Board
2.6	INEPT, APT& INADEQUATE	3	Chalk & Talk	Black Board
UNIT -3 MASS SPECTROSCOPY (15 Hours)				
3.1	Mass Spectroscopy-Introduction	2	Chalk & Talk	Black Board
3.2	Ion production-EI,CI	2	Chalk & Talk	PPT

3.3	FD and FAB	2	Chalk & Talk	PPT
3.4	Factors affecting fragmentation	3	Chalk & Talk	PPT
3.5	Molecular ion peak & meta stable peak	2	Chalk & Talk	Black Board
3.6	Mc Lafferty rearrangement	2	Chalk & Talk	Black Board
3.7	Nitrogen rule-Retro diels-Alder reaction.	2	Chalk & Talk	Black Board
UNIT -4 ORGANIC PHOTOCHEMISTRY			**(15 Hours)**	
4.1	Photochemistry of alkenes	3	Chalk & Talk	Black Board
4.2	Intramolecular reactions of olefinic bond- geometrical isomerism	2	Chalk & Talk	Black Board
4.3	Cyclisation reactions, rearrangement of 1,4- and 1,5-dienes	3	Chalk & Talk	Black Board
4.4	Photochemistry of carbonyl compounds- dimerisation-Norrish Type I and Type II reactions	4	Chalk & Talk	PPT
4.5	Paterno-Buchi reaction	1	Chalk & Talk	Black Board
4.6	Barton reaction, photoreduction of ketones	2	Chalk & Talk	Black Board
UNIT-5-PERICYCLIC REACTIONS			**(15 Hours)**	
5.1	Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatrienes and allyl systems	2	Chalk & Talk	PPT
5.2	FMO and PMO approaches	3	Chalk & Talk	Black Board

5.3	Electrocyclic reactitons- conrotatory and disrotatory motions	2	Chalk & Talk	Black Board
5.4	Electrocyclic reactitons- 4n & 4n+2	3	Chalk & Talk	Black Board
5.5	Cycloaddition- suprafacial and antarafacial additions	1	Chalk & Talk	PPT
5.6	Cycloaddition- (2+2) and (4+2) cycloadditions	1	Chalk & Talk	Black Board
5.7	Cheleotropic reactitons	1	Chalk & Talk	Black Board
5.8	Sigmatropic rearrangement- 3,3 and 5,5-sigmatropic rearrangements, Claisen, Cope rearrangements	2	Chalk & Talk	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Seminar 5 Mks.	Better of W1, W2 5Mks.	M1+M2 10 Mks	MID-SEM TEST 15 Mks	35 Mks.	5 Mks.	40Mks.	
K2	5	-	-	2 ½	-		-	-
K3	-	5	4	2 ½	5		5	12.5 %
K4	-	-	3	5	12		12	30 %
K5	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :**

K2*-Understand,* ***K3****-Apply,* ***K4****-Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	**C2**	**C3**	**C4**	**C5**	**CIA**	**ESE**	**Total**
5	**10**	**15**	**5**	**5**	**40**	**60**	**100**

C1 - Best of Two Weekly Tests

C2 - Average of Two Monthly Tests

C3 - Mid Sem Test

C4 - Seminar (Once in a Sem.)

C5 - Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To acquire a complete knowledge of the basic principles of ^{1}H-NMR, ^{13}C-NMR and Mass spectroscopy	K2, K3, K4 &K5	PSO1& PSO2
CO 2	To be acquainted with complete knowledge of the significance of the number, and splitting of signals in NMR	K2, K3, K4 &K5	PSO1,PSO3& PSO6
CO 3	To be competent to assign structures to simple molecules on the basis of Mass spectra	K2, K3, K4 &K5	PSO5&PSO8
CO 4	To understand the concepts of photochemistry of ketone & alkenes and to enumerate the cyclo addition reactions of carbonyl compounds	K2, K3, K4 &K5	PSO1,PSO4&PSO6
CO 5	To distinguish the similarities and differences of Pericyclic reactions and Cyclo addition and sigmatropic reactions	K2, K3, K4 &K5	PSO5, PSO6

Mapping of Cos with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9
CO1	3	3	2	1	1	1	1	1	1
CO2	3	1	3	1	1	3	1	1	1
CO3	2	1	1	1	3	1	1	3	1
CO4	3	1	1	3	1	3	1	1	1
CO5	2	1	1	1	3	3	1	1	1

Mapping of Cos with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	3	2	3	2
CO3	3	2	3	2
CO4	3	2	3	2
CO5	3	2	3	2

Note: ♦ Strongly Correlated - **3** ♦ Moderately Correlated - **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr.A.Rajeswari**
2. **Dr.B.Vinosha**

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CBCS Curriculum for M.Sc. Chemistry

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	19PG3C12	Physical chemistry-III (Group Theory, Surface Chemistry and Macromolecules)	MAJOR CORE	6Hrs.	5

Objective: This course covers the detailed study of group theory and its application and also covers the principles of surface chemistry, and a brief study of macromolecules.

COURSE OUTCOME

After successful completion of the course, the students are able

- To learn about symmetry elements and symmetry operations, the point groups and character table
- To Describe the selection rule for infrared-active and Raman active transitions, electronic transitions
- To analyse the hybridization of given compounds and to apply HMO theory to Ethylene and some conjugated systems
- To Classify of surface active agents, Polymers, and to derive Gibbs adsorption and BET isotherms
- To explain the kinetics of vinyl, cationic and anionic polymerizations and to determine the mass of polymers.

UNIT-I: Group Theory I 18 Hrs

UNIT-II: Group Theory II 18 Hrs

UNIT-III: Group Theory III 18 Hrs

UNIT-IV: Surface Chemistry 18 hrs

UNIT-V: Macromolecules 18 hrs

UNII: Group Theory I **18 Hrs.**

Symmetry elements and symmetry operations- Point groups – symmetry number from point groups- matrix representation of symmetry operations- Reducible and Irreducible representation – Statement of orthogonality theorem – Character tables and their constructions- C_{2v}, C_{3v}, D_{3h} and C_4 point groups.

UNIT: II Group Theory II **18 Hrs**

Application of group theory to spectroscopy and molecular problems - Symmetries of Normal modes of vibration- Application of group theory to normal mode of analysis (Water, ammonia and ethylene) - Symmetry integrals- Applications for spectral selection Rules of vibration spectra- IR and Raman fundamentals- Symmetries of molecular orbitals - Selection rules- electronic transitions.

UNIT: III Group Theory III **18 Hrs**

Group theory and Quantum mechanics- Wave function as a basis for irreducible representation – Hybridization- sp^2 and sp^3, HMO and HMO calculation- delocalization of ethylene, Butadiene and cyclopropenyl system.

References:

1) F.A.Cotton-Chemical application of group theory-wiley eastern Ltd-1971.
2) V.Ramakrishnan and M.S.Gopinathan-Group theory in Chemistry-Vishal -1988

UNIT– IV: Surface Chemistry **18 hrs**

Adsorption- surface tension, Capillary action, pressure difference across curved surface(laplace equations).Vapour pressure of droplets (Kelvine equation) Gibbs adsorbtion isotherm, estimatiom of surface area (BET equation) Surface films on liquids. (Electrokinetic phenomenon), catalytic activity at surfaces.

Micells:

Surface active agents, Classification of surface active agents, micelliyation, hydrophopic interactions, critical micellarconcentrartion (CMC) , factors affecting the CMC surfactants. Counter ion binding to micells, thermodynamics of micelliyation.phaseseperation and mass action models, solubilazation, micro emulsion reverse micells.

References:

Micelles, Theoretical and applied aspects .V. Aloroi, Plenum.

UNIT-V: Macromolecules: 20 Hrs

Polymer-definition and types of polymer, kinetics of polymerization (Vinyl, Cationic and Anionic polymerization). Electrically conducting, fire resistant, liquid crystal polymers.

Molecular mass, number and mass average molecular mass, molecular mass determination (viscometer, light scattering and sedimentation methods).

Chain configuration of macro molecules, calculation of various dimensions of various chain structures.

References:

Introduction to polymer science-V.R. Gowarikar, N. V.Viswanathan and J.sridhar.willey eastern.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
	UNIT -1 Group Theory I			
1.1	Group Theory I -Symmetry elements and symmetry operations- Definition with examples	2	Chalk & Talk	Black Board

1.2	Group definition, Types of groups with examples, Sub-groups	2	Chalk & Talk	LCD
1.3	Class, conjugate elements- definition, examples, Number of classes and sub-groups	2	Lecture	PPT & White board
1.4	Point group introduction, how to arrive at the point group of molecules, Point group and geometry, Examples for various point groups	3	Lecture	Smart Board
1.5	Symmetry number from point groups- matrix representation of symmetry operations	2	Lecture	Black Board
1.6	Reducible and Irreducible representation – Statement and Consequences of the Great orthogonality theorem, Introduction to Character table	3	Lecture	Black Board
1.7	Construction of character table for C_{2V}, C_{3V} point groups	2	Lecture	White board
1.8	Construction of character table for D_{3h} and C_4 point groups	2	Discussion	Black Board
UNIT -2	**Group Theory - II**			
2.1	Application of group theory to spectroscopy and molecular problems- Introduction	2	Lecture	Green Board
2.2	Symmetries of Normal modes of vibration- Application of group theory to normal mode of analysis to Water,	2	Chalk & Talk	Green Board
2.3	Application of group theory to normal mode of analysis to ammonia	2	Lecture	LCD
2.4	Application of group theory to normal mode of analysis to ethylene	2	Chalk & Talk	Black Board

2.5	Application of group theory to normal mode of analysis to molecules having i and Pauli's mutual exclusion principle	2	Discussion	LCD
2.6	Symmetry integrals- Applications for spectral selection Rules of vibration spectra- IR and Raman fundamentals	2	Lecture	Black Board
2.7	Selection rules for electronic transitions	3	Lecture	Black Board
2.8	Application of group theory to find out the allowed and forbidden transitions of HCHO and Ethylene	3	Chalk & Talk	Black Board
UNIT -3	**Group Theory III**			
3.1	Group theory and Quantum mechanics, Wave function as a basis for irreducible representation	3	Chalk & Talk	Using Models
3.2	Using Group theory prediction of hybridisation of molecules with sp^2 and sp^3 hybridisation	2	Chalk & Talk	Black Board
3.3	Derivation of Expressions for sp^2 and sp^3 hybrid orbitals using group theory	2	Chalk & Talk	Black Board
3.4	Use of Group theory in HMO and HMO calculations, Huckel's appromiations and advantage of using group theory in HMO rtheory	2	Chalk & Talk	Black Board
3.5	Application of HMO theory to Ethylene molecule to calculate Delocalisation energy and derive expressions for HMO functions	3	Lecture	Black Board

3.6	Application of HMO theory to 1,3-butadiene molecule to calculate Delocalisation energy and derive expressions for HMO functions	3	Lecture	Black Board
3.7	Application of HMO theory to cyclopropeny system molecule to calculate Delocalisation energy and derive expressions for HMO functions	2	Discussion	LCD
3.8	Application of HMO theory to cyclobutadiene molecule to calculate Delocalisation energy and derive expressions for HMO functions	2	Chalk & Talk	Green Board
UNIT -4	**Surface Chemistry**			
4.1	Surface Chemistry- Adsorption-surface tension, Capillary action, pressure difference across curved surface(laplace equations)	3	Chalk & Talk	Black Board
4.2	Vapour pressure of droplets (Kelvine equation) Gibbs adsorbtion isotherm,	2	Discussion	LCD
4.3	Derivation of BET isotherm and estimatiom of surface area using BET equation	2	Chalk & Talk	Black Board
4.4	Surface films on liquids. (Electrokinetic phenomenon), catalytic activity at surfaces.	2	Discussion	LCD
4.5	**Micells:** Surface active agents, Classification of surface active agents, micelliyation	3	Lecture	Black Board
4.6	hydrophopic interactions, critical micellarconcentrartion(CMC) , factors affecting the CMC surfactants	2	Lecture	Black Board

4.7	Counter ion binding to micells, thermodynamics of micelliyation	2	Chalk & Talk	Black Board
4.8	Phase seperation and mass action models, solubilazation, micro emulsion reverse micells.	2	Discussion	LCD
UNIT -5	**Macromolecules**			
5.1	Macromolecules- Introduction to Polymers, Types of polymers with examples	3	Chalk & Talk	Black Board
5.2	Kinetics of polymerization Vinyl polymerization	2	Lecture	Black Board
5.3	Kinetics of polymerization cationic and anionic polymerization	3	Chalk & Talk	Black Board
5.4	Electrically conducting polymers- Introduction and examples	2	Chalk & Talk	Black Board
5.5	Fire resistant and liquid crystal polymers, Molecular mass, number and mass average molecular mass,	3	Chalk & Talk	Black Board
5.6	molecular mass determination (viscometer, light scattering	2	Discussion	LCD
5.7	molecular mass determination using sedimentation velocity and equilibrium methods.	2	Discussion	LCD
5.8	Chain configuration of macro molecules, calculation of various dimensions of various chain structures.	2	Lecture	Black Board

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Better of W1, W2 5	M1+M2 5+5=10	Mid-Sem.Test 15	Once in a Sem. 5			40	-
K1	-	-	-	-	-		-	-
K2	-	2	3	-	5		5	12.5 %
K3	5	3	4	-	12		12	30 %
K4	-	5	4	-	9		9	22.5%
K5	-	-	4	5	9		9	22.5 %
Non-Scho.							5	12.5 %
Total	5	10	15	5	35	5	40 mks.	100 %

CIA

Scholastic	**35**
Non Scholastic	**5**
	40

✓All the course outcomes are to be assessed in the various CIA components.

✓The levels of CIA Assessment based on Revised Bloom's Taxonomy for I PG are :

K2*-Understand,* ***K3****-Apply,* ***K4****-Analyse, K5 - Evaluate*

EVALUATION PATTERN

SCHOLASTIC				NON - SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 – Best of Two Weekly Tests

C2 – Average of Two Monthly Tests

C3 - Mid Sem Test

C4 – Seminar (Once in a Sem.)

C5 – Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Explain symmetry elements and symmetry operations, analyze the point groups of molecules and construct character table	K2 , K3, K4& K5	PSO1, PSO2, PSO4& PSO6
CO 2	Classify the infrared-active and Raman active vibrational modes and list out the allowed and forbidden electronic transitions group theoretically and determine the normal modes	K2 , K3, K4& K5	PSO1, PSO2, PSO4 &PSO6

CO 3	Find out SALC's, apply group theory to find out the hybridization of given molecules and determine delocalization energyof Ethylene and some conjugated systems using HMO theory	K2 , K3, K4& K5	PSO1, PSO2, PSO4&PSO6
CO 4	Define surface tension, Capillary action, Classify of surface active agents, and to derive Gibbs adsorption and BET isotherms	K2 , K3, K4& K5	PSO1, PSO2, PSO3, PSO6& PSO7
CO 5	To explain the kinetics of vinyl, cationic and anionic polymerizations and determine the mass of polymers.	K2, K3 & K4	PSO1, PSO2, PSO4, PSO6, PSO7& PSO8

Mapping of Cos with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9
CO1	3	3	1	3	1	3	1	1	1
CO2	3	3	1	3	1	3	1	1	1
CO3	3	3	1	3	1	3	1	1	1
CO4	3	3	3	2	1	3	3	1	1
CO5	3	3	1	3	1	3	3	3	1

Mapping of Cos with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	1
CO2	3	2	2	1
CO3	3	2	2	1
CO4	3	2	2	1
CO5	3	3	2	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr.S. Sukumari**
2. **Dr. Sr.J.Arul Mary**

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CBCS Curriculum for M.Sc. Chemistry

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	19PG3C13	Green Chemistry	MAJOR CORE	6 Hrs.	5

Course Objectives:

To know eco-friendly methods of synthesis. This helps in planning the synthesis of any type of organic compounds with the revolution of Green Chemistry.

Course Outcome:

After successful completion of the course, the students are able

- To know about the alternative feedstock and to study about the process and advantages of alternative materials
- To get familiarise about the green chemistry technology
- To understand the need of alternative energy sources
- To learn different types of renewable energy sources
- To acquire knowledge about the greener techniques in industries

UNIT I: PRINCIPLES & CONCEPT OF GREEN CHEMISTRY

UNIT II: MEASURING AND CONTROLLING ENVIRONMENTAL PERFORMANCE

UNIT III:EMERGING GREEN TECHNOLOGY AND ALTERNATIVE ENERGY SOURCES

UNIT IV: RENEWABLE RESOURCES

UNIT V: INDUSTRIAL CASE STUDIES

UNIT I: PRINCIPLES & CONCEPT OF GREEN CHEMISTRY 18 Hrs

Introduction –Concept and Principles-development of Green Chemistry- Atom economy reactions –rearrangement reactions , addition reactions- atom uneconomic-sublimation-elimination-Wittig reactions-toxicity measures- Need of Green Chemistry in our day to day life.

UNIT II:MEASURING AND CONTROLLING ENVIRONMENTAL PERFORMANCE 18 Hrs

Importance of measurement – lactic acid production-safer Gasoline – introduction to life cycle assessment-four stages of Life Cycle Assessment (LCA) – Carbon foot printing-green process Matrics-eco labels -Integrated Pollution and Prevention and Control(IPPC)-REACH (Registration, Evaluation, Authorization of Chemicals)

UNIT III:EMERGING GREEN TECHNOLOGY AND ALTERNATIVE ENERGY SOURCES 18 Hrs

Design for Energy efficiency-Photochemical reactions- Advantages-Challenge faced by photochemical process. Microwave technology on Chemistry- Microwave heating –Microwave assisted reactions-Sono chemistry and Green Chemistry – Electrochemical Synthesis-Examples of Electrochemical synthesis.

UNIT IV: RENEWABLE RESOURCES 18 Hrs

Biomass –Renewable energy – Fossil fuels-Energy from Biomass-Solar Power-Other forms of renewable energy-Fuel Cells-Alternative economics-Syngas economy-hydrogen economy-Bio refinery chemicals from fatty acids-Polymer from Renewable Resources –Some other natural chemical resources.

UNIT V: GREENER TECHNIQUES IN INDUSTRIES 18 Hrs

Methyl Methacrylate (MMA)-Greening of Acetic acid manufacture-Vitamin C-Leather manufacture –Types of Leather –Difference between Hide and Skin-Tanning – Reverse tanning –Vegetable tanning –Chrome tanning-Fat liquoring –Dyeing – Application-Polyethylene- Ziegler Natta Catalysis-Metallocene Catalysis-Eco friendly Pesticides-Insecticides.

Reference Books:

1. Mike Lancaster , Green Chemistry and Introductory text, II Edition
2. P.T.Anastas and J.C Warner, Green Chemistry theory and Practice, Oxford University

press, Oxford (1988).

3. P.Tundo*et. al.*, Green Chemistry, Wiley –Blackwell, London (2007).

4. ProttiD.Dondi*et.al.*,Green Chemistry

5. T.E Graedel, Streamlined Life cycle Assessment, Prentice Hall, NewJersey (1998).

6. V.K. Ahluwalia,Methods and Reagents of Green Chemistry: An Introduction by Green Chemistry.

COURSE CONTENTS & LECTURESCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-1	**PRINCIPLES & CONCEPT OF GREENCHEMISTRY**			
1.1	Introduction -Concept and Principles-development of Green Chemistry	2	Chalk & Talk	Black Board
1.2	Atom economy reactions	2	Chalk & Talk	LCD
1.3	Rearrangement reactions	3	Lecture	PPT& White board
1.4	Addition reactions	3	Lecture	Smart Board
1.5	Atom uneconomic-subtitution	2	Lecture	Black Board
1.6	Elimination-Wittig reactions	2	Discussion	Google classroom
1.7	toxicity measures	2	Discussion	Google classroom
1.8	Need of Green Chemistry in our day to day life.	2	Discussion	Black Board
UNIT-2	**MEASURING AND CONTROLLING ENVIRONMENTAL PERFORMANCE**			
2.1	Importance of measurement	2	Chalk & Talk	Black Board

2.2	lactic acid production-safer Gasoline	2	Chalk & Talk	LCD
2.3	introduction to life cycleassessment	3	Lecture	PPT &White board
2.4	Four stages of Life Cycle Assessment (LCA)	3	Lecture	Smart Board
2.5	Carbon foot printing-green process Matrics	2	Lecture	Black Board
2.6	Green process Matrics-eco labels	2	Discussion	Google classroom
2.7	Integrated Pollution and Prevention and Control(IPPC)	2	Discussion	Google classroom
2.8	REACH (Registration, Evaluation, Authorization of Chemicals)	2	Discussion	Black Board
UNIT -3EMERGING GREEN TECHNOLOGY AND ALTERNATIVE ENERGY SOURCES				
3.1	Design for Energy efficiency-Photochemical reactions	2	Chalk & Talk	Black Board
3.2	Advantages-Challenge faced by photochemical process.	2	Chalk & Talk	LCD
3.3	Microwave technology on Chemistry.	3	Lecture	PPT& White board
3.4	Microwave heating -Microwave assisted reactions.	3	Lecture	Smart Board
3.5	Sono chemistry.	2	Lecture	Black Board
3.6	Green Chemistry	2	Discussion	Google classroom
3.7	Electrochemical Synthesis	2	Discussion	Google classroom

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
3.8	Examples of Electrochemical synthesis.	2	Discussion	Black Board
UNIT 4: RENEWABLE RESOURCES				
4.1	Biomass -Renewable energy	2	Chalk & Talk	Black Board
4.2	Fossil fuels-Energy from Biomass	2	Chalk & Talk	LCD
4.3	Solar Power- Other forms of renewableenergy	3	Lecture	PPT& White board
4.4	Fuel Cells-Alternative economics	3	Lecture	Smart Board
4.5	Syngas economy- hydrogen economy	2	Lecture	Black Board
4.6	Bio refinery chemicals from fatty acids	2	Discussion	Google classroom
4.7	Polymer from Renewable Resources	2	Discussion	Google classroom
4.8	Some other natural chemical resources	2	Discussion	Black Board
UNIT V: GREENER TECHNIQUES IN INDUSTRIES				
5.1	Methyl Methacrylate (MMA)-Greening of Acetic acid manufacture	3	Chalk & Talk	Black Board
5.2	Vitamin C-Leather manufacture	3	Chalk & Talk	LCD

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
5.3	Types of Leather -Difference between Hide and SkinTanning	3	Lecture	PPT& White board
5.4	Reverse tanning -Vegetable tanning	3	Lecture	Smart Board
5.5	Chrome tanning-Fat liquoring	3	Lecture	Black Board
5.6	Dyeing -Application	3	Discussion	Google classroom

Levels	C1	C2	C3	C4	Total Scholastic Marks	Non Scholastic Marks C5	CIA Total	% of Assessment
	Session - wise Average 5 Mks.	Better ofW1, W2 5+5=10 Mks.	M1+M2 15Mks	MID-SEM TEST 5Mks	35 Mks.	5 Mks.	40Mks.	
K1	5	-	-	2 ½	-		-	-
K2	-	5	4	2 ½	5		5	12.5 %
K3	-	-	3	5	12		12	30 %
K4	-	-	3	5	9		9	22.5%
Non Scholastic	-	-	-	-	9		9	22.5 %
Total	5	5	10	15	35	5	40	100 %

CIA	
Scholastic	**35**
Non Scholastic	**5**
	40

- ✓ **All the course outcomes are to be assessed in the various CIA components.**
- ✓ **The levels of CIA Assessment based on Revised Bloom's Taxonomy for PG are :**

  K1-Remember, **K2**-Understand, **K3**-Apply, **K4**-Analyse, **K5** - Evaluate

- ✓ **The I PG course teachers are requested to start conducting S1, W1,M1,**

EVALUATIONPATTERN

SCHOLASTIC				NON – SCHOLASTIC	MARKS		
C1	C2	C3	C4	C5	CIA	ESE	Total
5	10	15	5	5	40	60	100

C1 - Average of Two Session WiseTests

C2 - Average of Two Monthly Tests

C3 - Mid SemTest

C4 - Best of Two Weekly Tests

C5 - Non - Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To know about the alternative feedstock and sustainable development	K2& K3	PSO1, PSO2, PSO5 &PSO7
CO 2	To get familiarise about the environmental performance	K2, K3 & K5	PSO2, PSO4,PSO5 & PSO8
CO 3	To understand about the various emerging green trends in synthetic chemistry	K2& K3	PSO1, PSO8 &PSO9
CO 4	To study the importance of renewable and natural chemical resources	K2& K4	PSO4 &PSO5
CO 5	To learn the different greener techniques used in industries.	K2, K4&K5	PSO9

Mapping COs Consistency with PSOs

CO/ PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CO1	3	3	2	2	3	2	3	2	2
CO2	2	3	2	3	3	2	2	3	2
CO3	3	2	2	2	2	2	2	3	3
CO4	2	2	2	3	3	2	2	2	2
CO5	2	2	2	2	2	2	2	2	3

Mapping of Cos with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	3
CO2	3	2	2	3
CO3	2	3	2	2
CO4	3	1	1	3
CO5	3	3	2	3

Note: ♦ Strongly Correlated–**3** ♦ Moderately Correlated –**2**
♦ Weakly Correlated-**1**

COURSE TEACHERS

1. **Dr.A RAJESHWARI**
2. **Dr.K.R.SUBIMOL**

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HOD'SSignature

Curriculum for M.Sc. Chemistry

I M.Sc., SEMESTER –1

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	21PG2SLC	Research Methodology	PG Self learning	-	2

COURSE DESCRIPTION

This paper focuses on all the important aspects of Research Methodology

COURSE OBJECTIVES

This course helps the students to study about all concepts related to Research problem, literature survey, Web and library resources for research and writing research papers and proposals.

Course Outcomes (COs)

CO1	Introduce the purpose and importance of research .
CO2	Understand the various sources of information for literature survey.
CO3	Illustrate the Web and library resources for research.
CO4	Understand the writing of research papers &know the methodology of writing thesis and journal articles.
CO5	Analyse the writing of research proposal.

UNIT - 1 : Introduction to Research

The search for knowledge, purpose of research, scientific method, characteristics of research, Types of research- fundamental or pure research, applied research, action research, historical research, experimental research.

Explanation of research problems, sources of research problems, selection of research problem characteristics of a good research problem, errors in selecting a research problem.

UNIT-II: Literature Survey

Sources of information, Primary, Secondary, Tertiary sources, Journals, Journal abbreviations, Abstracts, Current titles, Reviews, Monographs, Textbooks, Current contents, Introduction to Chemical Abstracts. Online searching, Database, *Scifinder*, *Scopus*, Citation Index, Impact Factor.

UNIT-III: Use of Web resources

The Internet and World Wide Web, internet resources for chemistry, internet search engines, using spreadsheets, word processors, databases and other packages, finding and citing information.

UNIT-IV: Scientific Writing

General aspects of scientific writing, reporting practical and project work, Format of the research report, style of writing the report, references and bibliography, Steps to publish a scientific article in a journal: types of publications- communications, articles, reviews; when to publish, where to publish, specific format required for submission, organization of the material, abbreviations used in scientific writing.

UNIT-V: Writing of Research Proposal:. Research Proposal: Format of research proposal, individual research proposal and institutional proposal.

Reference Books:

1. Ranjit kumar, Research Methodology: A Step by Step Guide for Beginners, Pearson Education; 2nd Ed., (2005).
2. Dr.C.R. Kothari, Research Methodology: Methods and Techniques, New Age International Publishers, 2nd Ed., New Delhi (2014.)
3. M.D. Barbara Gastel and Robert A. Day, How to Write and Publish a Scientific Paper, Greenwood Publishing Group Inc, 8th Ed., 2016.

4. Tanmoy Chakraborty and Lalita Ledwani, Research Methodology in Chemical Sciences: Experimental and Theoretical Approach, Apple Academic Press; 1st Ed.,, 2016.
5. R. L. Dominoswki, Research Methods, Prentice Hall, 1981.
6. H. F. Ebel, C. Bliefert and W. E. Russey, The Art of Scientific Writing, VCH, Weinheim, 1988.
7. H. M. Kanare, Writing the Laboratory Notebook; American Chemical Society: Washington, DC, 1985.
8. J. S. Dodd, Ed., The ACS Style Guide: A Manual for Authors and Editors; American Chemical Society: Washington, DC, 1985.
9. Gibaldi, J. Achtert, W. S. Handbook for writers of Research Papers; 2nd ed.; Wiley Eastern, 1987.
10. Joseph, A. Methodology for Research; Theological Publications: Bangalore, 1986

PSO

PSO 1	Equip with an in-depth knowledge of varied fields namely Organic Chemistry, Inorganic Chemistry, Physical and nanochemistry.
PSO 2	Train in problem solving procedures enables to interpret the experimental data into structures and mechanisms.
PSO 3	Provides a tremendous exposure and cultivates analytical and synthesising measures necessary to take up project work in reputed institutions.
PSO 4	Programme renders diversified thinking thereby promotes creative skills.
PSO 5	to solve the problems that cause a negative impact on surroundings to pursue salient steps to safeguard environment
PSO 6	Application-oriented input sharpens the skill to undertake CSIR-NET exam.
PSO 7	Knowledge with practical dimensions becomes a driving power to undertake research in different areas at a global level.
PSO 8	Multi-layered input enables to avail opportunities at chemical, pharmaceutical industries.
PSO 9	Becomes a contributing force and development agent in society.

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9
CO1	1	2	3	3	1	1	3	2	1
CO2	2	1	1	3	1	1	3	2	1
CO3	1	2	1	3	1	1	3	2	1
CO4	3	3	3	3	1	1	3	2	1
CO5	1	3	3	3	1	1	3	2	1

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	3	2
CO2	3	3	2	2
CO3	2	1	3	2
CO4	3	1	2	2
CO5	2	2	3	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr.S.Sukumari**

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HOD'S Signature

FATIMA COLLEGE (AUTONOMOUS) MADURAI-18

M.Sc.Chemistry- IV SEMESTER

Batteries and its applications – Self Learning

(For those who joined in June- 2022 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	22PG4SLCP	Batteries and its applications	Self Learning	-	2

Objective: This course gives a detailed study of electrochemistry and Batteries

COURSE OBJECTIVES

This course helps the students to study about all concepts related to electrochemical series, batteries and applications of batteries.

Course Outcomes (COs)

After the completion of the course the students will be able to

CO1	Use Nernst equation to calculate the electrode potential and emf of electrochemical cells.
CO2	Understand the various sources of information about electrochemical series.
CO3	Illustrate types of batteries
CO4	Understand lithium batteries
CO5	Analyse clean energy

Units

Unit I

Galvanic cells and EMF – electrode reactions – electrode potentials and cell reactions – representations of electrodes – sign conventions.

Unit II

Electrochemical series– measurements of EMF- Construction of electrochemical cells – Applications.

Unit III

Types of Batteries (Primary and secondary Batteries)

Unit IV

Lithium Ion Batteries , Advantages and disadvantages- How Li-Ion Battery Works?

Unit V

Clean Energy Institute - Super capacitor battery, Charging and Working.

References

Text Book:

1. The principles of Physical chemistry by Puri, Sharma and Pathania.

Reference Book:

1. Introduction to Electrochemistry By Samuel Glasstone

PSO

PSO 1	Equip with an in-depth knowledge of varied fields namely Organic Chemistry, Inorganic Chemistry, Physical and nanochemistry.
PSO 2	Train in problem solving procedures enables to interpret the experimental data into structures and mechanisms.
PSO 3	Provides a tremendous exposure and cultivates analytical and synthesising measures necessary to take up project work in reputed institutions.
PSO 4	Programme renders diversified thinking thereby promotes creative skills.
PSO 5	to solve the problems that cause a negative impact on surroundings to pursue salient steps to safeguard environment
PSO 6	Application-oriented input sharpens the skill to undertake CSIR-NET exam.
PSO 7	Knowledge with practical dimensions becomes a driving power to undertake research in different areas at a global level.
PSO 8	Multi-layered input enables to avail opportunities at chemical, pharmaceutical industries.
PSO 9	Becomes a contributing force and development agent in society.

Mapping of C0s with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9
CO1	1	2	3	3	1	1	3	2	1
CO2	2	1	1	3	1	1	3	2	1
CO3	1	2	1	3	1	1	3	2	1
CO4	3	3	3	3	1	1	3	2	1
CO5	1	3	3	3	1	1	3	2	1

Mapping of C0s with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	3	2	1
CO2	3	3	2	1
CO3	3	3	2	1
CO4	3	3	2	1
CO5	3	3	2	1

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -1

COURSE DESIGNER:

1. **Dr.S.Sukumari**

Forwarded By

S-Tedora.

HOD'S Signature