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. CHEMISTRY

PROGRAMME CODE : PSCH

ACADEMIC YEAR : 2020 - 2021

DEPARTMENT OF CHEMISTRY

B.Sc. CHEMISTRY

For those who joined in June 2019 onwards

Acadmic Year 2020-2021

PROGRAMME CODE : PSCH

COURSE CODE	COURSE TITLE	Hours/week	Credits	Maximum Marks		
				CIA	ESEM	Total
SEMESTER 1						
19PG1C1	**INORGANIC CHEMISTRY -I** (Basic Concepts, Covalent and Ionic Bonding, Solid State and Crystallography, and Nuclear Chemistry)	6	4	40	60	100
19PG1C2	**ORGANIC CHEMISTRY -I** (Reaction Mechanism and Stereochemistry)	6	4	40	60	100
19PG1C3	**PHYSICAL CHEMISTRY –I** (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
19CIEDC	**ESSENTIALS OF LIFE**	3	3	40	60	100

	LIBRARY	1	-	-	--	
Total		**30**	**19**			
SEMESTER – 11						
19PG2C6	**INORGANIC CHEMISTRY –II** (Advanced coordination chemistry)	6	**4**	40	60	100
19PG2C7	**ORGANIC CHEMISTRY –II** (Elimination and addition reactions, organic spectroscopy and conformational analysis)	6	4	40	60	100
19PG2C8	**PHYSICAL CHEMISTRY –II** (Chemical kinetics and quantum mechanics)	6	4	40	60	100
19PG2C9	**INORGANIC QUANTITATIVE ANALYSIS**	4	2	40	60	100
19PG2C10	**ORGANIC QUANTITATIVE ANALYSIS**	4	2	40	60	100
19C2EDC	**ESSENTIALS OF LIFE**	3	3	40	60	100
	LIBRARY	1	-	-	-	-
Total		**30**	**19**			
SEMESTER III						
19PG3C11	**ORGANIC CHEMISTRY -III** (Spectroscopy and Pericyclic Reactions)	6	5	40	60	100
19PG3C12	**PHYSICAL CHEMISTRY -III** (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	**PHYSICAL CHEMISTRY PRACTICALS-I** (Electrical Experiments)	6	4	40	60	100
19PG3S1C1	**INTERNSHIP**	Off-class	3	50	50	100
	LIBRARY	2	-	-	-	-
Total		**30**	**26**			
SEMESTER 1V						
19PG4C15	**INORGANIC CHEMISTRY –III** (Organometallic chemistry-I & ii, basic concepts for bio-inorganic chemistry-I & ii and inorganic chains, rings and cages)	6	5	40	60	100
19PG4C16	**ORGANIC CHEMISTRY –IV** (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**	off class	3	50	50	100
	LIBRARY	2	-	-	-	-
Total		**30**	**26**			

	TOTAL	**120**	**90**			
OFF CLASS	**SOFT SKILLS**		4			
	COMPUTER APPLICATION COURSES		4			
	COMPREHENSIVE VIVA		2			
	MOOC COURSES		MIN- 2			
	READING CULTURE		1			
	TOTAL		13+			

FATIMA COLLEGE (AUTONOMOUS) MADURAI – 625 018

DEPARTMENT OF CHEMISTRY

INORGANIC CHEMISTRY - I – 19PG1C1

(Basic Concepts, Covalent and Ionic Bonding, Solid State and Crystallography, and Nuclear Chemistry)

(For those who joined in 2007 onwards)

Hours per Week: 6 **Credits: 4**

OBJECTIVES:

- To acquire an in-depth knowledge about the fundamentals and bonding in Inorganic chemistry.
- To know more about more acids and bases with their theoretical background
- To acquire an extensive knowledge in nuclear Chemistry

COURSE OUTCOME

After the completion of the course the students will be able

- CO 1: To analyse all chemical species involved in organic and Inorganic reactions and to identify those as acid and bases
- CO 2: To classify the bonds as ionic and covalent and to compare the theories
- CO 3: To categorize the solid systems, to calculate the lattice energy and draw conclusions on their stability
- CO 4 : To predict the structures and magnetic properties of Inorganic compounds
- CO 5 : To gain indepth knowledge of nuclear reactions, reactors and the applications of radio isotopes in all fields

Unit I : Basic concepts of Inorganic Chemistry

Unit II : Covalent Bonding

Unit III : Solid state and Crystallography

Unit IV : Ionic Bonding

Unit V : Nuclear Chemistry

Unit I : Basic concepts of Inorganic Chemistry **20 Hrs**

The Modern long form of periodic table - Periodic properties of elements - ionic radius - ionisation potential - electron affinity - electronegativity scales.

Acids and Bases – Bronsted & Lewis concepts - pH , pK_a, buffer - Acid, base concept in non aqueous solvent - liq.ammonia, HF, anhydrous H_2SO_4 and N_2O_4. Super acids - HSAB principle – Simbiosis – measure and theoretical basis - application.

Unit II: Covalent Bonding **15Hrs**

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 - shapes of molecules.

Unit III : Solid state and Crystallography **20 Hrs.**

Elements of crystallography – symmetry – point groups, space groups, lattices and crystal systems - x-ray diffraction, experimental methods of crystal structure determination, application to Bio-molecules (proteins),structure factor determination – Metallic bond – band theory of solids – electrical and mechanical properties of solids – semi conductors – super conductors.

Unit IV: Ionic Bonding **15 Hrs**

Lattice type - Born Lande equation - Born Haber cycle - radius ratio rule-typical crystal structures - calcite, CsCl, CdI_2, zinc blende & Spirels. Defects in solids - non stoichiomerty, experimental methods of study of stoichiometry, solid state reactions.

Unit V: Nuclear Chemistry **20 Hrs**

Nuclear Chemistry – Radioactivity – decay constant – half life period – artificial transmutation – GM counter – scintillation counter – nuclear forces – nuclear fission and fusion reactions – nuclear models – nuclear accelerators – cyclotrons – synchro cyclotrons, betatrons, nuclear reactors – fast breeders – radio isotopes – their applications.

Reference books

(i) Inorganic chemistry - James.E.Huheey.
(ii) Inorganic chemistry - J.D. Lee
(iii) Introduction to solids - L. Azaroff,
(iv) Elements of Nuclear Chemistry - R. Gopalan
(v) Essentials of Nuclear Chemistry – H.J. Arnikar

FATIMA COLLEGE (AUTONOMOUS), MADURAI-18
DEPARTMENT OF CHEMISTRY
ORGANIC CHEMISTRY – I – 19PG1C2
(Reaction Mechanism and Stereochemistry)
(For those who joined in 2007 onwards)

6 Hrs/week **4 Credits**

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

Course outcome:

After completion of the course the students should be able :

- To interpret the concept of aromaticity and the main properties of aromatic compounds.
- To explore reactivity patterns of conjugated ,aromatic molecules and to evaluate the kinetics and thermodynamics controlled reactions.
- To define the fundamentals of chirality, prochirality, symmetry elements and applications of atropisomers.
- To comprehend of nucleophiles, electrophiles, electronegativity, and resonance
- To sketch the preparation and properties of heterocyclic compounds.

UNIT I	a)Bonding in organic compounds b) structure and reactivity	18 Hrs
UNIT II	Introduction to reaction mechanism	18 Hrs
UNIT III	Stereochemistry	18 Hrs
UNIT IV	substitution reactions	18 Hrs
UNIT V	Natural products Chemistry a) Heterocyclic compounds b) Carbohydrates	18 Hrs

UNIT- I **18 Hrs**

a) Bonding in organic compounds

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.

b) Structure and reactivity

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, Prelogs rule.

UNIT IV **18 Hrs**

a) Nucleophilic substitution

S_N1, S_N2 and S_Ni 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 nucleophilic substitution- S_NAr, S_N1 and benzyne mechanism.

b) Electrophilic substitution

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 of pyrazole, oxazole, thiazole and indole
   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 sucrose, maltose, lactose and cellobiose. Aminosugars.

Reference books:

1. Jerry March, Advanced organic chemistry, Reactions, mechanisms and structure, John Wiley and sons 4th edition
2. Peter Sykes, A guide book to mechanism in organic chemistry, Longman
3. Peter Sykes, The search for organic reaction pathways, Longman
4. Carey and Sundberg, Advanced organic chemistry, Part A
5. Graham Soloman, Organic chemistry, John Wiley and sons 5th edition
6. S.M. Mukerjee and S.P. Singh, Reaction mechanism in organic chemistry
7. E.S. Gould, Mechanism and Structure in organic chemistry, 1960, Henry-Holtoo, Inc.
8. Ernest L. Eliel, Stereochemistry of carbon comounds, 1977, Tata McGraw Hill, New Delhi
9. D. Nasipuri, Stereochemistry of organic compounds, Wiley eastern limited, New Delhi
10. P.S. Kalsi, Stereochemistry (1990) 3rd Edn. New age International
11. I.L. Final, Organic chemistry, Vol.2,5th Edn. ELBS
12. R.M. Acheson, An introduction to heterocyclic compounds, John Wiley Editon
13. O.P. Agarwal, Chemistry of organic natural products, 15th Edn. Goel publishing house

FATIMACOLLEGE (AUTONOMOUS), MADURAI– 18

DEPARTMENT OF CHEMISTRY

PHYSICALCHEMISTRY-I–19PG1C3

(Applied Electro Chemistry & Statistical Thermodynamics)

(For those who joined in 2016 onwards)

Hours per Week: 6 **Credits: 4**

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

Course outcome:

After successful completion of the course, students will be able

CO1: To gain knowledge Kohlrausch's law and electrolytic conductance

CO2: To do calculation of conductance & Possess thorough understanding of Debye-Huckel equation

CO3: To apply the concept of electrochemistry & Gibbs phase rule

CO4: To categorize and compare various partition functions - translational, rotational, vibrational and electronic partition functions

CO5: To distinguish various Fermi-Dirac and Bose-Einstein statistics and Maxwell-Boltzmann statistics based on the nature of the particles

UnitI: Electrochemistry–I	18Hrs
UnitII: Electrochemistry–II	18Hrs
UnitII: ElectrochemistryandThermodynamics	18Hrs
UnitIV: ChemicalThermodynamics	18Hrs
UnitV : StatisticalThermodynamics	18Hrs

I. Electrochemistry–I **18Hrs**.

Introduction to electrolysis, Faraday'slaws–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, Interionic attractions, ion-ion and ion-solventinteractions,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–ion association. Electrochemical cells–Types of electrodes, Electrochemical series and its applications.

II. Electrochemistry–II 18Hrs.

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 EMFmeasurements and Fuel cells. Polarisation–Electrolytic polarization, Dissolution and Deposition potentials, determination of anode and cathode potential, Evidence for existence of 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, Electrokinetic phenomena-Electro–osmosis, Electro-phoresis,

III. Electrochemistry and Thermodynamics **18Hrs**

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. The behaviour of colloidal systems–colloidal electrolytes, poly electrolytes, Membrane equilibria–Dialysis, Ion exchangeresins. Electrocatalysis and Electrosynthesis. Biological applications of electrochemistry.

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

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

IV. Chemical Thermodynamics: 18**Hrs.**

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, Electro kinetic phenomena–diffusion,electricconduction,Irreversiblethermodynamicsforbiologicalsystems

V. Statistical Thermodynamics 18**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 gas degeneracy and electron gas (Fermi energy level). Heat capacities of diatomic gases. Einstein & Debye's the oryof heatcapacity of solids-,population inversion-negative Kelvin temperature

Reference books for Electrochemistry:

1. SamuelGlasstone,IntroductiontoElectrochemistry,
2. D.R.Crow, Principles& Applications of Electrochemistry, 3rdEdn, Chapman andHall.
3. B.Viswanathan,R.Venkataraman,Dr.K.Rengarajan,Dr.S.Sundaram,Dr.P. S.Raghavan, Electrochemistry Principles and applications, 1stEdn, S. ViswanathanPrintersLtd.,

Reference books for Thermodynamics:

1. J.RajaramandJ.C.Kuriacose,ThermodynamicsForStudentsofChemistry,2ndEdn.,S.L.N.ChandandCo.,Jalandhar,1986.
2. I.M.KlotzandR.M.Rosenberg,Chemicalthermodynamics,6thEdn.,W.A.BenjaminPublishers,California,1972.
3. M.C.Gupta,StatisticalThermodynamics,NewAgeInternational,Pvt.Ltd.,New Delhi,1995.
4. D.A.McQurrieandJ.D.Simon,*PhysicalChemistry-AMolecularApproach*,VivaBooksPvt.Ltd.,NewDelhi,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,Kinetictheory&StatisticalThermodynamics,NewDelhi,NarosaPublishing House,3rdEdn.,1989.

M.SC. CHEMISTRY

SEMESTER-I

INORGANIC QUALITATIVE ANALYSIS–

19PG1C4

(For those who joined in 2019 onwards)

Hours per Week:4 **Credit:2**

COURSE DESCRIPTION:

This paper gives a hands on experience of qualitatively analysing the inorganic salt mixtures containing common and rare earth metal cations by semimicro qualitative analysis

COURSE OBJECTIVE:

This paper deals with group separation and group analysis of the given inorganic mixtures

COURSE OUTCOME

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

CO 1-Describe the principle and procedure of semimicro qualitative analysis

CO 2-identify the groups to which the given cations belong to

CO 3--distinguish between the familiar and less familiar cations.

CO 4-select the confirmatory tests for specific cations

CO 5-Apply the theory behind the practicals to write chemical equations

QUALITATIVE ANALYSIS

Analysis of inorganic mixtures containing two familiar and two less familiar cations.

FAMILIAR (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^+ . **LESS**

FAMILIAR (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.

FATIMA COLLEGE (AUTONOMOUS), MADURAI-18 M.Sc.

DEPARTMENT OF CHEMISTRY

ORGANIC QUALITATIVE ANALYSIS – 19PG1C5

(For those who joined in 2017 onwards)

4Hrs/ Week **No. of Credits: 2**

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 + Neutral compounds

The possible functional groups are

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

I. Single step Organic preparations:

Preparationof

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

1. Acetyl salicylic acid from Salicylicacid.

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'sTextbook of Practical Organic Chemistry, 5 th Ed., Pearson Publication.

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

FATIMA COLLEGE (AUTONOMOUS) MADURAI – 18

DEPARTMENT OF CHEMISTRY

ESSENTIALS OF LIFE-19C1EDC

(Those who joined from 2019 onwards)

3Hrs/week **credits: 3**

COURSE OBJECTIVES :

The main objective of this course is to get to know about the study of pharmaceutical chemistry, volumetric analysis, preparation of house hold products, synthesis of polymers and agriculture chemistry.

COURSE OUTCOME:

- To acquire knowledge of common medicine.
- To express the concentration of solution in volumetric analysis.
- To differentiate column and TLC technique.
- To classify the different types of polymers and its characteristics.
- To analyze the different types of soil and differentiate natural fertilizer from artificial fertilizer.

UNIT I- PHARMACEUTICAL CHEMISTRY (9 Hrs)
UNIT II PREPARATION OF HOUSE HOLD ITEMS (9Hrs)
UNIT III - QUANTITATIVE ANALYSIS &
CHROMATOGRAPHIC TECHNIQUES (9Hrs)
UNIT IV – POLYMERS (9Hrs)
UNIT V - AGRICULTURAL CHEMISTRY (9Hrs)

Unit I: PHARMACEUTICAL CHEMISTRY (9 Hrs)

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

Unit II: PREPARATION OF HOUSE HOLD ITEMS (9Hrs)

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

Unit III -QUANTITATIVE ANALYSIS &

CHROMATOGRAPHIC TECHNIQUES **(9Hrs)**

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 IV -POLYMERS **(9 Hrs)**

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

Unit V - AGRICULTURAL CHEMISTRY **(9 Hrs)**

Introduction- Classification of soil, Natural manures- Vermi compost – uses – Artificial Manures – Chemical fertilizers – preparation and uses. Biogas production and manure.

Reference Books:

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, Pragati Prakashan , 2003.

FATIMA COLLEGE (AUTONOMOUS) MADURAI – 18

DEPARTMENT OF CHEMISTRY

INORGANIC CHEMISTRY-II-19PG2C6

(Advanced coordination chemistry)

For those who joined in 2019 onwards

Hrs/week : 6 **credits: 4**

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

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

COURSE OUTCOME:

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

- Compare the stabilities of complexes using stability constants and to identify the types of isomers
- To describe the theories of co-ordination compounds to understand the colours and magnetic properties and their position in the spectrochemical series
- . Investigate the structures of complexes using IR,NMR ,E SR and other spectral techniques
- Possess a thorough understanding of electronic spectra of complexes
- To arrive at the mechanisms of substitution reactions in six and four coordinated complexes using kinetic studies

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, Jobs method- 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 magneticmoments.

UNIT –III ELECTRONIC SPECTRA (18 HRS.)

Electronic spectra, selection rules, Term &Term symbol, term symbols derivation for p2 configuration, calculation of micro states, Orgel diagrams for octahedral and tetrahedral complexes of metal ions with d^1 to d^9 systems , 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.

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FATIMA COLLEGE (AUTONOMOUS), MADURAI-18

DEPARTMENT OF CHEMISTRY

ORGANIC CHEMISTRY – II - 19PG2C7

(Elimination and addition reactions, organic spectroscopy and conformational analysis)

(For those who joined in 2007 onwards)

6 Hrs/week **4 Credits**

Objective: 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.

COURSE OUTCOME:

After completion of the course the students should be able :

- CO1- To comprehend the mechanism of elimination and substitution reactions and to apply the stereochemistry in E1, E2, ionic and pyrolytic eliminations.
- CO2- To interpret the concept of nucleophilic and free radical addition reactions and metal hydride reduction and to discriminate the reactivity of organometalic reagents.
- CO3-. 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.
- CO4- 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 .
- CO5- To differentiate the molecular rearrangements and to solve the simple problems and to recall the various naming reactions and to interpret the products.

Units

Unit-I- Elimination addition reaction	15 Hrs
Unit-II- Addition reaction	15 Hrs
Unit-III-Conformational analysis	20 Hrs
Unit-IV-Organic Spectroscopy -IR, UV	20 Hrs
Unit-V- Selective Organic Name reactions	20 Hrs

Unit-I- Elimination Reactions **15 Hrs**

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-Bredt's rule.

Unit-II- Addition Reactions **15 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- OsO_4, alk.$KMnO_4$, 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.

Unit-III-Conformational Analysis **20 Hrs**

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

Unit –IV-Organic Spectroscopy UV, IR spectra 20 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 - Fieser woodward rules for calculating λ max in conjugated diene and carbonyl compounds, Applications of UV spectroscopy.

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,-NH_2,-COOH,-C-H, -C=C-H, -CHO,-C=C-H etc.- Application of IR spectra.

Unit –V- Selective Organic Name reactions 20 Hrs

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, Steven's rearrangement, dienone-phenol rearrangement.

References:

1.Jerry march, Advanced Organic chemistry, Reaction mechanism and structure,Willey,4th edn,1992.
2.Peter Sykes.A,Aguide book to mechanism in organic chemistry,Longmann.
3.E.S.Gould(1960), Mechanism and structure in organic chemistry,Henry-Holtoo INC.
4.Ernest.L.Eliel, Stereo chemistry of carbon compounds, 1997.22nd reprint,Tata Mcgraw-Hill,NewDelhi.
5.D.Nasipuri,Stereochemistry of organic compounds,1994,2nd edn,Wiley eastern limited,NewDelhi.
6.Silverstein,Bassler and Morrel,Spectrometric identification of organic compounds,4th edn,John Wiley and Sons.

7.P.S. Kalsi,spectroscopy of organic compounds,1993,Wiley eastern.
8.WiliamKemp,(1991) organic spectroscopy,Macmilan,3rd edition.

FATIMA COLLEGE (AUTONOMOUS) MADURAI – 18

DEPARTMENT OF CHEMISTRY

PHYSICAL CHEMISTRY –II - 19PG2C8

(Chemical kinetics and quantum mechanics)

(For those who joined in 2007 onwards)

Hours per Week: 6 **Credits: 4**

Objective: This paper provides an extensive study of the topics such as Chemical kinetics and Quantum mechanics.

Course Outcomes:

After studying this course, students should be able

- To Understand the concept of rate constants,ionic strength, Fast reactions, Catalysis, orthogonality and normalization and to solve the problems related to rate constants
- 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.
- To compare the various Theories of reaction rates and explain the postulates of quantum mechanics and operators
- 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
- To apply the Variation method and perturbation method to He atom and HMO theory to conjugated systems

Unit I : Chemical Kinetics – I

Unit II : Chemical Kinetics – II

Unit III : Chemical Kinetics – III

Unit IV : Quantum Mechanics – I

Unit V : Quantum Mechanics –II

I. CHEMICAL KINETICS - I 15 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 **15 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 **15 Hrs.**

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 .

References:

1. Chemical Kinetics By Laidler

IV. QUANTUM MECHANICS - I **25 Hrs.**

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

V. QUANTUM MECHANICS –II **20 hrs**

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 Hartree Fock Self consistent Field Theory,

Symmetric and Antisymmetric Wave functions , Pauli's exclusion principle of Antisymmetric wave functions, 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:

1. Introductory Quantum Chemistry by A. K. Chandra, TataMcgrawhill.
2. Quantum Chemistry by IRA – N. Levine, Printice hall.
3. Quantum Chemistry by Donald A. Mcquarrie.
4. Quantum chemistry by R.K. Prasad.

M.SC. CHEMISTRY

SEMESTER-II

INORGANIC QUANTITATIVE ANALYSIS– 19PG2C9

(For those who joined in 2019 onwards)

Hours per Week:4 **CrediSt:2**

COURSE DESCRIPTION:

This course gives training to prepare inorganic complexes in pure form and quantitative estimation of metal ions present in the solutions

COURSE OBJECTIVE:

This paper deals with the preparation of inorganic complexes from simple salts and also the estimation of amount of metal ions present in the given solution by using gravimetric and volumetic procedures

COURSE OUTCOMES

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

CO 1-Describe the principle and procedure of quantitative analysis

CO 2-identify the suitable complexing agents for the given metal ions

CO 3-draw the structure of various ligands and complexes

CO 4-distinguish volumetric analysis and gravimetic analysis

CO 5-Apply the expressions of various terms in calculations

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 from Cu and Zn salt solution mixture

2. Volumetric estimation of Cu from Cu and Ni salt solution mixture

3. Volumetric estimation of Ca from Ca and Mg salt solution mixture

4. Volumetric estimation of Ba from Ba and Zn salt solution mixture

III. GRAVIMETRIC ANALYSIS

1. Gravimetric estimation of Zn from Cu and Zn salt solution mixture

2. Gravimetric estimation of Ni from Cu and Ni salt solution mixture

3. Gravimetric estimation of Mg from Ca and Mg salt solution mixture

4. Gravimetric estimation of Zn from Ba and Zn salt solution mixture

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).

FATIMA COLLEGE (AUTONOMOUS),MADURAI-18

DEPARTMENT OF CHEMISTRY

ORGANIC QUANTITATIVE ANALYSIS – 19PG2C10

(For those who joined in 2017 onwards)

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

Course Descriptive:

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 givensubstance using suitable procedure and also prepare organic compounds using single stage.

Course Outcomes:

- . Students understand the quantitative analysis
- . To develop the ability for synthesizing organiccompounds by single stage.
- To develop the ability for synthesizing organiccompounds by double stage.
- To study the reaction mechanism.

Organic Estimations

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

Double stage Organic synthesis:

Synthesis of:

1. Benzanilide from benzophenoneoxime
2. p-bromoaniline fromp-bromo acetanilide
   Usage of Green reagent CAN, KBr instead of Br_2 and Glacial acetic acid)
3. Tribromoaniline fromaniline
   (Usage of Green reagent CAN, KBr instead of Br2 and Glacial acetic acid)
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 andsons, New Delhi, 1997

FATIMA COLLEGE (AUTONOMOUS) MADURAI – 18

DEPARTMENT OF CHEMISTRY

ESSENTIALS OF LIFE-19C2EDC

(Those who joined from 2019 onwards)

3Hrs/week **credits: 3**

COURSE OBJECTIVES :

The main objective of this course is to get to know about the study of pharmaceutical chemistry, volumetric analysis, preparation of house hold products, synthesis of polymers and agriculture chemistry.

COURSE OUTCOME:

- To acquire knowledge of common medicine.
- To express the concentration of solution in volumetric analysis.
- To differentiate column and TLC technique.
- To classify the different types of polymers and its characteristics.
- To analyze the different types of soil and differentiate natural fertilizer from artificial fertilizer.

UNIT I- PHARMACEUTICAL CHEMISTRY (9 Hrs)
UNIT II PREPARATION OF HOUSE HOLD ITEMS (9Hrs)
UNIT III - QUANTITATIVE ANALYSIS &
CHROMATOGRAPHIC TECHNIQUES (9Hrs)
UNIT IV – POLYMERS (9Hrs)
UNIT V - AGRICULTURAL CHEMISTRY (9Hrs)

Unit I: PHARMACEUTICAL CHEMISTRY (9 Hrs)

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

Unit II: PREPARATION OF HOUSE HOLD ITEMS (9Hrs)

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

Unit III -QUANTITATIVE ANALYSIS & CHROMATOGRAPHIC TECHNIQUES **(9Hrs)**

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 IV -POLYMERS **(9 Hrs)**

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

Unit V - AGRICULTURAL CHEMISTRY **(9 Hrs)**

Introduction- Classification of soil, Natural manures- Vermi compost – uses – Artificial Manures – Chemical fertilizers – preparation and uses. Biogas production and manure.

Reference Books:

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, Pragati Prakashan , 2003.

FATIMA COLLEGE (AUTONOMOUS) MADURAI – 18

DEPARTMENT OF CHEMISTRY

ORGANIC CHEMISTRY – III - 19PG3C11

(Spectroscopy and Pericyclic Reactions)

(For those who joined in 2018 onwards)

Hrs/week: 6 **No. of credits: 5**

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 OUTCOME

After successful completion of the course, the students are 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

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 (15HRS.)

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, 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.

FATIMA COLLEGE (AUTONOMOUS), MADURAI-625018

DEPARTMENT OF CHEMISTRY

PHYSICAL CHEMISTRY –III - 19PG3C12

(Group Theory, Surface Chemistry and Macromolecules)

(For those who joined in 2007)

Semester-III

6 Hrs/week **No. of credits: 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 **15 Hrs.**

UNIT-II: Group Theory II **20 Hrs**

UNIT-III: Group Theory III **20 Hrs**

UNIT-IV: Surface Chemistry **15 hrs**

UNIT-V: Macromolecules **20 hrs**

UNIT-I: Group Theory I **15 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 **20 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 **20 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 **15 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 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.

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.

FATIMA COLLEGE (AUTONOMOUS)
MADURAI-18
M.Sc CHEMISTRY-III SEMESTER – 19PG3C13
GREEN CHEMISTRY

(For those who joined from June 2019 onwards)

6 Hrs/week **5 credits**

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

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

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

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

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

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. Protti D.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.

FATIMA COLLEGE (AUTONOMOUS),MADURA-I625018

DEPARTMENTOF CHEMISTRY

Material Chemistry-19**PG3CE1**

(For those who joined in 2018)

4 Hrs/week **No.of credits: 4**

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 carnon 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: supramolecular structures

UNITII: SYNTHETICMETHODS OFNANOMATERIALS **(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: Purification carbon nanotubes

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. Metalnanoclusters, rare gas and molecular clusters.

Self-study-Properties of semiconducting nanoparticles

UNITIV: CHARACTERIZATION TECHNIQUES (12 HRS)

Microscopy, Atomic forcemicroscope (AFM), scanning electronmicroscope (SEM), transmission electron microscope (TEM), scanning probemicroscope (SPM),scanning tunellingmicroscope (STM). Spectroscopy-UV-visiblespectroscopy, Infra-redspectroscopy, Nuclearmagnetic resonancespectroscopy, Raman spectroscopy and Photoelectron spectroscopy.

Self-study: X-raydiffractiontechnique (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, cancertreatment, molecularmotors, neuro-electronic interfaces and tissue engineering

Self-study-Applications of nano devices.

References

1. Charles P. Poole, Jr., Frank J. Owens, Introduction tonanotechnology,JohnWiley& Sons-India,2010.
2. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill PublishingCompanyLimited, 2007.
3. A.S.Bhatia,Dr.S.M.Ishtiaque,NanoscienceandCarbonNanotubes,Deep&DeepPublicationsPvt.Ltd.
4. MarkRatner,DanielRatner,Nanotechnology,AGentleIntroductionToTheNextBigIdea,PearsonEducation,5thEdn,2009.
5. Dr.S.Shanmugam,Nanotechnology,MJPPublishers,2010.

FATIMA COLLEGE (AUTONOMOUS), MADURAI-625018

DEPARTMENT OF CHEMISTRY

BIO-ORGANIC CHEMISTRY-19PG3CE2

(For those who joined in 2007)

Semester-III

4 Hrs/week **No. of credits: 4**

Objective: This course deals with Bio-Organic Chemistry, structure of Proteins, biological catalysis and Coenzymes.

COURSE OUTCOME

After completion of the course the students are able to

- Understand concepts of molecular recognition and drug design
- Remember the synthesis and structure of Proteins and amino acids.
- Know the extraction and purification of enzymes and their application in catalysis.
- Categorize and analyze enzyme mechanisms.
- Analyze the structure and biological functions of Coenzymes.

UNIT-I - Introduction to Bio-OrganicChemistry **12 Hrs**

UNIT-II - Proteins **12 Hrs**

UNIT -III- Enzymes **12 Hrs**

UNIT -IV- Mechanisms of enzyme action **12 Hrs**

UNIT-V- Coenzymes **12 Hrs**

Unit-I Introduction to Bio-OrganicChemistry **12 Hrs**

Introduction to Bio-Organic Chemistry- Chirality and molecular recognition-molecular asymmetry and prochirality -Proximity effect-molecular adaptation-molecular recognition and drug design.

Unit-II Proteins **12 Hrs**

Classifications-peptide linkage-primary structure of peptides-C-Terminal aminoacid determination- hydrazinolysis - N-terminal amino acid determination-Edmann method-Synthesis of Peptides-Solid-phase pepdite synthesis- Secondary structure of proteins-Tertiary

structure of Proteins- Quaternary structure of proteins-An introduction to biosynthesis of α-aminoacids.

Unit-III Enzymes **12 Hrs**

Introduction and historical perspective - chemical and biological catalysis – Remarkable properties of enzymes like catalytic power, specificity and regulation-Nomenclature and classification-Extraction and purification-Fischer's lock and key and Koshland's induced fit hypothesis-concept and identification of active side by the use of inhibitors.

Unit-IV Mechanism of enzyme action **12 Hrs**

Transition state theory, Orientation and steric effect, acid– base catalysis-Covalent catalysis-Strain and distortion. Example of some typical enzyme mechanisms for chymotrypsin and ribonuclease.

Unit-V Coenzymes **12 Hrs**

Cofactors as derived from Vitamins, Coenzymes, Prosthetic groups, apo enzymes-Structure and biological functions of CoenzymeA, Thiamine pyrophosphate, Pyridoxal phosphate, NAD^+, $NADP^+$, FMN, FAD, Vitamin B_{12}.Mechanism of reactions catalysed by the above cofactors.

References:

1. Herman Dugas, (1988), Bioorganic chemistry, Springer-Verlag, 2nd edition.
2. Herman Dugas and C.Penny, BioorganicOrganic Chemistry, A Chemical approach to enzyme action, Springer-Verlag.
3. A. L. Lehninger, Principles of Biochemistry, ButterWorth publishers.
4. E. E. Corn and P.K. Stumpt, Outlines of Biochemistry.
5. Ambika Shanmugam, Biochemistry for medical students.
6. Trevor Palmer, Understanding enzymes, Prentice Hall.
7. Ed. Collin .J. Suckling, Enzyme Chemistry: Impact and application, Chapman and Hall.
8. Finar .I.L. Organic Chemistry Volume II.

FATIMA COLLEGE (AUTONOMOUS) MADURAI-18
PHYSICAL CHEMISTRY PRACTICALS-I-PG3C14
(Electrical experiments)
SEMESTER –III
(For those who joined from 2019 onwards)

HRS:6 **CREDIT:4**

Course Objective:

This course gives lab experience on physical experiments.

Course outcomes:

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

PHYSICAL CHEMISTRY EXPERIMENTS

- Conductometric Titration of Strong acid with a Strong Base.
- Conductometric Titration of Mixture of Strong acid and Weak acid with a Strong Base.
- Verification of Ostwald's Dilution law and Determination of Dissociation Constant.
- Alkaline Hydrolysis of Ethylacetate by conductometrically.
- Determination of the strength of HCl using pH meter.
- Determination of strength of HCl and CH_3COOH by pH titration.
- Potentiometric Titration of FAS.
- Determination of solubility product by Potentiometrically.

Reference Book

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

FATIMA COLLEGE (AUTONOMOUS) MADURAI-18

INTERNSHIP-19PG3SICI

SEMESTER –III

(For those who joined from 2007 onwards)

RESEARCH WORK

All the second PG students are sent to internship in various reputed research institutions

FATIMA COLLEGE (AUTONOMOUS) MADURAI – 18

DEPARTMENT OF CHEMISTRY

INORGANIC CHEMISTRY-III-19PG4C15

(Organometallic chemistry-I & II,

basic concepts for bio-inorganic chemistry-I & II and inorganic chains, rings and cages)

(For those who joined from 2018 onwards)

Hours per Week: 6 **Credit:5**

Objective:

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 Outcome:

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

- Illustrate the structure and mode of bonding in organometallic complexes
- Apply the different electron counting procedures to predict the shape and stability of organometallic complexes
- Illustrate the mechanism of dioxygen binding in various oxygen carrier proteins
- Classify and identify the different types of metalloenzymes and metallo proteins based on their biological functions.
- Interpret the structure of borazines, boranes and carboranes.

UNIT –I : ORGANOMETALLIC CHEMISTRY-I **18 Hrs**

UNIT –II : ORGANOMETALLIC CHEMISTRY-II **18 Hrs**

UNIT-III : BASIC CONCEPTS FOR BIO-INORGANICCHEMISTRY-I **18 Hrs**

UNIT-IV : BASIC CONCEPTS FOR BIO-INORGANIC CHEMISTRY-II **18 Hrs**

UNIT-V ; INORGANIC CHAINS, RINGS AND CAGES . **18 Hrs**

UNIT –I ORGANOMETALLIC CHEMISTRY-I **18 Hrs**

Introduction,16 and 18electron rule,Metal carbonyl complexes, polynuclear carbonyl complexes carbonyl hydride complexes,carbonylate anionic complexes, nitrosyl complexes, carbine complexes, non-aromatic alkene complexes, allyl and pentadienyl complexes. Metallocenes – Synthesis, strucutre and reactivity.

Self study: carbyne complexes, non-aromatic alkyne complexes,

UNIT –II ORGANOMETALLIC CHEMISTRY-II **18 Hrs**

Reactions of organometallic compounds, Substitution reactions in carbonyl complexes, oxidative addition and reductive elimination, carbonyl insertion, methyl migration alkene insertion and β-elimination.Catalysis by organometallic compounds- alkene hydrogenation, , hydroformylation,Monsanto acetic acid process, Waker's process, ,synthetic gasoline-Fischer- Tropsch process.

Self study: synthetic gas and Ziegler-Natta catalysis.

UNIT-III BASIC CONCEPTS FOR BIO-INORGANIC CHEMISTRY-I **18 Hrs**

Essential elements in biology-the role of model system-the alkali and alkaline earth metals-sodium,potassium,calcium & magnesium-metallophorphyrins-chlorophyll- hemeproteins-hemoglobin and myoglobin-Hill constant, cooperativity effect and Bohr effect, hemoglobin modeling-other heme protiens-cytochromes-peroxidases and catalases.

Self study:Triggering effect, carbommonoxide and cyanide poisoning.

UNIT-IV BASIC CONCEPTS FOR BIO-INORGANIC CHEMISTRY-II **18 Hrs**

Iron-sulphur proteins, Ruberdoxins, Ferredoxins-Hemerythrin-Iron supply and transport-Vitamine B12, metalloenzymes-zinc metalloenzymes, carbonic anhydrase-copper metallo enzymes, ascorbic acid oxidase- blue copper proteins and biological nitrogen fixation.

Self study: biological role of carboxy peptidase enzyme, nitrogen cycle

UNIT-V INORGANIC CHAINS, RINGS AND CAGES . **18 Hrs**

Chains, Catenation, intercalation chemistry. Rings- Borazine, Phosphazene, Phosphazene polymers, Sulphur –Nitrogen ring systems, one dimensional conductors. Cages –Phosphorus cage compounds, Boron cage compounds. Boranes-Preparation, properties, structure and

bonding in diborane ,Wades rule and Styx numbers. Carboranes and metallocarboranes.

Self study: heterocatenation, silicate minerals and bonding in tetra boranes,

Text Books

1. James.E.Huheey, Inorganic Chemistry, Pearson publications, 4th edition, 2008.
2. Asim K.Das,Bioinorganic chemistry,,Books & Allied (P) Ltd'2007

Reference Books

1.F.A.Cotton, G.Wilkinson, C.A. Murillo and M.Bochmann, .Advanced Inorganic Chemistry;Geofrey Wilinson & Carlos,6th Edition'2003
2.K.F.Purcell and J.C.Kotz, Inorganic Chemistry;Melbourne,Cenage learning'2010. 3.J.D.Lee, Concise Inorganic Chemistry, Oxford Blackwll Science, 5th Edition, 2005.

FATIMA COLLEGE (AUTONOMOUS), MADURAI-625018

DEPARTMENT OF CHEMISTRY

Organic chemistry IV-19PG4C16

(Retrosynthesis, reactions and reagents, natural products)

(For those who joined in 2007)

Hours/Week: 6 **Credits: 5**

Objective: 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.

Course outcome:

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

- To differentiate the carbon –carbon bond forming reactions and to interpret the products and to explore reactivity patterns of various coupling reactions
- To elucidate the structural units of quinine, morphine, □-pinene and □-codinene
- To correlate the skeletal units of nucleotides and nucleosides- RNA and DNA
- To categorize the reducing and oxidizing agents and its applications.
- To Sketch the effective and logical synthetic route for the synthesis of new molecules

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Unit I	Introduction to organic synthesis	**18 Hrs**
Unit II	Reagents in organic synthesis	**18 Hrs**
Unit III	Retrosynthesis	**18 Hrs**
Unit IV	Steroids and nucleic acids	**18 Hrs**
Unit V	Alkaloids and Terpenes	**18 Hrs**

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 dialkyl cuprate, lithium diisopropyl amide (LDA), dicyclohexylcarbodiimide (DCC), 1,3-dithiane, osmium tetroxide, dichloro dicyano 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**

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, Verlag Chemie, 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.

FATIMA COLLEGE (AUTONOMOUS), MADURAI-625018

DEPARTMENT OF CHEMISTRY

PHYSICAL CHEMISTRY –IV - 19PG4C17

(Spectroscopy, kinetic theory of gases, photochemistry and radiation chemistry)

(For those who joined in 2007)

Credits:6 **Hours/week:5**

Objective: This paper deals with many spectroscopic techniques like Microwave, IR, Raman and Photoelectron spectroscopies. This paper also deals with NQR and ESR.

Course outcome

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

- Describe the structure and mode of bonding in organometallic complexes containing carbonyls, nitrosyls, carbenes, carbynes, alkenes, alkynes and also metallocene complexes
- Apply different electron counting procedures to predict the shape and stability of organometallic complexes
- Illustrate the mechanism of dioxygen binding in various oxygen carrier proteins
- Classify different types of metalloenzymes and metallo proteins based on their biological functions.
- Distinguish whether the given compound belongs to chain or ring or cage or cluster

UNIT-I **18hrs**

Spectroscopy-I

Absorption and emission of EMR -LASER-Introduction 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 **18hrs**

Spectroscopy-II

Electronic spectra of diatomic molecules-molecular Quantum numbers-dissociation energy calculations- Brige Spener extrapolation technique- fortrat diagram-predissociation

spectra of the electronic states of polyatomic molecules- absorption of light- oscillator strength- charge transfer spectra.

Photoelectron Spectroscopy- basic principles- spectrum, UV and X-ray (ESCA) photoelectron spectroscopy, vibrational structure PES of Ar and O_2 and N_2.

UNIT-III **18hrs**

Spectroscopy-III

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

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

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

References:

Spectroscopy by Banwell & Drago

UNIT-IV **18hrs**

Kinetic theory of gases

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 **18hrs**

Photochemistry and Radiation chemistry

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,

References:

1) PHYSICAL CHEMISTRY - ATKINS
2) PHYSICAL CHEMISTRY -CASTELLAN
3) PHYSICAL CHEMISTRY - WALTER J.MOORE
4) Photo chemistry -Turo
5) photo chemisty - Rohatkaji Mukerji.

FATIMA COLLEGE (AUTONOMOUS), MADURAI-625018

DEPARTMENT OF CHEMISTRY

Analytical Chemistry –19PG4CE3

(For those who joined in 2007)

Hrs/week: 4 **No.of credits: 4**

Objective: This course deals with types of error analysis, chromatographic techniques, electro analytical methods and applications of C language in chemistry.

COURSE OUTCOME

After successful completion of the course, students will be able

- To acquire the complete knowledge of C language
- To develop logics which will help them to create programs, applications of chemistry problems in C.
- To explicate the theoretical principles of selected instrumental methods within electro analytical and spectrometric/spectrophotometric methods, and main components in such analytical instruments.
- To explain the confidence level and confidence limit, the sources of random errors and effects of random errors on analytical results.
- To illuminate the theoretical principles of various separation techniques in chromatography, and typical applications of chromatographic techniques

Unit – I	**(a)**	**Error Analysis**	**12 Hrs**
	(b)	**Chromatography**	
Unit – II	**Spectrophotometric methods and Radiochemical methods**		**12 Hrs**
Unit – III	**(a)**	**Electroanalytical methods**	**12 Hrs**
	(b)	**Thermal methods**	
Unit – IV		**Programming in C Language**	**12 Hrs**
Unit – V		**Applications of C Language in Chemistry**	**12 Hrs**

Unit –I **(12 Hrs)**

(a) **Error Analysis** Accuracy and Precision, Determinate and Indeterminate errors, Significant figures, Ways of expresssing accuracy – Absolute and relative error, Standard deviation, Propagation of errors, 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, Statistics of sampling.

(b) Chromatography

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

Unit –II **(12 Hrs)**

Spectrophotometric methods and Radiochemical methods

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

Unit – III **(12 Hrs)**

(a) Electroanalyttical methods

Coulometry and coulometric titrations, Cyclic Voltametry.

(b) Thermal methods

Principles of TGA, DTA and DSC - Applications to simple salts – Oxysalts, Carbonates and complex salts, Thermometric titrations.

Unit –IV **(12 Hrs)**

Programming in C Language

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

(b) 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 –V **(12 Hrs)**

Applications of C Language in Chemistry

Writing the Program using the various features of C language – Calculation of mean activity Co-efficient of an electrolyte, Determination of electronegativity of an atom from bond energy data using pauling's relation, Determination of lattice energy of a crystal using Born-Lande equation, Shapes of molecules or ions using VSEPR Theory, Detemination of Normality, Molarity and Molality of solutions, Determination of half life of a radioactive nucleus and Calculation of Binding energy.

References

Units I to III

1. Analytical Chemistry by G.D.Chiristian.
2. Analytical Chemistry by U.N.Dash
3. Instrumental methods of analysis by Willard merit Dean
4. Fundamentals of analytical chemistry by Skoog.West&Holler.

Units IV & V

5. Programming in ANSI C by E.Balagurusamy
6. Computers in Chemistry by K.V.Raman

FATIMACOLLEGE (AUTONOMOUS), MADURAI-625018

DEPARTMENT OF CHEMISTRY

Chemical Engineering –19PG4CE4

(For those who joined in 2007)

Semester-IV

4 Hrs/week **4 credits**

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

COURSE OUTCOME

After successful completion of the course, students will be able

- To write C- Program using various features of C- language
- To categorize the various conditioning methods in water treatment
- To apply the principles involved in spectrophotometric analysis.
- To compare the mechanism between dry corrosion and wet corrosion
- To synthesize some industrially important polymers

Unit-I Programming in C Language and its applications in Chemistry (12 Hrs)

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

(b) 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. Writing the Program using the various features of C language - Determination of Mass number for an atom, Shapes of molecules using VSEPR Theory, Detemination of Normality,

Unit –II Water Technology (12 Hrs)

Hardness of water- Estimation of hardness – Treatment of water for domestic supply –Boiler feed water and its requirements – softening and conditioning methods – External and internal conditioning-Desalination of Brackish water.

Unit –III Spectrophotometric methods and Radiochemical methods (12 Hrs)

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

Unit –IV Non conventional energy sources **(12 Hrs)**

Nuclear energy – Light water nuclear power plant –Breeder Reactor- Solar energy – Solar hear collectors- solar water heater-Solar cells and its applications -Wind energy – Methods of harnessing wind energy-and Fuel Cells-Hydrogen oxygen fuel cells-Fuel battery-Merits and Demerits.

Unit-V Polymers **(12 Hrs)**

Introduction-Types of polymerization, Mechanism, Plastics, Classification-Engineering plastics, Rubber or elastomers-Vulcanization of Rubber and important synthetic Rubbers-Composites-Types of composites.

References:

1. Programming in ANSI C by E.Balagurusamy
2. Computers in Chemistry by K.V.Raman
3. Instrumental methods of analysis by Willard merit Dean

FATIMA COLLEGE (AUTONOMOUS) MADURAI-18
PHYSICAL CHEMISTRY PRACTICALS-II-19PG4C18
SEMESTER –IV

(Non-Electrical experiments)

(For those who joined from 2019 onwards)

HRS:6 **CREDIT:4**

Course Objective:

This course gives lab experience on physical experiments.

Course outcomes:

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

- 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.

FATIMA COLLEGE (AUTONOMOUS) MADURAI-18
PROJECT-19PG4CPR
SEMESTER –III

(For those who joined from 2007 onwards)

PROJECT WORK

All the second PG students are sent to do three months project(MAY,JUNE AND JULY) in various reputed research institutions