FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A" Grade by NAAC (3rd Cycle)
74th Rank in India Ranking 2020 (NIRF) by MHRD
Maryland, Madurai- 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT: CHEMISTRY

NAME OF THE PROGRAMME : M.Sc.,

PROGRAMME CODE : PSCH

ACADEMIC YEAR : 2020-2021

FATIMA COLLEGE (AUTONOMOUS), MADURAI-18

DEPARTMENT OF CHEMISTRY

For those who joined in June 2019 onwards

PROGRAMME CODE : PSCH

COURSE CODE	COURSE TITLE	HRS / WK	CREDIT	CIA Mks	ESE Mks	TOT. MKs
SEMESTER – I						
19PG1C1	BASIC CONCEPTS, COVALENT AND IONIC BONDING, SOLID STATE AND CRYSTALLOGRAPHY, AND NUCLEAR CHEMISTRY	6	4	40	60	100
19PG1C2	REACTION MECHANISM AND STEREOCHEMISTRY	6	4	40	60	100
19PG1C3	APPLIED ELECTRO CHEMISTRY & STATISTICAL THERMODYNAMICS	6	4	40	60	100
19PG1C4	INORGANIC QUALITATIVE ANALYSIS	4	2	40	60	100
19PG1C5	ORGANIC QUALITATIVE ANALYSIS	4	2	40	60	100
19PGCEDC1	EDC -ESSENTIALS OF LIFE	3	3	40	60	100
	LIBRARY	1	-	-	-	-
Total		**30**	**19**			
SEMESTER – II						
19PG2C6	ADVANCED COORDINATION CHEMISTRY	6	4	40	60	100
19PG2C7	ELIMINATION AND ADDITION REACTIONS, ORGANIC SPECTROSCOPY AND CONFORMATIONAL ANALYSIS	6	4	40	60	100
19PG2C8	CHEMICAL KINETICS AND QUANTUM MECHANICS	6	4	40	60	100
19PG2C9	INORGANIC QUANTITATIVE ANALYSIS	4	2	40	60	100

COURSE CODE	COURSE TITLE	HRS / WK	CREDIT	CIA Mks	ESE Mks	TOT. MKs
19PG2C10	ORGANIC QUANTITAIVE ANALYSIS AND PREPARATIONS	4	2	40	60	100
19PGCEDC2	EDC ESSENTIALS OF LIFE	3	3	40	60	100
	LIBRARY	1		-	-	-
Total		**30**	**19**			
SEMESTER - III						
19PG3SIC1	INTERNSHIP/SUMMER PROJECT*	-	3	50	50	100
19PG3C11	SPECTROSCOPY AND PERICYCLIC REACTIONS	6	5	40	60	100
19PG3C12	GROUP THEORY, SURFACE CHEMISTRY AND MACROMOLECULES	6	5	40	60	100
19PG3C13	GREEN CHEMISTRY	6	5	40	60	100
19PG3CE1/ 19PG3CE2	MATERIAL CHEMISTRY / BIO ORGANIC CHEMISTRY	4	4	40	60	100
19PG3C14	ELECTRICAL EXPERIMENTS-I	4	2	40	60	100
Total		**30**	**26**			
SEMESTER - IV						
19PG4C15	ORGANOMETALLIC CHEMISTRY-I&II, BASIC CONCEPTS FOR BIO-INORGANIC CHEMISTRY-I&II AND INORGANIC CHAINS, RINGS AND CAGES	6	5	40	60	100
19PG4C16	RETROSYNTHESIS, REACTIONS AND REAGENTS, NATURAL PRODUCTS	6	5	40	60	100

COURSE CODE	COURSE TITLE	HRS / WK	CREDIT	CIA Mks	ESE Mks	TOT. MKs
19PG4C17	SPECTROSCOPY, KINETIC THEORY OF GASES, PHOTOCHEMISTRY AND RADIATION CHEMISTRY	6	5	40	60	100
19PG4CE3/ 19PG4CE4	ANALYTICAL CHEMISTRY / CHEMICAL ENGINEERING	6	4	40	60	100
19PG4C18	Physical practicals-II (Non-electrical experiments)	6	2	40	60	100
19PG4CPR	PROJECT & VIVA VOCE		3	50	50	100
Total		**30**	**26**			
	Total	**120**	**90**			

OFF-CLASS PROGRAMME

ADD-ON COURSES

Courses	Hrs.	Credits	Semester in which the course is offered	CIA Mks	ESE Mks	Total Marks
SOFT SKILLS	40	4	I	40	60	100
COMPUTER APPLICATIONS	40	4	II	40	60	100
MOOC COURSES (Department Specific Courses) * Students can opt other than the listed course from UGC-SWAYAM /UGC /CEC	-	Minimum 2 Credits	-	-	-	
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		13 +				

EXTRA CREDIT COURSE

Course Code	Courses	Hrs.	Credits	Semester in which the course is offered	CIA Mks	ESE Mks	Total Marks
19PGSLC1	**SELF LEARNING COURSE for ADVANCE LEARNERS (Offered for II PG)**	-	-	III & IV	40	60	100

- **Lab Courses :**
  - A range of 10-15 experiments per semester

- **Summer Internship:**
  - Duration-1 month (2nd Week of May to 2nd week of June-before college reopens)

- **Project:**
  - Off class
  - Evaluation components-Report writing + Viva Voce (Internal marks-50) + External marks 50

- **EDC:**

  Syllabus should be offered for two different batches of students from other than the parent department in Sem-I &Sem-II

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	19PG1C2	REACTION MECHANISM AND STEREOCHEMISTRY	PG Core	6 Hrs.	4

COURSE DESCRIPTION

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

COURSE OBJECTIVES

The course deals with reaction mechanism of aliphatic and aromatic substitution reactions, bonding in organic molecules, stereochemistry and natural products chemistry.

UNITS

UNIT –I BONDING IN ORGANIC COMPOUNDS, STRUCTURE AND REACTIVITY (18 HRS.)

Delocalised bonding, conjugation, cross conjugation, resonance, steric inhibition to resonance- hyperconjugation, tautomerism, concept of aromaticity, anti aromaticity, non aromaticity and homoaromaticity, Huckel's rule, alteranate and nonalternate hydrocarbons, aromaticity in nonbenzenoid compounds- fulvenes, azulenes and tropolones.

Electronic effects, hydrogen bonding and steric effects. Factors influencing the dissociation constant of acids and bases, concept of HSAB. Quantitative correlations of structure and reactivity. Hammett equation and linear free energy relationship- Application and limitations. Substituent and reaction constants, Taft equation.

UNIT –II INTRODUCTION TO REACTION MECHANISM (18 HRS.)

Types of mechanisms, types of reactions, activation energy, transition state, intermediates, energy profile diagram for endergonic and exergonic reactions. Reaction intermediates-carbocations, carbanions, free radicals, carbenes, benzyne and nitrenes-their generation, stability and structure. Methods of determining reaction mechanism-kinetic and non kinetic methods. Kinetic and thermodynamic control of chemical reactions. Principle of microscopic reversibility, Hammond's postulate.

UNIT –III STEREOCHEMISTRY (18 HRS.)

Concept of chirality, recognition of symmetry elements and chiral structure. Molecules with more than one chiral center, threo and erythro nomenclature, Specification of (E,Z and R,S) configuration for compounds with chiral center, axis and planes by CIP notation. Interconversion of sawhorse, Newmann and Fischer formulae. The concept of prochirality, topicity, prostereoisomerism. Equivalent, enantiotopic and diastereotopic ligands and faces of molecules. Stereospecific and stereoselective reactions, optical purity. Atropisomerism-stereochemistry of allenes, spiranes, biphenyls, ansa compounds and paracyclophanes. Assymetric synthesis, Crams rule, Prelog's rule.

UNIT –IV NUCLEOPHILIC AND ELECTROPHILIC SUBSTITUTION (18 HRS.)

SN1, SN2 and SNi mechanism and stereochemistry. Factors affecting the reactivity- effect of substrate structure, nucleophile, (nucleophilicity and basicity), nature of the leaving group and solvent. NGP-involving C=C bond, halogen, carboxylate group, phenyl group, nitrogen and sulphur. Nucleophilic substitution at an allylic carbon, trigonal carbon and vinylic carbon. Ambident nucleophile and ambident substrate. Aromatic nucleophilicsubstitution-SNAr, SN1 and benzyne mechanism.

Arenium ion mechanism, orientation and reactivity in monosubstituted benzene, orientation in benzene rings with more than one substituents, orientation on other ring systems (naphthalene, furan, pyrrole, thiophene, quinoline and Isoquinoline).

UNIT –V NATURAL PRODUCTS CHEMISTRY (18 HRS.)

A) Preparation and reactions ofpyrazole, oxazole, thiazole.

Preparation and reactions of coumarine, flavones and anthocyanins-quercetin, caffeine and theobromine

B) Carbohydrates: Methods of determining the size of sugar rings, structural elucidation of lactose and cellobiose.

REFERENCES:

1. March J and Smith M, Advanced Organic Chemistry, 5th Edition, John-Wiley and Sons, US, 2001.
2. Peter Sykes, A guide book to mechanism in organic chemistry, Pearson, US, 6th Edition, 2003.
3. Mukerjee S M and Singh S P, Reaction mechanism in organic chemistry, Laxmi Publications, Delhi, 2007.
4. Gould E S, Mechanism and Structure in organic chemistry, Henry-Holtoo, Inc. 1962.
5. Ernest L. Eliel, Stereochemistry ofcarboncomounds, Tata McGraw Hill, New Delhi,1977.
6. Kalsi P S, Stereochemistry of carbon compounds, 3rd Edition, New Age International Publishers, 1995.
7. Finar I L, Organic chemistry, Vol.2, ELBS, 5th Edition,1956.
8. Agarwal O P, Chemistry of organic natural products, 15th Edition, Goel publishing house, Meerut, 2015.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To interpret the concept of aromaticity and the main properties of aromatic compounds
CO 2	To explore reactivity patterns of conjugated, aromatic molecules and to evaluate the kinetics and thermodynamics controlled reactions
CO 3	To define the fundamentals of chirality, prochirality, symmetry elements and applications of atropisomers
CO 4	To comprehend of nucleophiles, electrophiles, electronegativity, and resonance
CO 5	To sketch the preparation and properties of heterocycliccompounds

I M.Sc. Chemistry

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	**19PG1C3**	**APPLIED ELECTRO CHEMISTRY & STATISTICAL THERMODYNAMICS**	MAJOR	**6**	4

COURSE DESCRIPTION: This course has been framed to enable the students to gain knowledge on theory and applications of electro chemistry & statistical thermodynamics**.**

COURSE OBJECTIVES: This course gives a detailed study of electrochemistry, chemical thermodynamics and statistical thermodynamics

UNITS

UNIT –I Electrochemistry – I (15HRS.)

Introduction to electrolysis, Faraday's laws – specific, equivalent and Molar conductance and their variation on dilution, Kohlrausch's law and its applications, Applications of conductance measurements.

The theory of electrolytic conductance – variation of ionic speeds, The degree of dissociation, Inter ionic attractions – ion-ion and ion-solvent interactions, the electrical potential in the vicinity of an ion, Debye-Huckel equation, Limiting and extended forms of the Debye-Huckel equation, Onsager equation and its validity .

Electrochemical cells – Types of electrodes, Electrochemical series and its applications.

UNIT –II Electrochemistry – II (15HRS.)

Thermodynamics of Reversible cells and reversible electrodes, EMF and equilibrium constant, Nernst equation. EMF of concentration cells with and without transference, Liquid junction potential, applications of EMF measurements and Fuel cells.concentration polarization, polarographic cell Assembly, Ilkovic equation, Fick's law of diffusion, Half-wave potential, Applications of polarography.

Kinetics of electrode reactions – Butler-Volmer equation, Tafel equations, The diffusion Over potential. Interfacial (double layer) phenomena – Types of interface, Electro kinetic phenomena- Electro – osmosis, Electro-phoresis

UNIT –III Electrochemistry and Thermodynamics (15 HRS.)

(a) Amperometric titrations, consecutive electrode processes, Decomposition voltages, Over voltage – Influence of pH and temperature on over voltage, Oxygen over voltage, Applications of over voltage – Corrosion, corrosion inhibition – Galvanising and corrosion inhibitors, electro deposition of metals in aqueous solution.

(b) The behaviour of colloidal systems – colloidal electrolytes, polyelectrolytes, Membrane equilibria – Dialysis, Ion – exchange resins. Electrocatalysis and Electrosynthesis. Biological applications of electrochemistry.

c).Gibbs phase rule and its application to three component systems. Microscopic reversibility and Onsager's reciprocity relation., coupled reactions.

d).Translational, rotational, vibrational and electronic partition functions, partition function and equilibrium constant. Bose Einstein condensation, degeneracy, applicatiion to liquid helium& paramagnetism

UNIT –IV Chemical Thermodynamics (15HRS.)

A general review of enthalpy, entropy and Free energy concepts, Genesis of third law and its limitations – Thermodynamics of systems of variable

compositions – partial molar quantities and their determination – chemical potential – Gibbs-Duhem equation – Duhem – Margules equation – Fugacity and its determinations – choice of Std. state – Activity and activity coefficients – determination – Electrolytes and non-electrolytes-– Introduction to non-equilibrium thermodynamics – transformation of the generalized fluxes and forces, non-equilibrium – Stationary states, phenomenological equations, Electrokinetic phenomena – diffusion, electric conduction, Irreversible thermodynamics for biological systems

UNIT –V :' Statistical Thermodynamics (15 HRS.)

Concept of distribution, Thermodynamic probability and most probable distribution. Microstate and Macrostate, Ensemble averaging,Postulates of ensemble averaging, canonical, Grand canonical and microcanonical ensembles, corresponding distribution laws. Maxwell-Boltzmann statistics – partition functions – thermodynamic properties from partition function

Quantum statistics – Fermi-Dirac and Bose-Einstein statistics – photon gas, Electron gasdegeneracy and electron gas (Fermi energy level). Heat capacities of diatomic gases.Einstein & Debye's theory of heat capacity of solids-,populationinversion-negative Kelvin temperature

REFERENCES

Reference books for Electrochemistry:

1. Samuel Glasstone, *Introduction to Electrochemistry*, Affiliated East – West press private limited, 2002.
2. D.R.Crow, Principles & Applications of Electrochemistry, 3rd Edn, Chapman and Hall.
3. B.Viswanathan, R.Venkataraman, Dr.K. Rengarajan, Dr.S.Sundaram, Dr. P.S. Raghavan, Electrochemistry Principles and applications, 1st Edn, S. Viswanathan Printers Ltd.,

Reference books for Thermodynamics:

1. J. Rajaram and J.C. Kuriacose, Thermodynamics For Students of Chemistry, 2nd Edn., S.L.N.Chand and Co., Jalandhar, 1986.
2. I.M. Klotz and R.M. Rosenberg, Chemical thermodynamics, 6th Edn., W.A.Benjamin Publishers, California, 1972.
3. M.C. Gupta, Statistical Thermodynamics, New Age International, Pvt. Ltd., New Delhi, 1995.
4. D.A. McQurrie and J.D. Simon, *Physical Chemistry - A Molecular Approach*, Viva Books Pvt. Ltd., New Delhi, 1999.
5. R.P. Rastogi and R.R. Misra, *Classical Thermodynamics*, Vikas Publishing, Pvt. Ltd., New Delhi, 1990.
6. F.W. Sears & G.L. Salinger, Thermodynamics, Kinetic theory & Statistical Thermodynamics, New Delhi, Narosa Publishing House, 3rd Edn., 1989.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To gain knowledge Kohlrausch's law and electrolytic conductance
CO 2	Calculation of conductance & Possess thorough understanding of Debye-Huckel equation
CO 3	Apply the concept of electrochemistry & Gibbs phase rule
CO 4	Categorize and compare various partition functions - translational, rotational, vibrational and electronic partition functions
CO 5	Distinguish various Fermi-Dirac and Bose-Einstein statistics and Maxwell-Boltzmann statistics based on the nature of the particles

I M.SC. CHEMISTRY
SEMESTER-I

(For those who joined in 2019 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PACH	19PG1C4	INORGANIC QUALITATIVE ANALYSIS	PRACTICAL	4 Hrs.	2

COURSE DESCRIPTION

This paper gives a hands on experience of Qualitatively analysing the Inorganic salts containing simple and rare earth metal cations.

COURSE OBJECTIVES:

- To study the principle of distribution of common and rare metal ions in different groups.
- To know the inter- and intra group precipitation and separation of metal ions.
- To improve the skill in the qualitative analysis of rare metal ions in different groups.
- To identify the methodology to analyse a metal ion in the presence of another metal ion.

Qualitative analysis
Analysis of a mixture of four cations containing two common and two rare cations.
Common cations:
Group I: Pb and Hg;
Group II: Hg, Cu, Cd, Bi, Sb, As, and Sn;
Group III: Al, Fe, and Cr;
Group IV: Mn, Zn, Co, and Ni;
Group V: Ca, Sr, and Ba;
Group VI: Mg, K, and NH_4^+ .
Rare cations:
Group I: W and Tl; Group IA: Se and Te;
Group II: Mo;
Group III: Be, Tl, Ce, Ti, Th, Zr, V, and U;
Group VI: Li

This analysis involves two steps

1. **Group separation**
   Classification of cations into groups by using group reagents
2. **Group Analysis**
   Confirmatory test for cations

Text Book

V. V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rd ed., The National Publishing Company, Chennai, 1974.

Reference book .

Vogel's Text book of Inorganic Qualitative Analysis, 4th Ed, ELBS, London,1974.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To study the principle of distribution of common and rare metal ions in different groups.
CO 2	To know the inter- and intra group precipitation and separation of metal ions.
CO 3	To improve the skill in the qualitative analysis of rare metal ions in different groups.
CO 4	To identify the methodology to analyse a metal ion in the presence of another metalion.

I M.SC. CHEMISTRY
SEMESTER-I
(For those who joined in 2019 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PACH	19PG1C5	ORGANIC QUALITATIVE ANALYSIS	PRACTICAL	4 Hrs.	2

COURSE DESCRIPTION:

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.

Qualitative Analysis of an organic binary mixture

- Pilot separation
- Bulk separation
- Analysis of organic compounds

The functional groups are combined in the following combinations.

- Acidic + Phenolic compounds
- Basic + Phenolic compounds
- Acidic + Neutral compounds
- Basic +Neutral compounds

The possible functional groups are

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

I. Single step Organic preparations:

Preparation of

1. p-Nitro acetanilide from Acetanilide
2. 2-Naphthylbenzoate from 2-Napthol
3. Dibenzalacetone from Benzaldehyde

4. Acetyl salicylic acid from Salicylic acid.

Reference books:

1. Ganapragasam& Ramamurthy G, Organic Chemistry Lab Manual , 2nd 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 Textbook of Practical Organic Chemistry, 5 th Ed., Pearson Publication.

3. Vengataswaran V et al., Basic Principle of Practical Chemistry, Sultan Chand and sons, New Delhi, 1997.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To be skilled in the separation of binary organic mixtures.
CO 2	To gain knowledge on the skills of doing micro level analysis
CO 3	To know the methods of qualitative analysis of organic compounds
CO 4	To learn about the preparation of suitable derivative of the organic functional
CO 5	To prepare organic compounds

I M.Sc. Chemistry

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	19PG2C6	Advanced Coordination Chemistry	Lecture	6	4

COURSE DESCRIPTION: It deals with theories, charecterisation with spectral studies and reaction mechanism of coordination compounds.

COURSE OBJECTIVES: This course provides the study of different aspects of co ordination chemistry such as bonding, reaction mechanism and electronic spectra and other spectral techniques

UNITS

UNIT –I INTRODUCTION TO CO-ORDINATION CHEMISTRY – I **(18HRS.)**

Co-ordination numbers- Isomerism-Geometrical &Optical-ORD, CD-Chelate effect, stability of complexes – determination of stability constant, factors affecting stability constants, V.B.Theory –postulates, formation of complex ions on the basis of VB theory,limitations and Magnetic properties of complexes

UNIT –II BONDING IN CO-ORDINATION CHEMISTRY (18HRS.)

Bonding in Co-ordination compounds, VBT, CFT, CFSE, CFT to tetrahedral,tetragonal and square planar complexes, factors affecting Δ ,applications of CFT, spectrochemical series-Nephelauxelic effect, M O theory to Octahedral, Jahn_teller effect-square planer complexes-Pi bonding and MOT, experimental evidence for Pi-bonding, orbital contribution to magnetic moments.

UNIT –III ELECTRONIC SPECTRA (18 HRS.)

Electronic spectra, selection rules, Term &Term symbol, term symbols derivation for p^2 configuration, calculation of micro states, Orgel diagrams for octahedral and tetrahedral complexes of metal ions with d^1 to d^9systems , Tanabe Sugano diagram for d^2,d^6 and d^7 systems, Tetragonal distortions from octahedral symmetry and charge transfer spectra.

UNIT –IV Other Spectral Techniques for Co-ordination Compounds

(18HRS.)

Applications of Mossbauer, NQR, NMR, EPR, IR Spectral Techniques to co-ordination complexes.

UNIT –V : REACTION MECHANISMS (18HRS.)

Reaction Kinetics and mechanism,substitution reactions in square planar complexes,Thermodynamic and Kinetic Stability-Kinetics of Octahedral substitution,mechanisms of Redox reactions.Outer sphere-inner sphere E.T reactions

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

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	Compare the stabilities of complexes using stability constants and to identify the types of isomers
CO 2	To describe the theories of co-ordination compounds to understand the colours and magnetic properties and their position in the spectrochemical series
CO 3	Investigate the structures of complexes using IR,NMR ,E SR and other spectral techniques
CO 4	Possess a thorough understanding of electronic spectra of complexes
CO 5	To arrive at the mechanisms of substitution reactions in six and four coordinated complexes using kinetic studies

I M.Sc. Chemistry

SEMESTER –I

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	19C1EDC	ESSENTIALS OF LIFE	EDC	3 Hrs.	3

COURSE DESCRIPTION

This paper deals with pharmaceutical chemistry, volumetric analysis, preparation of house hold products, synthesis of polymers and agriculture chemistry.

COURSE OBJECTIVES

- To understand the concepts of pharmaceutical chemistry and importance of polymer chemistry.
- To apply the various methods to prepare the house hold products

UNIT I -PHARMACEUTICALCHEMISTRY (9 HRS)

Introduction to drugs- Antibiotics, disinfectants, anesthetics-antipyretics-anti inflammatory drugs- diabetics & hypoglycemic drugs-cancer-neoplastic drugs.

UNIT II -PREPARATION OF HOUSEHOLDITEMS (9 HRS)

Preparations of house hold items- phenoyl, liquid soap, detergent powder, dish washing powder, candle and Incense stick.

UNIT III- QUANTITATIVE ANALYSIS & CHROMATOGRAPHIC TECHNIQUES (9 HRS.)

Preparation of solutions- percentage by weight, molarity, molality, standard solution, primary and secondary solution, determination of unknown concentration. Chromatographic techniques – Thin Layer Chromatography and Column chromatography.

UNIT –IVPOLYMERS: (9 HRS)

Introduction – Polymerisation, Individual polymers, Natural and synthetic rubber, Polyamides, Poly urethanes, Poly Vinyl chlorides, Polyesters, Polyethylene.

UNIT –V– I AGRICULTURAL CHEMISTRY (9 HRS)

Introduction- Classification of soil, Natural manures- Vermi compost – uses Artificial Manures – Chemical fertilizers – preparationanduses. Biogas production andmanure.

REFERENCES:

1. Jayashree Gosh, Textbook of Pharmaceutical Chemistry, S.Chand& Chand publications New Delhi (1997).
2. JayashreeGhosh, Fundamental concepts of Applied chemistry, S.Chand publications, New Delhi (2013).
3. Finar I L, Organic Chemistry Volume I and II, Sixth Edition, ELBS with Longmann, Singapore (1997).
4.H. Kaur, Instrumental methods of chemical analysis, PragatiPrakashan , 2003.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	Acquire knowledge of commonmedicine.
CO 2	Prepare different house hold materials
CO 3	To calculate the concentration of solution in volumetricanalysis and compare column and TLCtechnique.
CO 4	Classify the different types of polymers and itscharacteristics.
CO 5	Idetify the different types of soil and compare natural fertilizer from artificial fertilizer.

I M.Sc.,CHEMISTRY

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	19PG2C7	Organic chemistry-II	PG Core	90 Hrs.	6

COURSE DESCRIPTION

This course enables the students to get a thorough knowledge of elimination and addition reactions, conformational analysis and selective organic name reactions and rearrangements, study of organic spectroscopy and their applications in structural elucidation of organic compounds.

COURSE OBJECTIVES

This course deals with elimination and addition reactions, conformational analysis and selective organic name reactions and rearrangements. It also provides an elaborate study of organic spectroscopy and their applications in structural elucidation of organic compounds

UNITS

UNIT –I ELIMINATION REACTIONS (18HRS.)

Elimination- E2,E1 and E1CB mechanism . Orientation of the double bond.Hoffmann and Sayetzeff rules. Reactivity-effect of substrate, attacking base, the leaving group and medium. Competition between elimination and substitution. Orientation in pyrolytic elimination.

Self-Study: Bredt's rule

UNIT –II ADDITION REACTIONS (18 HRS.)

Addition to carbon-carbon multiple bonds-Electrophilic addition, Nucleophilic addition, Free radical addition, Addition to conjugated systems.

Orientation and reactivity. Hydroboration, addition of bromine to E and Z-2-butene, Hydroxylation- OsO4, Woodward method and Prevost reaction.

Addition to Carbon-Hetero multiple bonds-Mechanism and reactivity. Addition of alcohols and amines to aldehydes and ketones- mechanism of metal hydride reduction. - Addition of Grignard reagents, organozinc and organo lithium reagents to carbonyl and unsaturated carbonyl compounds.

Self-Study: Hydroxylation using alk. KMnO4

UNIT –III CONFORMATIONAL ANALYSIS (18 HRS.)

a)Introduction-Configuration and conformation-Conformation of molecules-acyclic molecules, ethane and n-butanes. Conformation of cyclohexane, mono and disubsitutedcyclohexanes, Cyclohexanones. Fusedbicyclicmolecules,polycyclicmolecules,perhydrophenanthrenes.

b)Conformation and Reactivity:

Conformation and reactivity in acyclic systems – Ionic elimination – pyrolytic elimination, NGP by bromine. Conformation and reactivity in cyclohexane system SN1, SN2, saponification, ionic elimination, pyrolytic elimination, NGP – 3^0 H and acetoxy group, epoxide ring formation and ring opening, Electrophilic addition, Molecular rearrangements, Curtin Hammett Principle.

Self-Study: Conformation ofdecalins

UNIT –IV ORGANIC SPECTROSCOPY UV,IR SPECTRA (18 HRS.)

i) UV-Visible Spectroscopy- Theory of electronic spectroscopy, Types of electronic transitions – Chromophore, Auxochrome, Bathochromic shifts, Hypsochromic shift, Hypochromic and hyperchromic shift – Factors affecting λ max – solvent effect, Conjugation and steric hindrance - Fieserwoodward rules for calculating λ max in conjugated diene and carbonyl compounds.ii) IR Spectroscopy- Basic principles – Factors influencing vibrational frequencies – vibrational coupling and Fermi resonance, Electronic effects, Bond angles, field effect, physical state and solvent effect – Scanning of IR spectrum – Fingerprint regions - molecular vibrational frequency-characteristic frequencies of some important functional groups such as

>C=O,- CN,-OH,-NH2,-COOH,-C-H, -C=C-H, -CHO,-C=C-H etc.- Application of IR

spectra.

Self-Study: Applications of UV spectroscopy.

UNIT –V SELECTIVE ORGANIC NAME REACTIONS (18HRS.)

Favorski reaction-Stork- enamine reaction, Ene reaction-shapiro reaction-Baeyer Villiger reaction-, Birch reduction, Mannich reaction, Wittig reaction, Stobbe reaction, Beckmann, Fries, Wagner-Meerwein rearrangement, Wolf rearrangement, Skraup synthesis, ,dienone-phenol rearrangement.

Self-Study: Steven's rearrangement

REFERENCES:

1.Jerry march, Advanced Organic chemistry, Reaction mechanism and structure,Willey,4th edn,2001.

2.E.S.Gould, Mechanism and structure in organic chemistry,Henry-

Holtoo INC, 1960.

3.Ernest.L.Eliel, Stereo chemistry of carbon compounds, Tata Mcgraw-

Hill,NewDelhi22nd reprint, 2000,.

4.D.Nasipuri,Stereochemistry of organic compounds, ,Wiley eastern limited,NewDelhi, ,3rdedn, 2003.

5.Silverstein,Bassler and Morrel,Spectrometric identification of organic

compounds, ,John Wiley and Sons, 4thedn.

6.P.S. Kalsi,spectroscopy of organic compounds, ,Wiley eastern,3rdedn. 2016.

7.WiliamKemp, organic spectroscopy,Macmilan,3rdedn. 1991.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To comprehend the mechanism of elimination and substitution reactions and to apply the stereochemistry in E1, E2, ionic and pyrolytic eliminations.
CO 2	To interpret the concept of nucleophilic and free radical addition reactions and metal hydride reduction and to discriminate the reactivity of organometalic reagents.
CO 3	To explore reactivity patterns of substituted cyclohexanes and to employ conformational reactivity in cis and trans decalins and to apply conformations in SN1, SN2, ionic, pyrolytic eliminations and NGP reactions.
CO 4	To acquire a complete knowledge of the principles of UV, IR spectroscopy and to examine the various functional groups present in organic molecules using λmax and IR frequency values .
CO 5	To differentiate the molecular rearrangements and to solve the simple problems and to recall the various naming reactions and to interpret the products.

I M.Sc., Chemistry

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	19PG2C8	Chemical Kinetics and Quantum Mechanics	PG Core	90 Hrs.	6

COURSE DESCRIPTION

This paper focuses on all the important aspects of Chemical Kinetics and Quantum Mechanics.

COURSE OBJECTIVES

This course helps the students to approach the chemical systems using quantum mechanical approach, to study about all concepts and theories related to Chemical kinetics

UNITS

I. CHEMICAL KINETICS - I 18 Hrs.

a) Basics of Chemical Kinetics

b) Kinetics and mechanisms of complex, consecutive and chain reactions- Formation of HBr, Decomposition of acetaldehyde and Pyrolysis of methane,Catalysis by ions of variable valency, activation of molecular hydrogen. Kinetics of reactions in solution – Diffusion controlled reaction in solution, Influence of ionic strength on reaction rates – The salt effects, Influence of solvent on reaction rates and Isotope effect.

II. CHEMICAL KINETICS - II 18 Hrs.

a) Techniques for fast reactions – stopped flow technique, relaxation methods, temperature and pressure jump methods, shock tube methods, flash photolysis and pulse radiolysis, Influence of temperature on reaction rates and potential energy surfaces.

b) Introduction to catalysis – homogeneous catalysis – acid base catalysis – mechanism, catalytic activity and acid base strength, acidity function. Catalysis by enzymes – Michaelis – Menten mechanism, influence of pH and temperature on enzyme catalysed reactions. Heterogeneous catalysis – derivation of B.E.T isotherm.

III. CHEMICAL KINETICS – III AND QUANTUN MECHANICS-I 18 Hrs.

a) Theories of reaction rates – Collision theory, Theory of absolute reaction rates (ARRT) – Thermodynamic treatment, Theory of Unimolecular reactions – Lindemann, Hinshelwood, RRK, RRKM, Slater's theory and Marcus theory of electron transfer reactions .

b) Introduction to Quantum mechanics - The schrodinger wave equation, Postulates of Quantum mechanics, Operators – Linear operator, commuting operators, Hermitian operator. Eigen functions and Eigen values, Orthogonality and Normalisation.

IV. QUANTUM MECHANICS - II 18 Hrs.

Discussion of solutions of Schrödinger equation to particle in a One Dimensional Box, Three Dimensional Box, The Simple Harmonic Oscillator, The Rigid rotator, The H-atom, Probability Distribution curves, Angular momentum - Quantum mechanical definition of angular momentum, Commutation Relations, Physical significance of Commutation relations, Eigen functions and Eigen Values of angular momentum.Symmetric and Antisymmetric Wave functions , Pauli's exclusion principle of Antisymmetric wave functions.

V. Quantum Mechanics –III 18hrs

Approximation methods – The Variation theorem, Linear variation principle, Application of variation method to He – atom, Perturbation theory (only Time independent, First order and non-degenerate),

Application of Perturbation Theory to He-atom. Hartree's and HartreeFock Self consistent Field Theory,Huckel Molecular orbital theory –Huckel theory of conjugated system-Delocalization Energy, Bond order and Charge density calculations, Application of HMO to ethylene, butadiene, cyclobutadiene and cyclopropenyl system .

References Books:

1. K. J. Laildler, Chemical Kinetics, Pearson, 3rdEdn, 2012

2. G.L. Agrawal, Basic chemical kinetics, TataMcgraw-Hill, 1stEdn, 1990.

3. N.Levine, *Quantum Chemistry*, 5thEdn, PrinticeHallof India, NweDelhi, 2000.

4. D.A. McQuaric and J. D. Simon.*Physical Chemistry, A Molecular Approach*,Viva Books

Pvt. Ltd., New Delhi, Reprint, 1998.

5. D. A. McQuarie, Quantum Chemistry, Viva Books PW. Ltd.,New Delhi, Reprint, 2003.

6. R.K. Prasad,Quantum Chemistry through problems and Solutions, New Age International

Publishers, New Delhi, 3rdEdn, 2006.

7. A. K. Chandra, Introductory Quantum Chemistry, TataMcgraw-Hill, New Delhi, 4thEdn, 2001.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To Understand the concept of rate constants, ionic strength, Fast reactions, Catalysis, Operators, orthogonality and normalization and to solve the problems related to rate constants and operators
CO 2	To explore and to evaluate the kinetics of complex, consecutive and chain reactions and Kinetics of reactions in solution and to learn the Influence of ionic strength on reaction rates.
CO 3	To compare the various Theories of reaction rates and explain the postulates of quantum mechanics and operators
CO 4	To determine solutions of Schrödinger equation to particle in a One Dimensional Box, Three Dimensional Box, The Simple Harmonic Oscillator, The Rigid rotator, The H-atom
CO 5	To apply the Variation method and perturbation method to He atom and HMO theory to conjugated systems

I M.Sc.

SEMESTER –II

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PGACH	19C2EDC	ESSENTIALS OF LIFE	EDC	3Hrs.	3

COURSE DESCRIPTION

This paper deals with pharmaceutical chemistry, volumetric analysis, preparation of house hold products, synthesis of polymers and agriculture chemistry.

COURSE OBJECTIVES

To understand the concepts of pharmaceutical chemistry and importance of polymer chemistry.

To apply the various methods to prepare the house hold products

UNIT I -PHARMACEUTICALCHEMISTRY (9 HRS.)

Introduction to drugs- Antibiotics, disinfectants, anesthetics-antipyretics-anti inflammatory drugs- diabetics & hypoglycemic drugs-cancer-neoplastic drugs.

UNIT II -PREPARATION OF HOUSEHOLDITEMS: (9 HRS.)

Preparations of house hold items- phenoyl, liquid soap, detergent powder, dish washing powder, candle and Incense stick.

UNIT III- QUANTITATIVE ANALYSIS & CHROMATOGRAPHIC TECHNIQUES: (9 HRS.)

Preparation of solutions- percentage by weight, molarity, molality, standard solution, primary and secondary solution, determination of unknown concentration.Chromatographic techniques – Thin Layer Chromatography and Column chromatography.

UNIT –IVPOLYMERS: (9 HRS)

Introduction – Polymerisation, Individual polymers, Natural and synthetic rubber, Polyamides, Poly urethanes, Poly Vinyl chlorides, Polyesters, Polyethylene.

UNIT –V– I AGRICULTURAL CHEMISTRY (9 HRS)

Introduction- Classification of soil, Natural manures- Vermi compost – uses – Artificial Manures – Chemical fertilizers – preparationanduses. Biogas production andmanure.

REFERENCES:

4. Jayashree Gosh, Textbook of Pharmaceutical Chemistry, S.Chand& Chand publications New Delhi (1997).

5. JayashreeGhosh, Fundamental concepts of Applied chemistry, S.Chand publications, New Delhi (2013).

6. Finar I L, Organic Chemistry Volume I and II, Sixth Edition, ELBS with Longmann, Singapore (1997).

4.H. Kaur, Instrumental methods of chemical analysis, PragatiPrakashan , 2003.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	Acquire knowledge of common medicine.
CO 2	Prepare different house hold materials
CO 3	To calculate the concentration of solution in volumetric analysis and compare column and TLC technique.
CO 4	Classify the different types of polymers and itscharacteristics.
CO 5	Identify the different types of soil and compare natural fertilizer from artificial fertilizer.

I M.SC. CHEMISTRY

SEMESTER-II

(For those who joined in 2019 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	19PG2C9	INORGANIC PRACTICALS-II - INORGANIC QUANTITATIVE ANALYSIS	PRACTICAL	4	2

COURSE DESCRIPTION

This course gives training to prepare inorganic complexes in a pure form and to estimate metal ions present in the solution.

COURSE OBJECTIVES:

- To enable the students to acquire the quantitative skills in volumetric analysis and gravimetric analysis
- To improve the skill in quantitative estimation of metal ions by various titric methods
- To identify the methodology to estimate a metal ion in the presence of another metal ion.
- To improve the skill in synthesis of inorganic complexes.

I.Preparation of inorganic complexes:

1. Hexathioureaplumbusnitrate
2. Potassiumcupricsulphate
3. Trioxalatoaluminate(III).
4. Tristhioureacopper(I)sulphate
5. Sodiumnitroprusside
6. Tetramminecopper(II)sulphate

II.Volumetric analysis

1. Volumetric estimation of Ca and Mg in the solution containing Ca and Mg
2. Volumetric estimation of Cu in the solution containing Cu and Ni
3. Volumetric estimation of Cu in the solution containing Cu and Zn.
4. Volumetric estimation of Ba in the solution containing Ba and Zn

III. Gravimetric analysis

1. Gravimetric determination of Zn in Cu and Zn solution
2. Gravimetric determination of Ni in Cu and Ni solution.
3. Gravimetric determination of Mg in Ca and Mg solution.
4. Gravimetric determination of Zn in Ba and Zn solution.

ReferenceBooks:

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
2. G. Marr and B. W. Rockett, Practical Inorganic Chemistry ,Von Nostrand 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).

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To enable the students to acquire the quantitative skills in volumetric analysis and gravimetric analysis
CO 2	To improve the skill in quantitative estimation of metal ions by various titric methods
CO 3	To identify the methodology to estimate a metal ion in the presence of another metal ion.
CO 4	To be skilled in synthesis of inorganic complexes

ORGANIC CHEMISTRY PRACTCAL – II – 19PG2C10

I M.Sc. CHEMISTRY

SEMESTER-II

(For those who joined in 2019 onwards)

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	19PG2C9	INORGANIC PRACTICALS-II - INORGANIC QUANTITATIVE ANALYSIS	PRACTICAL	4	2

COURSE DESCRIPTION

This course gives a hands on experience of quantitatively analyzing organic compounds and to synthesis organic compounds using two stages.

COURSE OBJECTIVE:

To make the students to estimate quantitatively the given substance using suitable procedure and also prepare organic compounds using single stage.

I. Organic Estimations

1. Estimation of Glucose (Lane and eynon's method)
2. Estimation of Glucose (Bertrand's method)
3. Estimation of Glycine
4. Estimation of Ethyl Methyl Ketone

II. Double stage

Organic synthesis:

Synthesis of:

1. Benzanilide from benzophenoneoxime
2. p-bromoaniline from p-bromoacetanilide
3. Tribromoaniline from aniline
4. P-Nitroaniline from acetanilide

References:

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 Textbook of Practical Organic Chemistry*, 5 th Ed., Pearson Publication.

Vengataswaran V et al., *Basic Principle of Practical Chemistry*, Sultan Chand and sons, New Delhi, 1997

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	Students understand the quantitative analysis
CO 2	To develop the ability for synthesizing organic compounds by single stage
CO 3	To develop the ability for synthesizing organic compounds by double stage.
CO 4	To study the reaction mechanism.

II M.Sc. Chemistry

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	19PG3C11	Spectroscopy and Pericyclic reactions	Lecture	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.

UNITS

UNIT I-^{1}H -NMR SPECTROSCOPY (15 HRS)

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

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

UNIT II-^{13}C- NMR SPECTROSCOPY & 2D-NMR SPECTROSCOPY (15 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 (15 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 (15HRS.)

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 (15HRS.)

Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatrienes and allyl systems, classification of pericyclic reactions- FMO and PMO approaches (excluding Correlation diagram method) – Electrocyclic reactitons-conrotatory and disrotatory motions- 4n, 4n+2- Cycloaddition- suprafacial and antarafacial additions, (2+2) and (4+2) cycloadditions, Cheleotropic reactitons- 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 OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To acquire a complete knowledge of the basic principles of ^{1}H-NMR, ^{13}C-NMR and Mass spectroscopy
CO 2	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
CO 3	To be competent to assign structures to simple molecules on the basis of nuclear magnetic resonance spectra
CO 4	To distinguish the similarities and differences of Pericyclic reactions and Cyclo addition and sigmatropic reactions
CO 5	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

II M.Sc.

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	19PG3C12	Group Theory, Surface Chemistry and Macromolecules	PG Core	90 Hrs.	6

COURSE DESCRIPTION

This paper focuses on all the important aspects of Group Theory, Surface Chemistry and Macromolecules

COURSE OBJECTIVES

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.

UNITS

UNIT-I: 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 **18Hrs**

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 18Hrs

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

UNIT– IV: Surface Chemistry 18hrs

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 micellar concentrartion(CMC) , factors affecting the CMC surfactants. Counter ion binding to micells, thermodynamics of micelliyation. phase seperation and mass action models, solubilazation, micro emulsion reverse micells.

UNIT-V: Macromolecules: 18hrs

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

1) F. A. Cotton, Chemical Applications of Group Theory. 2nded.,John Wiley & Sons, 1971.

2) K. V. Raman, Group Theory and its Applications to Chemistry, Tata McGraw-Hill, NewDelhi, 1990

3) V.Ramakrishnan and M.S.Gopinathan-Group theory in Chemistry-Vishal -1988.

4).Y.Moroi, Micelles, Theoretical and applied aspects, 1stEdn, Plenum Press, New York, 1992

5.)V. R. Gowariker, N. V. Viswanathan and JayadevSreedhar, Polymer science, Halsted Press (John Wiley & Sons), New York, 1stEdn, 1986.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To learn about symmetry elements and symmetry operations, the point groups and character table
CO 2	To Describe the selection rule for infrared-active and Raman active transitions, electronic transitions
CO 3	To analyse the hybridization of given compounds and to apply HMO theory to Ethylene and some conjugated systems
CO 4	To Classify of surface active agents, Polymers, and to derive Gibbs adsorption and BET isotherms
CO 5	To explain the kinetics of vinyl, cationic and anionic polymerizations and to determine the mass of polymers.

II 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	LECTURE	6	5

COURSE DESCRIPTION

This paper focuses on all the important aspects of Green chemistry like principles, concepts, renewable sources and Greener techniques.

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.

UNITS

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.

REFERENCES:

9. Mike Lancaster , Green Chemistry and Introductory text, II Edition
10. P.T.Anastas and J.C Warner, Green Chemistry theory and Practice, Oxford University press, Oxford (1988).
11. P.Tundo*et. al.*, Green Chemistry, Wiley –Blackwell, London (2007).
12. P.Tundo*et. al.*, Green Chemistry, Wiley –Blackwell, London (2007).
13. Protti D.Dondi *et.al.*,Green Chemistry
14. V.K. Ahluwalia,Methods and Reagents of Green Chemistry: An Introduction by Green Chemistry.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To know about the alternative feedstock To study about the process and advantages of alternative materials
CO 2	To get familiarise about the green house technology
CO 3	To understand the advantage and disadvantages o protecting the cultivation.
CO 4	To study about the biocatalytic reactions and fermentation
CO 5	To learn about the industrial case studies

II M.Sc.,CHEMISTRY

SEMESTER –III

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS /WEEK	CREDITS
PGACH	19PG3CE1	BASICS,SYNTHESIC METHODS PROPERTIES, CHARACTERIZATION TECHNIQUES AND APPLICATIONS OF NANOMATERIALS	LECTURE	4	5

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 OBJECTIVES

- To understand the unique properties of nanomaterials
- To apply the various instrumentation techniques to characterize the nanomaterials

UNIT I : BASICS OF NANOMATERIALS (15 HRS)

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

Self-studysupramolecular structures

UNIT II : SYNTHETIC METHODS OF NANOMATERIALS (15 HRS)

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: Purification carbon nanotubes

UNIT III :PROPERTIES OF NANOMATERIALS (15 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.Metalnanoclusters- rare gas and molecular clusters.

Self-study - Properties of semiconducting nanoparticles

UNIT IV :CHARACTERIZATION TECHNIQUES (15 HRS)

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

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

UNITV : APPLICATIONS OF NANOMATERIALS (15 HRS)

Nanosensors: applications of optical nanosensors ,chemical nanosensors, electrochemical nanosensors, micro-electro mechanical sensors and biosensors,

Nanocatalyst: Applications ofplatinum,palladium,silver,cobaltnanoparticles,CNTs and polymeric naomaterials as catalyst

Nanomedicine: Nanomaterials in drug delivery,photodynamic therapy, molecular imaging,cancertreatment,molecularmotors,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 PublicationsPvt. Ltd.
4. Mark Ratner, Daniel Ratner, Nanotechnology, A Gentle Introduction To The Next Big Idea, Pearson Education, 5thEdn, 2009.
5. Dr. S. Shanmugam, Nanotechnology, MJP Publishers, 2010.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	Distinguish between bulk material and nanomaterials
CO 2	Choose the suitable synythetic methods to prepare particular nanomaterials
CO 3	Interpret the structure of nanomaterials using various characterisation techniques
CO 4	Catagorize and identify the different types Carbon nano structures
CO 5	Summarise the uses of nanomaterials in various fields

II M.Sc.,CHEMISTRY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	19PG4C15	ORGANOMETALLIC CHEMISTRY-I&II, BASIC CONCEPTS FOR BIO-INORGANIC CHEMISTRY-I&II AND INORGANIC CHAINS, RINGS AND CAGES	LECTURE	6 Hrs.	6

COURSE DESCRIPTION

This paper deals with preparation,reactions and structure of Organometallic compounds. This paper also provides information about organometallic catalysts and basic concepts and structures of minerals and vitamins

COURSE OBJECTIVES

- To understand the concepts of organometallic chemistry and importance of biological compounds.
- To apply the various rules to interpret the structure of organometallic complexes and bioinorganic complexes.

UNIT –I TITLE Organometallic Chemistry-I: (18 HRS.)

Introduction, 16 and 18electron rule, Metal carbonyl complexes, polynuclear carbonyl complexes, Anionic carbonyl complexes(carbonylate ions), carbonyl hydrides, Nitrosyl complexes, Carbene and Carbyne complexes, Non Aromatic Alkene and Alkyne complexes, Allyl and pentadienyl complexes, Metallocenes – Synthesis, Strucutre and reactivity

UNIT –II TITLE : Organometallic Chemistry-II: (18 HRS.)

Reactions of organometallic compounds – Substitution reactions in carbonyl complexes, Oxidative Addition and Reductive Elimination, Insertion and Elimination, catalysis by organometallic compounds- Alkene

hydrogenation, synthetic gas, Hydroformylation, Monsanto Acetic Acid process, The Waker process, Synthetic gasoline-Fischer Tropsch process, Ziegler-Natta catalysis.

UNIT –III TITLE :Basic concepts for Bio-inorganic chemisty-I (18 HRS.)

Essential elements in biology-the role of model system-the alkali and alkaline earth metals-sodium,potassium,calcium& magnesium-metalophorphyrins-chlorophyll-Hemeproteins-hemoglobin and myoglobin-Hemoglobinmodeling-other Hemeprotiens-cytochromes-peroxidases and catalases.

UNIT –IV TITLE:Basic concepts for Bio-inorganic chemisty-II(18 HRS)

Iron-sulphur proteins-Ruberdoxins-Ferredoxins-Hemerythrin-Iron supply and transport-Vitamine B12,metalloenzymes-zinc metalloenzymes copper metallo enzymes and Nitrogen fixation.

UNIT –V TITLE : Inorganic Chains, Rings and Cages (18 HRS)

Chains – Catenation, Heterocatenation, Silicate minerals, Intercalation Chemistry, Rings- Borazines,Phosphazenes, Phosphazene polymers, Sulphur – Nitrogen ring systems, One dimensional Conductors, Cages – Phosphorus cage compounds, Boron cage compounds- Boranes-Preparation, properties, structure and Bonding in Diborane and TetraBoranes, Wades rule, and Styx numbers, Carboranes and Metallocarboranes.

REFERENCES:

2. James.E.Huheey, Inorganic Chemistry, Pearson publications, 4th edition, 2008.
3. F.A.Cotton, G.Wilkinson, C.A. Murillo and M.Bochmann, .*Advanced Inorganic Chemistry*; GeofreyWilinson& Carlos,6th Edition'2003
4. K.F.Purcell and J.C.Kotz, Inorganic Chemistry;Melbourne,Cenage learning'2010.
5. J.D.Lee, Concise Inorganic Chemistry, Oxford Blackwll Science, 5th Edition, 2005.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	Illustrate the structure and mode of bonding in organometallic complexes
CO 2	Apply the different electron counting procedures to predict the shape and stability of organometallic complexes
CO 3	Illustrate the mechanism of dioxygen binding in various oxygen carrier proteins
CO 4	Classify and identify the different types of metalloenzymes and metallo proteins based on their biological functions.
CO 5	Interpret the structure of borazines, boranes and carboranes.

II M.Sc., CHEMISTRY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	19PG4C16	RETROSYNTHESIS, REACTIONS AND REAGENTS, NATURAL PRODUCTS	LECTURE	6 Hrs.	5

COURSE DESCRIPTION

This paper focuses on all the important aspects of retrosynthesis, mechanism and applications of various synthetically useful reagents and naming reactions.

COURSE OBJECTIVES

This paper deals with types of Carbon-Carbon bond forming reactions, introduction to organic synthesis, preparation and synthetic applications of some organic reagents used for synthesis, structural elucidation of few alkaloids, terpenoids, steroids and nucleic acids. This paper also deals with disconnection approach for synthesis

UNITS

UNIT –I INTRODUCTION TO ORGANIC SYNTHESIS (18 HRS.)

Carbon-carbon bond forming reactions using Grignard synthesis, Aldol condensation, Michael addition, Wittig reaction, Diels-alder reaction, Suzuki,Still and Heck coupling. Functional group modifications. Linear and convergent synthesis-stereoselectivity(Enantio and diastereoselectivity), chemoselectivity, regioselectivity, protecting groups.

UNIT –II REAGENTS IN ORGANIC SYNTHESIS (18 HRS.)

Use of the following reagents in organic synthesis and functional group transformation: Lithium dialkylcuprate, lithium diisopropyl amide (LDA), dicyclohexylcarbodiimide (DCC), 1,3-dithiane, osmium tetroxide, dichlorodicyano benzoquinone (DDQ), phase-transfer catalyst (PTC), SeO_2, crown ethers

UNIT –III RETROSYNTHESIS (18 HRS.)

Synthons and types- synthetic equivalent- target molecule- functional group interconversions- antithesis- Retrosynthesis of achiral open chain molecules and cyclic target molecules, one group and two group C-X disconnections and synthetic strategies- guidelines to a good disconnection, 1,2- 1,3- 1,4- 1,5- and 1,6- difunctional disconnections- retrosynthetic analysis of Z-Heneicos-6-en-11-one and Z-jasmone

UNIT –IV STEROIDS AND NUCLEIC ACIDS (18 HRS.)

(a) Steroids: Structural elucidation (including synthesis) of cholesterol, androsterone and oestrone

(b) Nucleic acids- structure, nucleotides and nucleosides- RNA, Types of RNA- DNA, structure, replication of DNA.

UNIT –V ALKALOIDS AND TERPENES (18 HRS.)

ALKALOIDS

Structural elucidation (including synthesis) of quinine and morphine

TERPENES

Structural elucidation (including synthesis) of α-pinene and α-codinene

REFERENCES:

1. S. Warren, Organic synthesis: The disconnection approach, John Wiley & Sons, Inc., 1992.

2. S. Warren, Designing Organic Syntheses: A Programmed Introduction to the Synthon Approach, John Wiley & Sons, Inc., 1978.

3. J-H. Fuhrhop, and G. Penzlin, Organic Synthesis: Concepts, Methods, Starting Materials,VerlagChemie, Weinheim, 1983.

4. J. M. Coxon and B. Halton, Organic Photochemistry, Cambridge University Press, 2nd ed. 1987.

5. C. H. DePuy and O. L. Chapman, Molecular reactions and photochemistry, Tata-McGraw Hill, 1975.

6. S. Mukergi, Pericyclic reactions, Macmillan, India.

7. I. Fleming, Pericyclic reactions, Oxford university press, 1998.

8. F. A. Carey and R. J. Sundberg, Advanced organic chemistry, Part A: Structure and Mechanism, Plenum press, 3th Ed., 1990.

9. F. A. Carey and R. J. Sundberg, Advanced organic chemistry, Part B: Reactions and synthesis, Plenum press, 3th Ed., 1990.

10. R. B. Woodward and R. Hoffmann, The concervation of orbital symmetry, Academic press, 1970.

11. I. L. Finar, Organic chemistry, Volume II, ELBS, 5th Ed. 1975.

C5 – Non – Scholastic

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To differentiate the carbon –carbon bond forming reactions and to interpret the products and to explore reactivity patterns of various coupling reactions
CO 2	To elucidate the structural units of quinine, morphine, α-pinene and α-codinene
CO 3	To correlate the skeletal units of nucleotides and nucleosides-RNA and DNA
CO 4	To categorize the reducing and oxidizing agents and its applications.
CO 5	To Sketch the effective and logical synthetic route for the synthesis of new molecules

II M.Sc. CHEMISTRY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	19PG4C17	SPECTROSCOPY, KINETIC THEORY OF GASES, PHOTOCHEMISTRY AND RADIATION CHEMISTRY	LECTURE	6	6

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

This paper deals with many spectroscopic techniques like Microwave, IR, Raman and Photoelectron, ESR, NQR and Mossbauer, Kinetic theory of gases and Photochemistry and Radiation Chemistry

UNITS

UNIT-I Spectroscopy-I 18hrs

Absorption and emission of Electro Magnetic Radiation -LASER-Interaction of EMR with matter-Einstein coefficients, Microwave, IR and Raman spectroscopy of diatomic molecules determination of molecular parameters-Vibrational spectra of polyatomic molecules-IR and Raman active modes-overtone and combination bands-Fermi resonance-Group frequencies and coupling interaction.

UNIT-II Spectroscopy-II 18hrs

Electronic spectra of diatomic molecules-molecular Quantum numbers-dissociation energy calculations- Birge Sponer extrapolation technique- fortrat

diagram-predissociation spectra of the electronic states of polyatomic molecules- absorption of light- oscillator strength- charge transfer spectra, Photoelectron Spectroscopy- basic principle - UV and X-ray (ESCA) photoelectron spectroscopy, PES of Ar and O_2 and N_2.

UNIT-III Spectroscopy-III 18hrs

ESR spectroscopy- principles of g-factor, experimental methods, spectrum –fine and hyperfine structures- applications.

NQR spectroscopy-Quadrupole moment. Coupling constant- Quadrupole transition- electric field gradient and molecular structure.

Mossbauer spectroscopy - recoilless emission and resonant absorption-experimental methods. Isomer shifts, Quadrupole and magnetic interactions. Applications.

UNIT-IV Kinetic theory of gases 18hrs

Equation of state –molecular speeds-distribution of molecular velocities-one, two and three dimensions-Maxwell Boltzmann distribution law-Principles of equipartition of energy- rotations and vibrations of molecules-the molecular collisions- mean free path-transport properties-thermal conductivity-viscosity and diffusion of gases.

UNIT-V Photochemistry and Radiation chemistry 18hrs

Physical properties of the electronically excited molecules-excited state dipole moments excited state pKa, excited state redox potential. Fluorescence, phosphorescence and other deactivation process- Stern –Volmer equation and its applications. Photosensitisation and chemiluminescence experimental techniques in photochemistry- flash photolysis technique.

Radiation chemistry- source of high energy- interaction of high energy radiation with matter, radiolysis of water- definition of G value. Primary and secondary process.

Reference Books:

1. C. N. Banwell and E. M. McCash, *Fundamentals of Molecular Spectroscopy*, 4th edn., Tata McGraw Hill, New Delhi, 2000.
2. R. S. Drago, *PhysicaI Methods in Chemistry*; Saunders: Philadelphia, 1977.
3. P.W. Atkins and J. de Paula, *Physical Chemistry*, 7th ed., Oxford University Press, Oxford, 2002.
4. Gilbert W. Castellan, Physical Chemistry, Narosa publishing house, New Delhi, 3rd Edn, 2002.
5. Walter J. Moore, Physical Chemistry, Orient Longmann, London, 5th Edn, 2004.
6. K.K.Rohatgi Mukherjee, *Fundamentals of photochemistry (Revised edition)*, Wiley,Eastern Ltd., 1996.
7. H.J. Arnicker, Essentials of Nuclear Chemistry, New Age International Pvt. Ltd., 2005.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To Outline the selection rules for rotational and vibrational spectra and rationalize the role of the molecular dipole moment in the selection rules.
CO 2	To apply knowledge to detailed understanding of electronic states of atoms, molecules, Franck-Condon Principle
CO 3	To predict the number of ESR signals of organic radical anions, Complexes and NQR transitions.
CO 4	To understand molecular velocities in one, two and three dimensions
CO 5	To distinguish between between Fluorescence and Phosphorescence, Primary and secondary processes, radiative and non-radiative transitions,To compare Ground and excited state acidity, dipole moments and redox potentials

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SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSCH	PG4CE3	ANALYTICAL CHEMISTRY	PG Core	6 Hrs.	4

COURSE DESCRIPTION

This paper focuses on all the important aspects of Analytical chemistry techniques and applications of C-programming to solve problems in CHEMISTRY.

COURSE OBJECTIVES

This paper deals with analytical methods. It also deals with programming in C language and its applications to solve problems in chemistry.

UNITS

UNIT –I PROGRAMMING IN C LANGUAGE (15 HRS.)

Introduction, Character set in C, Style of C Language – Identifiers and Key words – Constants, Variables and Data types, Operators in C.

Input and Output in C, Control statements in C, Storage classes in C, Functions in C, Arrays and pointers, Preprocessors in C, The type def statement and Files in C language.

UNIT –II APPLICATIONS OF C LANGUAGE IN CHEMISTRY (15 HRS.)

Writing the Program using the various features of C language – Determination of mass number of any atom-Determination of electronegativity of an atom from bond energy data using pauling's relation, Calculation of ionic strength, Determination of lattice energy of a crystal using Born-Lande

equation, Determination of Shapes of molecules or ions using VSEPR Theory, Detemination of Normality, Molarity and Molality of solutions, Determination of half life of a radioactive nucleus.

UNIT –III ELECTROANALYTICAL AND THERMAL METHODS (15 HRS.)

Coulometry and coulometric titrations, Cyclic Voltametry, Principles of TGA, and DSC - Applications to simple salts – Oxysalts, Carbonates and complex salts.

UNIT –IV ERROR ANALYSIS AND CHROMATOGRAPHY (15 HRS.)

Accuracy and Precision, Determinate and Indeterminate errors, Significant figures, Ways of expresssing accuracy – Absolute and relative error, Standard deviation, The confidence limit, Tests of significance – The F test and The student T test, Rejection of a result – The Q test, Linear least squares to plot the data, Correlation coefficient.

Principles, Adsorption, Partition, ion exchange chromatography, HPLC, Paper and Gas Chromatography.

UNIT –V SPECTROPHOTOMETRIC AND RADIOCHEMICAL METHODS (15 HRS.)

Principles and applications of photometry, Flame emission spectrometry, Atomic absorption spectrophotometry – Principles, Instrumentation (Block diagram), Fluorimetry, and photometric titrations.

REFERENCES:

1. Douglas A. Skoog, Donald M. West and F. James Holler, Fundamentals of analyticalChemistry, Harcourt Asia Pvt. Ltd., 2001.
2. R.A. Day, Jr. and A.L. Underwood, Analytical Chemistry,Prentice-Hall of India, 2001.
3. H. Kaur, Instrumental methods of chemical analysis, PragatiPrakashan, 2003.
4. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, Longman Scientific and Technical, 1989.
5. Balagurusamy E, Programming in ANSI C.
6. Raman KV, Computers in Chemistry.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To acquire the complete knowledge of C language
CO 2	To develop logics which will help them to create programs, applications of chemistry problems in C.
CO 3	To explicate the theoretical principles of selected instrumental methods within electro analytical and spectrometric/spectrophotometric methods, and main components in such analytical instruments.
CO 4	To explain the confidence level and confidence limit, the sources of random errors and effects of random errors on analytical results.
CO 5	To illuminate the theoretical principles of various separation techniques in chromatography, and typical applications of chromatographic techniques

II M.Sc.,CHEMISTRY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	19PG4CE4	CHEMICAL ENGINEERING	LECTURE	6 Hrs.	5

COURSE DESCRIPTION

This paper mainly deals with Engineering, analytical and application oriented chemistry. It also deals with programming in C language and its applications.

COURSE OBJECTIVES

- To apply the concepts of C++ in determination of concentrations of solutions
- To focus on the techniques in water treatment, spectrophotometric methods, protection against corrosion and general characteristic features of engineering plastics.

UNIT –I TITLE: Programming in C Language and its applications in Chemistry (15 Hrs)

Introduction, Character set in C, Style of C Language – Identifiers and Key words – Constants, Variables and Operators in C. Input and Output in C, Control statements in C, Storage classes in C, Functions in C, Arrays and pointers. Writing the Program using the various features of C language -Determination of normality, molarity and molality of solutions – Determination of half life of a radio active nucleus

UNIT –II TITLE : Water Technology (15 Hrs)

Hardness of water-Equivalents of calcium carbonate- units of hardness- Estimation of hardness – Treatment of water for domestic supply – Boiler feed water and its requirements- scale and sludge formation in boilers— Caustic embrittlement-priming and foaming- softening and conditioning methods – External and internal conditioning-Desalination of Brackish water-Reverse osmosis.

UNIT –III TITLE : Spectrophotometric methods and Radiochemical methods (15 Hrs)

Principles and applications of photometry, Atomic absorption spectrophotometry – Principles, Instrumentation (Block diagram), Fluorimetry. Turbidimetry, Nephelometry and photometric titrations.

UNIT –IV TITLE: Corrosion and its control: (15 Hrs)

Introduction – dry or chemical corrosion-Wet or electro chemical corrosion – galvanic corrosion –concentration cell corrosion-passivity- pitting corrosion- intergranular corrosion- water line corrosion-stress corrosion- factors influencing corrosion- protection against corrosion-corrosion inhibitors- applications of protective coatings.

UNIT –V TITLE : Polymers (15 Hrs)

Introduction, Engineering plastic-Rubber or elastomers-Vulcanization of Rubber and important synthetic Rubbers-Individual polymers – Poly methyl methacrylate –poly esters-poly carbonates-poly sulphones-poly imides-poly vinyl acetate-poly butadiene-poly chloro prene-phenol-formaldehyde resin-urea- formaldehyde and melamine formaldehyde resin-epoxy polymers and silicone polymers.

REFERENCES:

1) K.V. Raman-Computers in Chemistry – Tata Mc Graw- Hill - 2005.
2) E. Bala Guru samy – Programming in Ansi-C - Tata Mc Graw- Hill – Sixth edition -2014.
3) Jain and jain – Engineering Chemistry –Dhanpat rai publishing company (p) Ltd - 2014
4) Introduction to polymer science-V.R. Gowarikar, N. V.Viswanathan and J.sridhar.willey eastern.,-2017
5) Analytical Chemistry- Theory and Practice – U. N. Dash – Sultan Chand and Sons- 2013

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	To write C- Program using various features of C- language
CO 2	To categorize the various conditioning methods in water treatment
CO 3	To apply the principles involved in spectrophotometric analysis.
CO 4	To compare the mechanism between dry corrosion and wet corrosion
CO 5	To synthesize some industrially important polymeres

II M.Sc.,CHEMISTRY

SEMESTER –IV

For those who joined in 2019 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSCH	19PG4C18	PHYSICAL PRACTICALS-I (NON-ELECTRICAL EXPERIMENTS)	LECTURE	6	

COURSE OBJECTIVE:

This course gives lab experience on physical experiments.

COURSE OUTCOME:

After completion of the course the students should be able to:

- Developed expertise relevant to the professional practice of chemistry
- Developed an understanding of the breadth and concepts of physical chemistry
- An appreciation of the role of physical chemistry in the chemical sciences and engineering
- Developed an understanding of the role of the chemist and chemical engineer in tasks employing physical chemistry
- An understanding of methods employed for problem solving in physical chemistry
- Experience in some scientific methods employed in basic and applied physical chemistry
- Developed skills in procedures and instrumental methods applied in analytical and practical tasks of physical chemistry

- Developed skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments
- Developed some understanding of the professional and safety responsibilities residing in working with chemical systems.

PHYSICAL CHEMISTRY EXPERIMENTS

- Adsorption Characteristics of Oxalic acid and charcoal
- Adsorption Characteristics of Acetic acid and charcoal
- Acid catalysed hydrolysis of methyl acetate-Volumetry
- Activation energy of acid catalysed hydrolysis of methyl acetate
- Effect of ionic strength on the rate of persulphate iodide reaction
- Catalytic constant of an acid (Acetone and iodine in the presence of an acid)
- Kinetic of oxidation of alcohols by $K_2Cr_2O_7$ by spectrophotometry.
- Kinetics of iodination of acetone by spectrophotometry.

Reference Book

B.Viswanathan, P.S. Raghavan, Practical Physical Chemistry, 2005.

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES
CO 1	Developed expertise relevant to the professional practice of chemistry
CO 2	Developed an understanding of the breadth and concepts of physical chemistry
CO 3	An appreciation of the role of physical chemistry in the chemical sciences and engineering
CO 4	Developed an understanding of the role of the chemist and chemical engineer in tasks employing physical chemistry
CO 5	An understanding of methods employed for problem solving in physical chemistry
CO 6	Experience in some scientific methods employed in basic and applied physical chemistry
CO 7	Developed skills in procedures and instrumental methods applied in analytical and practical tasks of physical chemistry
CO 8	Developed skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments