

Semester II Teaching Plan

Department : Chemistry
Class : I M. Sc Chemistry
Title of the Course : **Core Course III:** Organic Reaction Mechanism - II
Semester : II
Course Code : CP232CC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
CP232CC1	6	-	-	5	6	90	25	75	100

Objectives

1. To understand the mechanism involved in various types of organic reactions with evidences.
2. To understand the applications of synthetically important reagents.
3. To design synthetic routes for synthetically used organic reactions.

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO-1	remember the basic principles of organic chemistry	PSO - 1	K1(R)
CO-2	understand the mechanism of various types of organic reactions.	PSO - 2	K2(U)
CO-3	apply the suitable reagents for the conversion of selective organic compounds.	PSO - 3	K3(Ap)
CO-4	analyze the principles of substitution, elimination, and addition reactions.	PSO - 1	K4(An)
CO-5	evaluate the reaction mechanisms and design new routes to synthesis of organic compounds.	PSO - 2	K5(E)& K6(C)

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Elimination and Free Radical Reactions					
	1	Mechanisms: E ₂ , E ₁ , and E _{1CB} mechanisms. Syn- and anti-eliminations. Orientation of the double bond: Hoffmann and Saytzeff rules.	5	K3(Ap)	Lecture with demonstration	Oral test and quiz-Slido
	2	Effect of substrate, solvent, attacking bases and leaving group. Stereochemistry of eliminations in acyclic and cyclic systems, pyrolytic elimination.	4	K4(An)	Flipped classroom-Nearpod	Presentation and group discussion
	3	Free radicals - detection and stability of radicals. Free radical reactions -characteristics of free radical reactions - polymerization, addition, halogenations, aromatic substitutions, rearrangements.	5	K3(Ap)	Lecture with ppt	Short test
	4	Free radical reactivity: Reactivity on aliphatic, aromatic substrates, reactivity in the attacking radical, effect of solvent.	4	K4(An)	Blended learning-Nearpod	Slip test and MCQ-Nearpod
II	Oxidation and Reduction Reactions					
	1	Mechanism of oxidation reactions-dehydrogenation by quinones, selenium dioxides, ferricyanide, mercuric acetate, lead tetraacetate, osmium tetroxide	5	K2(U)	Lecture with ppt	Quiz and MCQ-Quizizz
	2	Reactions involving cleavage of C-C bonds - cleavage of double bonds, oxidative decarboxylation, allylic oxidation, oxidation by chromium trioxide	3	K3(Ap)	Blended learning	Group discussion-MCQ (Nearpod)
	3	Oxidation by pyridine, DMSO-Oxalyl chloride (Swern oxidation) and Corey-Kim oxidation, dimethyl sulphoxide-dicyclohexyl carbodiimide (DMSO-DCCD)	5	K3(Ap)	Lecture using illustrations	Oral test

	4	Mechanism of reduction reactions-Wolff-Kishner, Clemmenson, Rosenmund, reduction with Trialkyl and triphenyltin hydrides	3	K4(An)	Flipped classroom	Short test and quiz-Slido
	5	Homogeneous hydrogenation, Hydroboration with cyclic systems, MPV and Bouveault-Blanc reduction.	2	K4(An)	Lecture with ppt	Oral test
III	Molecular Rearrangements					
	1	Molecular rearrangements-classification- electrophilic-nucleophilic and free radical rearrangements.	2	K2(U)	Flipped classroom-Zoom and Nearpod	Concept explanations
	2	Mechanisms of Wagner-Meerwein, Tiffenev-Demjanov, Dienone-phenol, Neber,Baker-Venkataraman, Baeyer-Villiger oxidation, Sommelet-Hauser, Von-Ritcher, Ullmann and Pummerer rearrangements.	6	K4(An)	Lecture with illustrations	Quiz-Kahoot, slip test and assignment-Google Classroom
	3	Di- π methane, Dakin, Favorskii, Quasi-Favorskii, Stevens,Fries and Photo Fries rearrangement.	6	K4(An)	Lecture with illustrations	MCQ-Slido and short test
	4	Intramolecular rearrangements - Claisen,Cope and oxy-Cope rearrangements.	4	K4(An)	Lecture with illustrations	Open book test
IV	Addition to Carbon Multiple Bonds					
	1	Addition to carbon-carbon multiple bonds- Addition reactions involving electrophiles, nucleophiles, free radicals, carbenes and cyclic mechanisms.	3	K2(U)	Blended learning-Zoom and Nearpod	Group discussion and presentation
	2	Orientation and reactivity, hydrogenation of double and triple bonds, Michael reaction, addition of oxygen and Nitrogen	3	K3(Ap)	Lecture with ppt and videos	MCQ- Quizizz and slip test
	3	Addition to carbon-hetero atom multiple bonds:Mannich reaction, acids, esters, nitrites, addition of Grignard reagentsand Wittig reaction.	4	K3(Ap)	Lecture with illustrations	Short test
	4	Addition of Grignard reagents- organozinc and organolithium reagents to carbonyl and unsaturated carbonyl	4	K4(An)	Lecture with illustrations	Surprise test

		compounds.				
	5	Mechanism of condensation reactions involving enolates - Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.	4	K4(An)	Lecture with ppt and videos	Quiz- Nearpod and group discussion
V	Reagents and Modern Synthetic Reactions					
	1	Lithium diisopropylamine (LDA) - Sodium cyanoborohydride (NaBH_3CN) - meta-Chloroperbenzoic acid (m-CPBA)	3	K3(Ap)	Lecture with illustrations	Open book test
	2	Dimethyl aminiopyridine (DMAP)- $\text{n-Bu}_3\text{SnH}$ -Triethylamine (TEA)-Diethylazodicarboxylate (DEAD)- N-bromosuccinimide (NBS)-Trifluoroacetic acid (TFA)	5	K4(An)	Lecture using ppt	Short test(MCQ)-Slido
	3	Phenyltrimethylammonium tribromide (PTAB)-Diazomethane and Zn-Cu. Diethyl maleate (DEM)-Copper diacetylacetonate ($\text{Cu}(\text{acac})_2$)- $\text{TiCl}_3\text{-NaIO}_4$ -	5	K3(Ap)	Blended learning-Nearpod	Class test
	4	Pyridinium chlorochromate (PCC)-Pyridinium dichromate (PDC)-Suzuki coupling-Heck reaction- Negishi reaction-Baylis-Hillman reaction.	5	K4(An)	Lecture using ppt	Slip test and MCQ-Quizizz

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability and Skill Development

Activities (Em/SD):

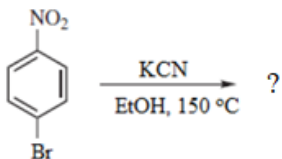
- Stereochemistry of elimination reactions - Group discussion
- Addition to carbon-carbon multiple bonds - Presentation
- Mechanism of condensation - Peer teaching
- Organic reagents - Group discussion

Assignment:

- Mechanism of molecular rearrangements
- Mechanism of oxidation and reduction reactions - Reflective writing

Sample questions

PART A

- Identify the most reactive halogen in free radical mediated halogenation reactions.
(a) Fluorine (b) Chlorine (c) Bromine (d) Iodine
- Assertion: E₂ reactions are favoured by polar aprotic solvents.
Reason: In aprotic solvents the cations are not solvated.
(a) Both A and R are true but R is not the correct explanation of A
(b) Both A and R are true and R is the correct explanation of A
(c) A is true but R is false
(d) R is true but A is false
- Which reagent converts carbonyl compounds to α,β unsaturated carbonyl compounds?
(a) LiAlH₄ (b) DDQ (c) SeO₂ (d) PCC
- In MPV reduction, which reagent is often used to transfer hydride ions?
(a) Sodium borohydride (b) Lithium aluminium hydride
(c) Sodium hydride (d) Boron trifluoride diethyl etherate
- Complete the following reaction:


O=[N+]([O-])c1ccc(Br)cc1 $\xrightarrow[\text{EtOH, 150 } ^\circ\text{C}]{\text{KCN}}$?
- Identify the rearrangement for the conversion of acetophenone to phenyl acetate.
(a) Neber rearrangement (b) Fries rearrangement (c) Favorskii rearrangement (d) Baeyer-Villiger rearrangement
- Which of the following reaction involves addition of nitrogen to a C=C double bond?
(a) Michael reaction (b) Stobbe reaction (c) Mannich reaction (d) Wittig reaction
- Point out the products obtained by the hydrolysis of amides.
(a) Carboxylic acids and alcohols (b) Carboxylic acids and aldehydes
(c) Carboxylic acids and ketones (d) Carboxylic acids and amines
- Triethylamine (TEA) is often employed as a:
a) Reducing agent b) Acid catalyst c) Base catalyst d) Nucleophilic catalyst
- TiCl₃ is a common reagent in:
a) Grignard reactions b) Wurtz reactions c) Wacker oxidation
d) Heck reactions

PART B

1. Identify the major product obtained for the dehydrobromination of 2-bromo-2-methyl pentane and explain the reason for its stability.
2. Discuss the stability of free radicals with examples.
3. Explain the mechanism of any one synthetic application for the following reagents.
(i) CrO_3 (ii) Oxalyl chloride
4. Predict the mechanism of MPV and Bouveault-Blanc reduction.
5. Apply the mechanism for the conversion of allyl benzene to cyclopropyl benzene.
6. Interpret the mechanism for the formation of δ -valerolactone from cyclopentanone.
7. Mention any four addition reactions of carbenes.
8. Illustrate the mechanism of Wittig reaction with an example.
9. What is DEAD? Explain their role in synthetic applications.
10. Analyze the mechanism of Suzuki reaction.

Part: C

1. Analyze E_1 and E_2 elimination reactions with examples.
2. Correlate Saytzeff and Hofmann rules with examples.
3. Explain any one application of the following oxidizing agents with mechanism (i) OsO_4
(ii) SeO_2
4. Illustrate the mechanism of Wolf-Kishner and Rosenmund reduction.
5. Compare Sommelet-Hauser and Stevens rearrangements.
6. Describe the mechanism of Baeyer-Villiger and Baker-Venkatraman rearrangements.
7. Illustrate the mechanism of Mannich and Stobbe reactions.
8. Interpret any four addition reactions of carbonyl compounds using organometallic reagents.
9. Give any three synthetic applications of NaIO_4 with mechanism.
10. Enumerate the applications of m-CPBA and TFA.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. M. Antilin Princela

Teaching Plan

Department : Chemistry
Class : I M.Sc Chemistry
Title of the Course : Core Course IV: Physical Chemistry-I
Semester : II
Course Code : CP232CC2

CourseCode	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CP232CC2	6	-	-	-	5	6	90	25	75	100

Objectives:

1. To recall the fundamentals of thermodynamics and the composition of partial molar quantities.
2. To understand the classical and statistical approach of the functions.
3. To compare the significance of Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein Statistics.
4. To correlate the theories of reaction rates for the evaluation of thermodynamic parameters.

Course Outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
1.	recall the basic concepts of thermodynamics.	PSO-1	K1
2.	understand the classical and statistical concepts of thermodynamics.	PSO-2	K2
3.	apply the thermodynamic concepts to study the kinetics of chemical reactions.	PSO-3	K3
4.	analyze the thermodynamics for real gases and mixtures.	PSO-2	K4
5.	evaluate the various kinetic methods of chemical reactions.	PSO-3	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

Teaching Plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Classical Thermodynamics					
	1.	Partial molar properties Chemical potential, Gibbs-Duhem equation-binary and ternary systems.	4	K2(U)	Inquiry based approach	Quiz- Quizizz
	2.	Thermodynamics of real gases - Fugacity-determination of fugacity by graphical and equation of state methods-dependence of temperature, pressure and composition.	4	K3(Ap)	Integrative approach	Class test
	3.	Thermodynamics of ideal and non-ideal binary mixtures, Duhem - Margulus equation, applications of ideal and non-ideal mixtures.	4	K3(Ap)	Collaborative approach	Group discussion
	4.	Activity and activity coefficients	2	K5(E)	Integrative approach	Home work-Slido
	5.	Standard states - determination-vapour pressure, EMF and freezing point methods.	4	K3(Ap)	Collaborative approach	Seminar presentation
II	Statistical thermodynamics					
	1.	Introduction of statistical thermodynamics, concepts of thermodynamic and mathematical probabilities-	2	K2(U)	Inquiry based approach	Oral test
	2.	distribution of distinguishable and non-distinguishable particles. Assemblies, ensembles, canonical particles.	2	K2(U)	Collaborative approach	Group discussion
	3.	Maxwell - Boltzmann, Fermi Dirac & Bose-Einstein Statistics- comparison and applications.	4	K3(Ap)	Integrative approach	Home work
	4.	Partition functions-evaluation of translational, vibrational and rotational partition functions for mono	3	K5(E)	Lecture using PPT	Seminar presentation

		atomic, diatomic and polyatomic ideal gases.				
	5.	Thermodynamic functions in terms of partition functions-calculation of equilibrium constants. Statistical approach to Thermodynamic properties: pressure, internal energy, entropy, enthalpy, Gibb's function, Helmholtz function residual entropy, equilibrium constants and equipartition principle.	4	K3(Ap)	Lecture using PPT	Seminar presentation
	6.	Heat capacity of mono and diatomic gases-ortho and para hydrogen. Heat capacity of solids-Einstein and Debye models.	3	K3(Ap)	Collaborative approach	Class test- Nearpod
III	Irreversible Thermodynamics					
	1.	Theories of conservation of mass and energy entropy production in open systems by heat, matter and current flow, force and flux concepts.	6	K2(U)	Co-operative learning	Group Discussion
	2.	Onsager theory-validity and verification- Onsager reciprocal relationships.	5	K2(U)	Integrative approach	Online assignment- Slido
	3.	Electro kinetic and thermo mechanical effect	3	K2(U)	Lecture method	Open book Test
	4.	Application of irreversible thermodynamics to biological systems.	4	K3(Ap)	Co-operative learning	Group Discussion
IV	Kinetics of Reactions					
	1.	Theories of reactions-effect of temperature on reaction rates, collision theory of reaction rates	3	K2(U)	Lecture method	Slip test
	2.	Unimolecular reactions - Lindeman and Christiansen hypothesis- Potential energy surfaces.	3	K2(U)	Integrative approach	Quiz-Quizizz
	3.	Transition state theory-evaluation of thermodynamic parameters of activation-applications of ARRT to reactions between	4	K2(U)	Integrative approach	Slip test

		atoms and molecules.				
	4.	Factors determining the reaction rates in solution - primary salt effect and secondary salt effect,	2	K3(Ap)	Peer group teaching	Peer Review
	5.	Homogeneous catalysis-acid- base catalysis-mechanism of acid base catalyzed reactions-Bronsted catalysis law, enzyme catalysis-Michelis-Menton catalysis.	6	K2(U)	Collaborative approach	Group discussion
V	Kinetics of complex and fast reactions					
	1.	Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions.	4	K2(U)	Lecture method	Seminar presentation
	2.	Chain reactions-chain length, kinetics of $H_2 - Cl_2$ & $H_2 - Br_2$ reactions (Thermal and Photochemical reactions) - Rice Herzfeld mechanism.	4	K2(U)	Inquiry based method	Quiz-Slido
	3.	Study of fast reactions-relaxation methods-temperature and pressure jump methods electric and magnetic field jump methods	4	K3(Ap)	Co-operative learning	Group Discussion
	4.	Stopped flow flash photolysis methods and pulse radiolysis.	2	K3(Ap)	Co-operative learning	Group Discussion
	5.	Kinetics of polymerization-free radical, cationic, anionic polymerization - Poly condensation.	4	K2(U)	Inquiry based learning	Student presentation

Course Focussing on Employability/ Entrepreneurship/ Skill Development:

Employability

Activities (Em/ En/SD): Determination of mathematical probability of distribution of particles

Assignment: Onsager theory-validity and verification- Onsager reciprocal relationships.

Seminar Topic:

Standard states -determination-vapour pressure, EMF and freezing point methods. Partition functions-evaluation of translational, vibrational and rotational partition functions for mono atomic, diatomic and polyatomic ideal gases. Thermodynamic functions in terms of partition functions-calculation of equilibrium constants. Statistical approach to Thermodynamic properties: pressure, internal energy, entropy, enthalpy, Gibb's function, Helmholtz function residual entropy, equilibrium constants and equipartition principle.

Sample questions

Part A

1. Duhem Margules equation gives the relationship between the partial pressure and _____ of two component liquid mixture.
(a) molality (b) moles (c) mole fraction (d) molarity
2. In a binary system the number of intensive variable is _____.
(a) 1 (b) 2 (c) 3 (d) 4
3. Boltzons are indistinguishable particles. (True / False)
4. The spin value of fermions are _____
5. According to Bose Einstein statistics the possible distribution of two particles 'a' between three energy state is _____.
(a) 6 (b) 3 (c) 4 (d) 9
6. Write the mathematical expression of force and flux.
7. What are effective collisions?
8. Free radical polymerization is a chain growth polymerization (True / False)

Part B

1. Discuss the significance of partial molar properties.
2. How do you determine partial molar properties using intercept method?
3. How is equilibrium constants determined in terms of partition function?
4. Classify the types of ensembles.
5. Compare Force and Flux.
6. List out the difference between optical and electron microscopy
7. Discuss the effect of secondary salt effect on reaction rates.

Part C

1. Derive Gibbs Duhem equation using partial molar properties
2. Explain intercept and density methods of determination of partial molar properties.
3. Compare MB, BE and FD.
4. Verify the Onsager reciprocity relations.
5. Derive the kinetics of Lindemann theory of unimolecular reactions
6. Discuss the kinetics of $\text{H}_2\text{-Cl}_2$ photochemical reaction.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. M. Shirley Treasa

Teaching plan

Semester-I

Department : **Chemistry**
Class : **I M.Sc Chemistry**
Title of the Course : **Elective Course III: a) Medicinal Chemistry**
Semester : **II**
Course Code : **CP232EC1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CP232EC1	4	-	-	-	3	4	60	25	75	100

Pre-requisite

Basic knowledge of medicinal chemistry

Learning Objectives

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

Course Outcomes

CO	On the successful completion of the course, students will be able to:	PSO addressed	Cognitive level
1.	understand the drug properties based on its structure.	PSO-1	K2
2.	apply the relationship between drug's chemical structure and its therapeutic properties.	PSO-2	K3
3.	analyze the factors that affect the absorption, distribution, metabolism, and excretion in drug design.	PSO-3	K4
4.	evaluate the different theories of drug actions at molecular level.	PSO-2	K5
5.	design new drugs for the treatment of various diseases.	PSO-3	K6

K1 - Remember; **K2** - Understand; **K3**– Apply

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Classification and Nomenclature of Drugs					
	1	Important terminologies - Molecular Pharmacology, pharmacophore, metabolites, antimetabolites, virus, bacteria, fungi, actinomycetes, mutation.	4	K2(U)	Flipped classroom and lecture using chalk and talk	Slip test and concept explanations - Slido
	2	Classification of drug. Nomenclature of drugs – non-proprietary names – source, assay (biological, chemical, immunological).	5	K3(Ap)	Group discussion	class test - quizizz
	3	Testing of potential of drugs and their side effects.	3	K4(An)	Flipped classroom and Group discussion	Short test and MCQ - Nearpod
II	Antibiotics					
	1	Introduction, Targets of antibiotics action.	3	K2(U)	Lecture using videos and ppt	Slip test and MCQ
	2	classification of antibiotics, enzyme-based mechanism of action.	4	K2(U)	Lecture using chalk and talk	Short test
	3	SAR of penicillin and tetracycline, clinical application of penicillin, cephalosporin.	3	K3(Ap)	Group discussion	Quiz- Quizizz
	4	Current trends in antibiotic therapy.	2	K4(An)	Lecture using videos and Debates	Short test and quiz
III	Antihypertensive agents and diuretics					
	1	Classification of cardiovascular agents,	3	K2(U)	Lecture using ppt	Concept explanations

	2	introduction to hypertension, etiology, types, classification of antihypertensive agents,	4	K4(An)	Lecture using chalk and talk	Slip test
	3	classification and mechanism of action of diuretics, Furosemide, Hydrochlorothiazide, Amiloride.	5	K3(Ap)	Lecture using chalk and talk	Short summary or overview
IV	Antipyretics and Anti-diabetic Drugs					
	1	Introduction, Mechanism of inflammation.	4	K2(U)	Lecture using videos and ppt	Concept explanations and short summary
	2	classification and mechanism of action - paracetamol, Ibuprofen, Diclofenac, naproxen, indomethacin, phenylbutazone and meperidine.	3	K4(An)	Lecture using chalk and talk and Field Trip	Slip test and Paper presentation
	3	Medicinal Chemistry of Antidiabetic agents- Introduction, Types of diabetics, Drugs used for the treatment, chemical classification, Mechanism of action – insulin and sulfonyl urea.	5	K2(U)	Lecture using chalk and talk	Short test and online quiz- Nearpod
V	Role of Metals in Drugs					
		Mechanism of drug action - absorption, drug delivery, drug excretion. Physiological effects of different functional groups in drugs.	4	K3(Ap)	Group discussion and Lecture using Chalk and talk	Short test
		Antineoplastic agents - Cobalt therapy. Biological role of salts of Na, K, and Ca, Cu, Zn.	4	K4(An)	Group discussion, and Peer tutoring	Slip test and MCQ-Slido
		Uses of MgSO ₄ .7H ₂ O, milk of magnesia, magnesium trisilicate, aluminium hydroxide gel, HgCl ₂ , HgI ₂ and Hg (CN) ₂ as disinfectants	4	K3(Ap)	Group discussion and Lecture using videos	Short test and Quiz- Quizizz

1. What term refers to the study of the interactions between drugs and living organisms?
 - a) Molecular Biology
 - b) Molecular Pharmacology
 - c) Biochemistry
 - d) Pathophysiology
2. What is the primary purpose of testing the potential of drugs and assessing their side effects?
 - a) Marketing
 - b) Quality Control
 - c) Regulatory Compliance
 - d) Safety and Efficacy Evaluation
3. Which of the following is a target of antibiotic action?
 - a) Nucleic Acids
 - b) Carbohydrates
 - c) Vitamins
 - d) Minerals
4. What is the main clinical application of penicillin?
 - a) Antiviral therapy
 - b) Antifungal therapy
 - c) Antibacterial therapy
 - d) Antiparasitic therapy
5. What is the primary classification criterion for antihypertensive agents?

- a) Chemical structure
 - b) Mechanism of action
 - c) Therapeutic index
 - d) Solubility in water
6. Which diuretic is known for its loop diuretic action and is commonly used in the treatment of edema and hypertension?
 - a) Furosemide
 - b) Hydrochlorothiazide
 - c) Amiloride
 - d) Spironolactone
 7. What is the mechanism of action of paracetamol as an antipyretic?
 - a) Inhibition of prostaglandin synthesis
 - b) Enhancement of immune response
 - c) Stimulation of CNS activity
 - d) Inhibition of bacterial cell wall synthesis
 8. Which category of drugs is used for the treatment of diabetes and includes insulin and sulfonylureas?
 - a) Antihypertensive agents
 - b) Antipyretics
 - c) Antidiabetic agents
 - d) Antibiotics
 9. What is the biological role of salts of Na, K, and Ca in drug action?
 - a) Enzyme inhibition
 - b) Drug absorption
 - c) DNA replication
 - d) Nervous system function
 10. In the context of drug delivery, what is the role of antineoplastic agents like Cobalt therapy?
 - a) Enhance drug absorption
 - b) Target specific organs
 - c) Inhibit cancer cell growth
 - d) Promote drug excretion

Part B

1. Explain the importance of molecular pharmacology in drug development, focusing on concepts like pharmacophore and metabolites. Provide examples.
2. Discuss methods for testing potential drugs and evaluating side effects. Why is assessing both efficacy and safety crucial in drug development?
3. Describe antibiotic targets and enzyme-based mechanisms. How do these contribute to antibiotic therapy? Give examples.
4. Explore the clinical applications of penicillin and cephalosporin. Discuss current trends in antibiotic therapy, addressing challenges and strategies against antibiotic resistance.
5. Provide an overview of hypertension, its classification, and discuss different antihypertensive agents' mechanisms.
6. Discuss the classification and mechanisms of diuretics, emphasizing drugs like Furosemide, Hydrochlorothiazide, and Amiloride.
7. Explore the mechanism of inflammation and the classification and mechanisms of action of antipyretic drugs. Discuss their uses and potential side effects.

8. Delve into the medicinal chemistry of antidiabetic agents. Provide an overview of diabetes types, drugs, and mechanisms of action of insulin and sulfonylurea.
9. Explain the mechanism of drug action concerning absorption, delivery, and excretion. Discuss the physiological effects of different functional groups in drugs.
10. Explore the biological role of salts of Na, K, Ca, Cu, Zn in drug action. Provide examples of drugs utilizing these salts in their mechanisms.

Part C

1. Explore molecular pharmacology's role in drug development, focusing on pharmacophore and metabolites. Discuss challenges in testing drugs for both efficacy and safety.
2. Investigate drug nomenclature, emphasizing non-proprietary names. Discuss testing methods and regulatory considerations for ensuring pharmaceutical safety and efficacy.
3. Examine antibiotic targets and mechanisms, using examples like penicillin and tetracycline. Discuss current trends in combating antibiotic resistance.
4. Explore clinical applications of penicillin and cephalosporin, comparing mechanisms and addressing challenges and innovative strategies for antibiotic development.
5. Provide an overview of hypertension and mechanisms of action for antihypertensive agents like beta-blockers and ACE inhibitors.
6. Explore diuretic classification and mechanisms, focusing on drugs like Furosemide and Hydrochlorothiazide. Discuss applications in treating conditions such as edema and hypertension.
7. Investigate the mechanism of inflammation and action of antipyretic drugs like paracetamol. Discuss therapeutic uses and potential side effects.
8. Delve into the medicinal chemistry of antidiabetic agents, covering diabetes types, drugs, and mechanisms of action for insulin and sulfonylureas.
9. Explain drug action mechanisms regarding absorption, delivery, and excretion. Discuss physiological effects of functional groups in drugs and their relevance to drug development.
10. Explore the biological role of metal salts like Na, K, Ca, Cu, Zn in drug action. Discuss drug examples utilizing these salts and assess therapeutic implications of incorporating them in formulations.

Head of the Department: Dr. M. Anitha Malbi

Course Instructor: Dr. B. T. Delma

Teaching plan

Department : Chemistry
Class : I M. Sc Chemistry
Title of the Course : Elective Course IV: a) Bio-Inorganic Chemistry
Semester : II
Course Code : CP232EC4

CourseCode	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CP232EC4	3	1	-	-	3	4	60	25	75	100

Pre-requisites:

The student should know the biological importance of Chemistry

Learning Objectives:

1. To understand the role of trace elements.
2. To understand the biological significance of iron, sulphur.
3. To study the toxicity of metals in medicines.
4. To have knowledge on diagnostic agents.
5. To discuss on various metalloenzymes properties.

Course Outcomes

CO	On the successful completion of the course, student will be able to:	PSO addressed	Cognitive level
1.	understand the importance trace elements in biological processes.	PSO-1	K1& K2
2.	analyze the mechanism of biological redox systems.	PSO-2	K2& K4
3.	interpret the role of nitrogen in biological systems.	PSO-3	K2& K3
4.	identify the toxicity of metals and suggest suitable diagnostic agents for cancer treatment.	PSO-2	K4& K5
5.	evaluate the kinetics and effect of pH, temperature on enzyme reactions	PSO-3	K3 & K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Essential trace elements					
	1	Selective transport and storage of metal ions: Ferritin, Transferrin and siderophores- Sodium and potassium transport, Calcium signaling proteins.	4	K2(U)	Flipped classroom and lecture using chalk and talk	Slip test and concept explanations - Slido
	2	Metalloenzymes: Zinc enzymes–carboxypeptidase and carbonic anhydrase.	5	K3(Ap)	Group discussion	Class test - quizizz
	3	Ironenzymes–catalase, peroxidase. Copperenzymes – superoxide dismutase, Plastocyanin, Ceruloplasmin, Tyrosinase. Coenzymes - Vitamin-B12 coenzymes	3	K4(An)	Flipped classroom and Group discussion	Short test and MCQ - Nearpod
II	Transport Proteins					
	1	Oxygen carriers-Hemoglobin and myoglobin - Structure and oxygenationBohr Effect. Binding of CO, NO, CN– to Myoglobin and Hemoglobin.	3	K2(U)	Lecture using videos and ppt	Slip test and MCQ- Quizizz
	2	Biological redox system: Cytochromes-Classification, cytochrome a, b and c. Cytochrome P-450.	4	K2(U)	Lecture using chalk and talk	Short test
	3	Non-heme oxygen carriers- Hemerythrin and hemocyanin.	3	K3(Ap)	Group discussion and problem solving	Quiz
	4	Iron-sulphur proteins- Rubredoxin and Ferredoxin- Structure and classification.	2	K4(An)	Lecture using videos and ppt	Short test and quiz
III	Nitrogen fixation					
	1	Introduction, types of nitrogen fixing microorganisms. Nitrogenase enzyme - Metal clusters in nitrogenase- redox property - Dinitrogen	8	K2(U)	Lecture using ppt	Concept explanations

		complex transition metal complexes of dinitrogen - nitrogen fixation via nitride formation and reduction of dinitrogen to ammonia.				
	2	Photosynthesis: photosystem-I and photosystem-II- chlorophylls structure and function.	4	K4(An)	Lecture using chalk and talk	Slip test- Nearpod
IV	Metals in medicine					
	1	Metal Toxicity of Hg, Cd, Zn, Pb, As, Sb.	4	K2(U)	Lecture using videos and ppt	Concept explanations and short summary
	2	Therapeutic Compounds: Vanadium-Based Diabetes Drugs; Platinum-Containing Anticancer Agents. Chelation therapy; Cancer treatment.	3	K4(An)	Lecture using chalk and talk	Slip test and quiz-Quizizz
	3	Diagnostic Agents: Technetium Imaging Agents; Gadolinium MRI Imaging Agents. Temperature and critical magnetic Field.	5	K2(U)	Lecture using chalk and talk	Short test
V	Enzymes					
		Introduction and properties - nomenclature and classification. Enzyme kinetics, free energy of activation and the effects of catalysis.	6	K3(Ap)	Group discussion and Lecture using Chalk and talk	Short test
		Michelis - Menton equation - Effect of pH, temperature on enzyme reactions. Factors contributing to the efficiency of enzyme.	6	K4(An)	Group discussion, and Peer tutoring	Slip test and MCQ-Slido

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability and Skill Development

Activities (Em/SD): Model making

Assignment: Case study on Metals in medicine.

Seminar Topics

Introduction, types of nitrogen fixing microorganisms. Nitrogenase enzyme - Metal clusters in nitrogenase- redox property - Dinitrogen complexes transition metal complexes of dinitrogen - nitrogen fixation via nitride formation and reduction of dinitrogen to ammonia. Photosynthesis: photosystem-I and photosystem-II-chlorophylls structure and function.

Sample questions

Part A

- Which protein is involved in the selective transport and storage of iron ions?
a. Transferrin b. Ferritin c. Siderophores d. Ceruloplasmin.
- Sodium and potassium transport is crucial for maintaining _____ balance in cells.
- Cytochrome P-450 is a key enzyme involved in _____ metabolism.
Hemerythrin and hemocyanin are examples of heme-containing oxygen carriers.(True / False)
- What is the primary enzyme involved in nitrogen fixation?
a. Nitrate reductase b. Nitrogenase c. Ammonia synthase d. Nitrogen oxidase
- Dinitrogen can be reduced to ammonia during nitrogen fixation through the formation of _____.
a. Nitrate b. Nitrite c. Nitride d. Nitrous oxide
- Chelation therapy is employed for the treatment of metal _____.
- Gadolinium is commonly used in MRI imaging agents due to its magnetic properties.
True / False
- Enzyme kinetics studies the _____ of enzymatic reactions.
a. Speed b. Temperature c. Mechanism d. Rate
- The Michaelis-Menten equation describes the relationship between substrate concentration and _____.
- The efficiency of enzymes can be influenced by pH and temperature. True / False

Part B

- Discuss the roles of Ferritin, Transferrin, and siderophores in selective metal ion transport, emphasizing their contributions to iron homeostasis.
- Contrast the structures and roles of Hemoglobin and Myoglobin. Explain the Bohr Effect and its impact on oxygen binding.
- Explore nitrogen fixation, covering types of microorganisms, the nitrogenase enzyme, metal clusters, and the redox properties involved in converting dinitrogen to ammonia.

4. Examine metal toxicities associated with Hg, Cd, Zn, Pb, As, and Sb. Discuss mechanisms, health implications, and potential treatments.
5. Provide an introduction to enzymes, covering properties, nomenclature, and classification. Discuss the Michaelis-Menten equation and its significance.
6. Explore the importance of sodium and potassium transport in maintaining cellular balance. Discuss their roles and significance in cellular physiology.
7. Discuss the implications of non-heme oxygen carriers (Hemerythrin and hemocyanin) in different organisms. Highlight their adaptations and functions in diverse biological systems.
8. Explore the role of nitrogenase enzyme in nitrogen fixation. Discuss the redox properties of nitrogenase and its contribution to nitrogen cycle.
9. Discuss the diagnostic applications of Technetium Imaging Agents. Highlight their use in medical imaging and their importance in diagnosing various medical conditions.
10. Explain the Michaelis-Menten equation and its significance in enzyme kinetics. Discuss how substrate concentration affects enzymatic activity.

Part C

1. Explore the significance of Zinc enzymes (carboxypeptidase and carbonic anhydrase) and Iron enzymes (catalase and peroxidase) in biological processes. Highlight their catalytic mechanisms and physiological importance.
2. Analyze non-heme oxygen carriers (Hemerythrin and hemocyanin) and iron-sulphur proteins (Rubredoxin and Ferredoxin). Discuss their structures and roles in biological redox systems.
3. Investigate photosynthesis, focusing on photosystem-I and photosystem-II. Discuss the structures and functions of chlorophylls in capturing and converting light energy.
4. Explore therapeutic compounds involving metals, such as Vanadium-based diabetes drugs and Platinum-containing anticancer agents. Discuss the application of chelation therapy in both cancer treatment and addressing metal toxicity.
5. Explore factors influencing enzyme efficiency, including pH and temperature effects. Discuss free energy of activation and its role in enzymatic catalysis, contributing to the regulation of enzyme-mediated reactions.
6. Investigate the coenzymes associated with Vitamin-B12. Discuss the chemical classification and mechanism of action, emphasizing their roles in various physiological processes.
7. Analyze the classification of cytochromes, focusing on cytochrome P-450. Discuss its role in drug metabolism and its significance in the pharmaceutical industry.
8. Investigate the structural and functional aspects of both photosystem-I and photosystem-II

in photosynthesis. Discuss how these systems work together to convert light energy into chemical energy.

9. Explore the temperature and critical magnetic field in the context of diagnostic agents. Discuss their relevance and applications in medical research and diagnosis.
10. Explore the factors contributing to the efficiency of enzymes. Discuss the effects of pH, temperature, and substrate concentration on enzyme reactions. Provide examples to illustrate these concepts.

Head of the Department: Dr. M. Anitha Malbi

Course Instructor: Dr. B. T. Delma

Teaching Plan

Department : Chemistry
Class : I M. Sc Chemistry
Title of the Course : Skill Enhancement Course III: c) Health science
Semester : II
Course Code : CP232SE1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CP232SE1	3	1	-	-	3	4	60	25	75	100

Learning Objectives:

1. To respond to critical needs in various healthcare settings
2. To develop and use the skills necessary to positively impact health care.

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO-1	recall and understand the importance of health, drugs, body fluids and vitamins	PSO - 1	K1(R) & K2(U)
CO-2	apply the function of drugs, nutrients, vitamins and their mode of action	PSO - 2	K3(AP)
CO-3	analyze and identify blood group and matching.	PSO - 3	K4(An)
CO-4	evaluate the functions of drugs and vitamins	PSO - 1	K5(E)
CO-5	develop skills to identify blood group and assist in first aid to provide health care to the community.	PSO - 2	K6(C)

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Health					
	1	Health - mental health and physical health	2	K2(U)	Lecture with illustrations	Oral test and quiz-Slido
	2	Food pyramid - types of malnutrition - causes and remedies	3	K4(An)	Flipped classroom-Nearpod	Presentation and group discussion
	3	Macro and micronutrients - carbohydrates - classification and their biological functions	3	K3(Ap)	Lecture with ppt	Short test
	4	Proteins-classification and their biological functions	2	K4(An)	Blended learning-Nearpod	Slip test and MCQ-Nearpod
	5	Vitamins - classification and their biological functions - dietary elements (Na, K, Ca, P, Mg, S, Fe, Zn, Se, Mo)	2	K2(U)	Peer Teaching	MCQ test
II	Drugs					
	1	Drugs - classification of drugs - drugs acting on CNS - general anaesthetics, hypnotics & sedatives	3	K2(U)	Lecture with ppt	Quiz and MCQ-Slido
	2	Narcotics, antipyretics, antirheumatics, analgesics, anticonvulsants and antitussives	3	K3(Ap)	Blended learning	Group discussion-MCQ (Nearpod)
	3	Chemotherapeutic drugs - antibiotics, antiseptics and disinfectants	3	K3(Ap)	Lecture using illustrations	Assignment
	4	Cardiovascular agents - anti cancer drugs - adverse effects of drugs.	3	K4(An)	Flipped classroom	Short test and quiz-Slido
III	Body Fluids					
	1	Body Fluids-composition of blood- blood volume, blood grouping - identification of blood groups and matching.	4	K2(U)	Flipped classroom-Nearpod	Concept explanations

	2	Determination of glucose in serum, Tests for salts in serum and urine	3	K4(An)	Lecture with demonstration	Practical-testing Analysis
	3	Functions of blood, blood pressure, anaemia, blood sugar - respiration - oxygen and carbon dioxide transport in blood	3	K3(Ap)	Lecture with illustrations	MCQ-Slido and short test
	4	Haemoglobin -myoglobin - composition of urine - electrolyte balance - Na/K pump.	2	K2(U)	Lecture with ppt	Open book test
IV	Health and Safety					
	1	Health and Safety- Safety in laboratory - importance, personal protection - dangers to avoid	3	K2(U)	Blended learning- Nearpod	Group discussion and presentation
	2	Chemical hazards - acid burns - acid and alkali on eye, poisoning by strong acids, caustic alkali. Hazards of carbon monoxide.	4	K3(Ap)	Lecture with ppt and videos	MCQ- Quizizz and slip test
	3	First-aid box- Rules of first aid, first aid for accidents, cuts, bruises. Bleeding, fracture, burns, fainting and poisonous bites.	5	K3(Ap)	Lecture with demonstration	Practical
V	Common and Vitamin Deficiency Diseases					
	1	Common and Vitamin Deficiency Diseases-Jaundice, cancer, Kidney stone - typhoid, Dengue	3	K3(Ap)	Lecture with illustrations	MCQ- Quizizz
	2	Ulcer- Goiter - Diabetes- Rickets -Scurvy -Beriberi- Pellagra	5	K4(An)	Lecture using ppt	Short test(MCQ)- Slido
	3	Night blindness, Covid-19 - causes - symptoms - diagnosis - vaccines/treatment.	4	K3(Ap)	Blended learning- Nearpod	Class test

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability and Skill Development

Activities (Em/SD):

Vitamins - Peer teaching

Drugs - Group discussion

Assignment:

Chemotherapeutic drugs - Reflective writing

Sample questions**PART A**

1. What is the primary function of carbohydrates?
a) Energy storage b) Building muscle c) Oxygen transport d) Nerve conduction
2. Which type of malnutrition is characterized by an excess intake of calories but with poor nutrient quality?
a) Undernutrition b) Overnutrition c) Marasmus d) Kwashiorkor
3. Which class of drugs induces a reversible loss of consciousness and sensation?
a) Hypnotics b) Antipyretics c) General Anesthetics d) Antitussives
4. What is the primary function of general anesthetics?
a) Inducing sleep b) Relaxing muscles c) Producing analgesia d) Stimulating the CNS
5. What is the primary function of the ABO system in blood grouping?
a) Regulating blood pressure b) Identifying antigens on red blood cells
c) Maintaining electrolyte balance d) Producing antibodies against pathogens
6. How is blood type matching done in blood transfusions?
a) Matching by color b) Cross-matching c) Random selection
d) Matching by temperature
7. What is the primary purpose of personal protective equipment (PPE) in a laboratory?
a) Enhancing comfort b) Ensuring fashion compliance
c) Preventing accidents and injuries d) Improving communication
8. How can chemical hazards be minimized in a laboratory setting?
a) Ignoring safety protocols b) Proper storage and handling
c) Increasing chemical exposure d) Using outdated equipment
9. What is a common symptom of vitamin A deficiency?
a) Swollen gums b) Difficulty seeing in low light
c) Skeletal deformities d) Severe joint pain

10. Which disease is transmitted primarily by the Aedes mosquito?

- a) Malaria b) Dengue c) Typhoid d) Tuberculosis

PART B

1. Explain the importance of both macro and micronutrients in maintaining a healthy diet. Provide examples of each.
2. Discuss the types of malnutrition, their causes, and propose remedies for preventing and addressing malnutrition globally.
3. Classify drugs acting on the CNS and provide examples for each category. Discuss their primary uses and potential side effects.
4. Explain the mechanism of action of antibiotics and how they differ from antiseptics. Highlight their significance in medical treatment.
5. Explain the functions of blood and the importance of maintaining electrolyte balance. Discuss the consequences of imbalances.
6. Describe the process of blood grouping, identification, and matching. How does it ensure a safe blood transfusion?
7. Discuss the causes, symptoms, and treatment of cancer. How can early detection improve prognosis?
8. Explore the consequences of vitamin deficiencies in diseases such as scurvy, beriberi, and pellagra. How can these deficiencies be prevented and treated?

Part: C

1. Break down the food pyramid, explaining the recommended proportions of different food groups and their significance in maintaining overall health.
2. Elaborate on the biological functions of carbohydrates, proteins, and vitamins. How does each contribute to the body's well-being?
3. Discuss the adverse effects of drugs and how they can be minimized. Provide examples and explain the importance of responsible drug use.
4. Explore the classification and functions of cardiovascular agents and anti-cancer drugs. How do these drugs contribute to patient care?
5. Discuss the composition of urine and the role of electrolyte balance in maintaining overall health. Explain how the Na/K pump contributes to this balance.
6. Explore the functions of blood pressure, its regulation, and the consequences of abnormal blood pressure levels.

7. Discuss the composition of urine and the role of electrolyte balance in maintaining overall health. Explain how the Na/K pump contributes to this balance.
8. Explore the functions of blood pressure, its regulation, and the consequences of abnormal blood pressure levels.
9. Elaborate on the causes, symptoms, and diagnosis of COVID-19. Discuss the importance of vaccines and available treatments.
10. Compare and contrast the symptoms, diagnosis, and treatment of kidney stones and ulcers.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. M. Antilin Princela

Teaching plan

Department : Chemistry
Class : II M.Sc Chemistry
Title of the Course : Core IX : Inorganic Spectroscopy, Photochemistry and Organometallics
Semester : IV
Course Code : PG2041

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PG2041	6	-	-	5	6	90	40	60	100

Objectives:

- To understand the principle, interpretation and applications of various spectroscopic techniques to inorganic compounds
- To know the applications of photochemistry, organometallics and bio-inorganic chemistry

Course Outcomes (COs)

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO-1	understand the principles and concepts of inorganic spectroscopy, photochemistry and organometallics.	PSO-1	K2(U)
CO-2	apply the principles of spectroscopy, photochemistry and organometallic chemistry to inorganic compounds.	PSO-2	K3(Ap)
CO-3	analyse the structure, reactions and functions of inorganic compounds.	PSO-2	K4(An)
CO-4	evaluate the spectral data and properties of inorganic compounds	PSO-3	K5(E)

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive Level	Pedagogy	Assessment/ Evaluation
I	IR, Raman and NMR Spectroscopy					
Q	1	IR spectroscopy: introduction - selection rules - stretching frequency of some inorganic ions	4	K2(U)	Lecture using Chalk and Talk	Evaluation through short test (Quizizz)
	2	Effect of coordination on the stretching frequency of sulphato - carbonato - sulphito - aqua - nitro - thiocyanato - cyano - thiourea and DMSO complexes.	5	K3(Ap)	Group Discussion	MCQ (Nearpod) Recall steps
	3	Raman spectroscopy: introduction - combined applications of IR and Raman spectroscopy in the structural elucidation of N ₂ O - ClF ₃ - NO ₃ ⁻ - ClO ₄ and metal carbonyls	4	K5(E)	Flipped classroom	Problem solving
	4	NMR spectroscopy: introduction - structural assessment of simple inorganic compounds	2	K3(Ap)	Lecture with ppt(Gamma)	Evaluation through short test
	5	Applications of ¹ H - ¹⁵ N - ¹⁹ F and ³¹ P NMR spectroscopy in structural problems. Fluxional molecules and effect of quadrupolar nuclei in NMR spectroscopy.	3	K5(E)	Problem solving	MCQ, True/False (Slido)
II	Mössbauer and Photoelectron Spectroscopy					

	1	Mössbauer (MB) spectroscopy: introduction - principle - recoil energy - doppler effect - number of MB signals	2	K2(U)	Group discussion	Recall steps, Evaluation through short test
	2	Isomer shift - quadrupole splitting and magnetic hyperfine splitting. Applications of MB spectroscopy to ^{57}Fe - ^{119}Sn and ^{129}I compounds	4	K5(E)	Flipped classroom	MCQ through slido
	3	Photoelectron Spectroscopy (PES): theory - types - origin of fine structures - shapes of vibrational fine structures - adiabatic and vertical transitions.	4	K2(U)	Introductory session	Recall, MCQ (Slido)
	4	PES and evaluation of vibrational constants of homonuclear diatomic molecules - N_2 and O_2 .	4	K4(E)	Lecture using Chalk and Talk	Problem solving
	5	Heteronuclear diatomic molecules - CO and HCl - polyatomic molecules H_2O - CO_2 - CH_4 and NH_3 . Koopman's theorem- applications and limitations.	4	K3(Ap)	Peer tutoring and group discussion	, Short summary
III	Inorganic Photochemistry					
	1	Importance of photochemistry. Photochemistry of Co(III) complexes - photosubstitution- photooxidation- photoreduction and photoanation reactions	4	K2(R)	Introductory session	MCQ, (Nearpod) True/False

	2	Photochemistry of Cr(III) complexes- Adamson's rule - photoaquation- photoisomerization - photoracemization - photoanation - photosubstitution in non-aqueous solvents and photoredox reactions	4	K3(Ap)	Lecture using Chalk and Talk and Group Discussion	Short essay
	3	Photochemistry of ruthenium polypyridyls - preparation and characteristics of $[\text{Ru}(\text{bpy})_3]^{2+}$ complex. Ground state and excited state properties of $[\text{Ru}(\text{bpy})_3]^{2+}$ complex..	4	K4(An)	Peer group tutoring and group discussion	Differentiate between various ideas
	4	Ground state and excited state properties of $[\text{Ru}(\text{bpy})_3]^{2+}$ complex..	3	K2(U)	Lecture using Chalk and Talk	Short summary
	5	Reactions of $[\text{Ru}(\text{bpy})_3]^{2+}$ complex - photosubstitution - photoredox and reductive quenching reactions.	3	K5(E)	Group discussion and problem solving	Longer essay, problem solving
IV	Organometallic Chemistry					
	1	Organometallic compounds - types. EAN rule - 18e- and 16e- rules – determination of oxidation state - configuration - coordination number of the metal centre - types and application 18e- / 16e- rules.	4	K1(R)	Lecture using videos	MCQ (quizizz) True/False

	2	Carbonyls - isolated concept - structure of simple and polynuclear carbonyls. Nitrosyls - bridging and terminal nitrosyls - bent and linear nitrosyls..	5	K2 (U)	Lecture and group discussion	Recall steps, simple definition
	3	Synthesis, properties and structural features of metal complexes with carbene - alkene - alkyne and arene...	3	K3(Ap)	Lecture and demonstration	Recall steps, Evaluation through class test
	4	Hapticity. Metallocenes-synthesis - properties and bonding in ferrocene Covalent versus ionic bonding in metallocene.	5	K3(Ap)	Lecture and PPT (Gamma)	Short essay
	5	Reactions of organometallic compounds - substitution - oxidative addition and reductive elimination - insertion and deinsertion (elimination) reactions	4	K6(C)	Group Discussion	Suggest idea with examples
V	Bio Inorganic Chemistry					
	1	Photosynthesis - photosystem I and II. Photosynthetic reaction center. Metallo enzymes - Zinc enzymes - structure and functions of carbonic anhydrase and carboxy peptidase.	4	K4(An)	Lecture and group discussion	Recall, MCQ(Near pod)True/False
	2	Iron enzymes - catalase and peroxidase. Super oxide dismutase (SOD) - superoxide toxicity - structure and function of Cu,Zn-SOD. Trace elements in biological system.	4	K4(An)	Lecture and group discussion	Recall steps, Evaluation through class test

	3	Metal ion toxicity - classes of toxic metal compounds and detoxification. Metals in medicine - anti-arthritis drugs - Au and Cu in rheumatoid arthritis.	4	K2(U)	Lecture & PPT	Short essay
	4	- Li in psychiatry - Pt, Au and metallocenes in anti-cancer drugs.	3	K3(Ap)	Lecture and Group Discussion	Suggest idea with examples
	5	Metals in radiodiagnosis and magnetic resonance imaging.	3	K4(An)	Lecture and videos	Recall steps, Evaluation through class test

Course Focussing on Employability/ Entrepreneurship/ Skill Development :

Employability/ Skill Development

Activities (Em/ En/SD): Seminar and model making –

Course Focussing on Cross Cutting Issues(Professional Ethics/ Human

Values/Environment Sustainability/ Gender Equity): (Environment Sustainability)

Activities related to Cross Cutting Issues: Nil

Assignment:

1. Applications of ^1H - ^{15}N - ^{19}F and ^{31}P NMR spectroscopy in structural problems.
2. Applications of MB spectroscopy to ^{57}Fe - ^{119}Sn and ^{129}I compounds.
3. Metals in radiodiagnosis and magnetic resonance imaging.

Seminar Topic:

Unit I :Raman spectroscopy: introduction - combined applications of IR and Raman spectroscopy in the structural elucidation of N_2O - ClF_3 - NO_3^- - ClO_4 and metal carbonyls
Unit II:Heteronuclear diatomic molecules - CO and HCl - polyatomic molecules H_2O - CO_2 - CH_4 and NH_3 .Koopman's theorem- applications and limitations.

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Sample questions

Part A

1. The degrees of freedom of a chemical compound of N atoms have is
3N (b) 3N+1 (c) 2N (d) 2N+1
2. Match the Following
 - (a) Change in polarizability - IR active
 - (b) Change in dipole moment - Raman Active
 - (c) More intense lines - Raman lines
 - (d) Weak lines - Rayleigh lines
3. Assertion (A): Collision broadening is caused in Mossbauer spectroscopy.
Reason (R) It is because of the collision among atoms, molecules and ions.
 - (a) A and R are true, R is the correct explanation of A
 - (b) A and R are true, R is not the correct explanation of A
 - (c) Both A and R are true
 - (d) Both A and R are false
4. The complex ions whose central metal atom does not obey EAN rule are
 - (a) Paramagnetic (b) Diamagnetic
 - (c) Ferromagnetic (d) Ferrimagnetic
5. Lithium possesses neuro protective properties by preventing apoptosis and increasing cell longevity. (True/False)

Part B

1. Highlight the effect of coordination of the stretching frequency of sulphato ion.
2. Discuss the origin of fine structures in PES.
3. List the conditions to obtain Mossbauer spectrum.
4. How can you apply quadrupole interactions to study the nature of compounds?
5. Discuss the magnetic hyperfine splitting in Mossbauer spectroscopy.
6. Apply Mossbauer spectroscopy to the study of iron compounds.
7. How can you study the tin compounds using isomer shift?
8. Discuss the classes of toxic metal compounds.
9. List out the trace elements in biological system.
10. Explain the oxidative addition and reductive elimination in organometallic compounds.

11. Mention the role of lithium in psychiatry.

.Part C

1. Apply IR and Raman spectroscopy to elucidate the structure of NO_3 and ClO_4
2. Analyse the ^{57}Fe and ^{119}Sn compounds using Mossbauer spectroscopy
3. Discuss the effect of quadrupolar nuclei in NMR spectroscopy
4. Discuss Koopman's theorem with its applications and limitations
5. Apply PES to evaluate the vibrational constants of polyatomic molecules H_2O - CO_2 - CH_4 and NH_3
6. Analyse the ^{57}Fe and ^{119}Sn compounds using Mossbauer spectroscopy
7. Analyse the oxidation states of Sn compounds using isomer shift..
8. Discuss 18e - and 16e - rules..
9. .With a neat sketch describe the structure and mechanism of action of Carboxypeptidase.
10. Explain the Metals in radiodiagnosis and magnetic resonance imaging.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. S. Lizy Roselet

Teaching plan

Department : Chemistry
Class : II M. Sc Chemistry
Title of the Course : Core X: Photochemistry and Natural Products
Semester : IV
Course Code : PG2042

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PG2042	6	-	-	5	6	90	40	60	100

Objectives

- To understand various organic reactions with their mechanism and synthetic utility.
- To elucidate the structure and synthesise natural products.

Course Outcomes (COs)

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO-1	understand various organic reactions and their mechanism in photochemical reactions	PSO-1	K2(U)
CO-2	apply the reaction mechanism in retrosynthesis	PSO-2,3	K3(A)
CO-3	analyze the structure and properties of different alkaloids	PSO-3	K4(An)
CO-4	evaluate the synthetic utility of reactions	PSO-2	K5(E)
CO-5	create and characterize the novel organic compounds	PSO-3,4	K6(C)

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Organic Photochemistry					
	1	Introduction - Thermal versus photochemical reactions and Jablonski diagram.	3	K2(U)	Flipped classroom	Slip test- Quizizz
	2	Photochemical reactions of ketones - photosensitization - Norrish type - I and Norrish type - II reactions and mechanisms - Paterno-Buchi reaction	5	K3(A)	Group discussion	Quiz-Slido
	3	photooxidation and photoreduction of ketones.	3	K4(An)	Lecture using ppt	Short test
	4	Photochemistry of arenes - Photodimerisation - photoisomerisation.	3	K2(U)	Lecture using videos and ppt	Slip test and MCQ
	5	Reactions involving free radicals - Barton - Hunsdiecker - Pschorr and Gomberg-Bauchman reactions.	4	K3(A)	Lecture with Group discussion	Short test & peer teaching
II	Pericyclic Reactions					
	1	Characteristics and classifications of pericyclic reactions - electrocyclic - cycloaddition and sigmatropic reactions.	5	K2(U)	Lecture using videos and ppt	Short summary and overview
	2	Woodward Hofmann rule. Retro-Diels Alder reaction - Diels Alder reaction - 2+2 - 2+4 reactions.	5	K2(U)	Lecture using illustrations	Slip test (MCQ)
	3	Cope rearrangements and Claisen rearrangements. Conservation of orbital symmetry.	3	K3(A)	Group discussion	Recall steps-MCQ (Nearpod)

	4	Prediction of reaction conditions using FMO - correlation diagrams and Zimmerman (Mobius-Huckel) approaches.	5	K4(An)	Lecture using chalk and talk	Short test-quizizz
III	Retrosynthetic Analysis					
	1	Retrosynthetic terminologies - linear and convergent approach - protecting groups - activating groups - synthons and synthetic equivalents.	4	K2(U)	Lecture using ppt	Concept explanations
	2	Target molecule - one functional group disconnection - two functional groups disconnection- 1,3- 1,5- and 1,4-dicarbonyl compounds.	5	K4(An)	Lecture using illustrations	Slip test-Slido
	3	Functional group addition and interconversions.Umploung synthesis.Latent polarity.	4	K3(A)	Flipped Classroom	Short summary or overview
	4	Retrosynthetic analysis - bisabolene - cis-jasmone - longifolene and cubane.	3	K5(E)	Lecture using examples	Slip test and quiz
	5	Synthetic uses of nitrocompounds and alkenes.	2	K3(A)	Lecture using ppt	Group discussion-Peer teaching
IV	Alkaloids					
	1	Extraction - general properties - classification and general methods for determining structure.	5	K2(U)	Lecture using videos and ppt	Concept explanations and short summary
	2	Structural elucidation - atropine - cocaine -	4	K4(An)	Lecture using illustrations	Slip test and quiz-Quizizz
	3	Structural elucidation - dictamnine -reserpine -	4	K2(U)	Flipped classroom	Short test-nearpod
	4	Structural elucidation-Aeronycineand morphine.	5	K4(An)	Lecture using ppt and group discussion	Group discussion and class test

V	Heterocyclic Compounds					
	1	Synthesis - reactions - structure - carbazole - oxazole - imidazole	3	K3(A)	Lecture using ppt	Slip test- Slido
	2	Synthesis - reactions - structure -thiazole - pyrones - pyrazole -	4	K2(U)	Group discussion and Peer tutoring	Overview
	3	Synthesis - reactions - structure-pyrimidine - pyrazine - coumarins and chromone.	5	K4(An)	Lecture using illustrations	Slip test and quiz-nearpod
	4	- Structural elucidation - flavones - isoflavone - anthocyanins - caffeine - theobromine and theopylline.	6	K6(C)	Flipped classroom	MCQ-Short test

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability and Skill Development

Activities (Em/SD):

FMO diagram- Group Discussion

Structural elucidation-Peer Teaching

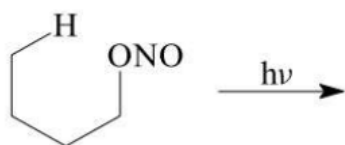
Assignment:

Correlation diagram- Reflective writing

Sample questions

Part A

1. The photochemical intermolecular abstraction of a γ -hydrogen is named as _____.
2. Predict the product



3. HOMO for hexa-1,3,5-triene under thermal condition is

- (a) Ψ_1 (b) Ψ_2 (c) Ψ_3 (d) Ψ_4

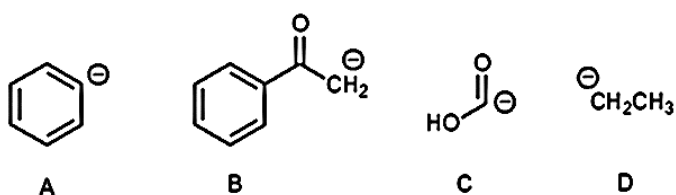
4. Pericyclic reaction takes place in the presence heat and light.(True/True)

5. Assertion (A): Carbonyl groups are protected by converting it into ketals

Reason (R): Ketals does not react with hydrides

- (a) A and R are true and R is the not the correct explanation of A
 (b) A and R are true and R is the correct explanation of A
 (c) Both A and R are false
 (d) A is true but R is false

6. Which of the following synthon is an example of Umpulong?



- (a) Structure A (b) Structure B (c) Structure C (d) Structure D

7. Which alkaloid was isolated from opium as the first crude drug?

- (a) Morphine (b) Nicotine (c) Cocaine (d) Caffeine

8. Predict the product obtained for the hydrolysis of atropine.

- (a) quinine (b) tropic acid (c) atropic acid C (d) tropinic acid

9. Cite any one reactions of carbazole.

10. Write the molecular formula of caffeine.

Part B

1. Illustrate photosensitization reaction with an example.
2. Differentiate thermal and photochemical reactions.
3. Illustrate photosensitization reaction with an example.
4. Draw the FMO diagram of electrocyclic reaction.
5. Differentiate linear and convergent approach in retrosynthesis.
6. Illustrate umpolung synthesis with an example.
7. Describe the general properties of alkaloids.
8. How will you extract alkaloids from plants?
9. Elucidate the structure of flavone.
10. Illustrate the preparation and properties of pyrimidine.

Part C

1. Explain Norrish type - I and Norrish type - II reactions of ketones.
2. Discuss photooxidation and photodimerization of ketones.
3. Draw FMO and PMO diagram of cycloaddition reaction.
4. Illustrate the mechanism of Cope and Claisen rearrangements.
5. Discuss the retrosynthetic analysis of cis-jasmone.
6. Analyse two group disconnections of carbonyl compounds with examples.
7. Elucidate the structure of reserpine.
8. Establish the structural elucidation of morphine.
9. Elucidate the structure of caffeine.
10. Discuss the synthesis and reactions of oxazole and pyrones.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. M. Antilin Princela

Teaching Plan

Department : Chemistry
Class : II M.Sc Chemistry
Title of the Course : Core Course XI: Polymer Chemistry
Semester : IV
Course Code : PG2043

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PG2043	6	-	-	5	6	90	40	60	100

Objectives:

- To gain knowledge about applications of polymers.
- To know the importance of various polymerization techniques.
- To study about synthetic polymers.

Course Outcome (COs)

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive Level
CO -1	Understand the concept of polymer chemistry	PSO - 1	K2(U)
CO -2	Apply the processing techniques in the manufacture of synthetic polymer	PSO - 5	K3(Ap)
CO -3	Analyze glass transition temperature, crystallinity and degradation in polymers.	PSO - 3	K4 (An)
CO -4	Evaluate molecular weight and size of the polymer	PSO - 3	K5(E)

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Chemistry of Polymerization					
	1.	Basic concepts of polymer chemistry - repeat unit - degree of polymerization - classification	4	K2(U)	Introductory session, Lecture using PPT	Concept explanations, Quiz
	2.	Stereochemistry of polymers nomenclature of stereoregular polymers	3	K2(U)	Group Discussion and Lecture using Chalk and talk	Short summary
	3.	Chain polymerization - free radical polymerization - ionic polymerisation	4	K3(Ap)	Integrative approach	Assignment
	4.	Coordination polymerisation: Zeigler-Natta catalyst - step polymerization - ring opening polymerization	4	K3(Ap)	Collaborative approach	Class test
	5.	Copolymerisation - block and graft copolymers - preparation.	3	K3(Ap)	Lecture using Chalk and talk , Group Discussion	Slip test-Nearpod
II	Polymerisation Techniques Molecular Weight and Size					
	1.	Polymerisation techniques -bulk - solution -suspension - emulsion polymerizations	4	K2(U)	Lecture using videos	Short test
	2.	Melt polycondensation - solution polycondensation interfacial condensation	4	K2(U)	Group Discussion	Evaluation through quiz-Quizzes
	3.	Solid and gas phase polymerization.	4	K2(U)	PPT	Presentation
	4.	Polydispersity and molecular weight distribution in polymers	3	K5(E)	Demonstrative and Problem solving approach	Evaluation through home work

	5.	The practical significance of polymer molecular weight.	3	K4(An)	Peer group teaching	Peer review
III	Polymer Processing					
	1.	Processing -Calendering - die casting - rotational casting - film casting	5	K2(U)	Lecture using PPT	Student presentation
	2.	Compression moulding - injection moulding - blow moulding - extrusion moulding	5	K2(U)	Lecture using PPT and videos	Seminar presentation
	3.	Thermoforming, foaming and reinforcing techniques	2	K2(U)	Lecture using PPT	Oral presentation
	4.	Hand lay-up technique - filament winding technique - spray-up technique	3	K3(Ap)	Peer group teaching	Peer review
	5.	Fibre spinning - dry spinning - wet spinning uniaxial orientation- post treatment for fibres.	3	K3(Ap)	Lecture using videos	Seminar presentation
IV	Synthetic Polymers					
	1.	Synthetic resins - plastics - manufacture - applications - polyethylene - PVC - teflon - polystyrene - polymethylmethacrylate -polyurethane - phenol-formaldehyde resins - urea- formaldehyde and melamine-epoxypolymers.	5	K3(Ap)	Collaboration approach	Short essays
	2.	Synthetic fibers - rayon - nylons -polyesters - acrylics – modacrylics.	2	K3(Ap)	Inquiry based approach	Slip test-Slido
	3.	Natural rubber - production -constitution - vulcanization (hot and cold)	3	K4(An)	Lecture using videos	Album preparation
	4.	Fillers and accelerators – antioxidants	3	K3(Ap)	Lecture method	MCQ
	5.	Synthetic rubber -SBR - butyl rubber - nitrile rubber -neoprene - silicone rubber and	5	K4(An)	Lecture method	Class test

		polysulphides.				
V	Polymer Degradation and Additives					
	1.	Polymer degradation	1	K2(U)	Inquiry based approach	Quiz-Quizzes
	2.	Types of degradation - thermal -mechanical photo - hydrolyticand oxidative degradations	7	K4(An)	Lecture method	Online assignment
	3.	Additives for polymers - fillers -plasticizers	5	K3(Ap)	Peer group teaching	Peer review
	4.	Thermal stabilizers - photo stabilizers - antioxidants and colorants.	5	K3(Ap)	Collaborative approach	Presentation

Course Focussing on Employability/ Entrepreneurship/ Skill Development :

Employability

Activities (Em/ En/SD): Album preparation for Rubber production

Course Focussing on Cross Cutting Issues(Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Nil

Activities related to Cross Cutting Issues : Nil

Assignment:

1. Chain polymerization
2. Molecular weight distribution in polymers - Problem solving
3. Polymer degradation - Online assignment

Seminar Topic:

Compression moulding - injection moulding - blow moulding - extrusion moulding- Fibre spinning - dry spinning - wet spinning - uniaxial orientation-post treatment for fibres.

Sample questions

Part A

1. Which of the following act as an initiator in free-radical polymerisation?
(a) Grignard reagent (b) Lewis acids (c) Benzoyl peroxide (d) Potassium amide
2. Protective colloid used in emulsion polymerisation is _____.
(a) polyvinyl alcohol (b) carboxymethyl cellulose (c) gum and casein (d) all the above.
3. Which of the following polymer is produced by extrusion moulding?
(a) PVC (b) polystyrene (c) PF (d) PMMA

4. Terephthalic acid and ethylene glycol undergo polyesterification to form PET. (True/False)
5. Photodegradation of polymer is caused by exposure to _____ radiation.
(a) visible (b) UV (c) IR (d) all the above
6. Benzaldehyde is evolved during _____ degradation of polystyrene.
(a) photo (b) oxidative (c) thermal (d) mechanical
7. Name the process that is used for converting bulk polymer into fibre.
(a) compression (b) spinning (c) moulding (d) extrusion
8. Which of the following act as an initiator in free-radical polymerisation?
a) Grignard reagent b) Lewis acids c) Benzoyl peroxide d) Potassium amide
9. The Ziegler Natta catalyst is formed between _____
a) Triethyl aluminium and titanium halide b) Triethyl aluminium and silver halide
c) Triethyl aluminium and platinum halide d) Triethyl aluminium and carbon halide

Part B

1. Classify the types of polymers.
2. Differentiate addition and copolymerization.
3. Discuss the casting technique of polymer processing.
4. Explain the role of thermal stabilizers and photo stabilizers in polymers.
5. Discuss briefly number average and weight average molecular weight of polymer.
6. Write short note on post treatment for fibres.
7. Explain the preparation and uses of nitrile rubber and silicone rubber.
8. Discuss the role of thermal stabilizers and photo stabilizers in polymers.

Part C

1. Discuss the mechanism of ionic polymerization with example.
2. Explain free radical copolymerisation and ionic copolymerization.
3. Discuss briefly about homogeneous polymerisation. Mention some applications.
4. Determine the molecular weight of a polymer by viscometer.
5. How are polymers processed by moulding techniques.
6. Enlist the significance of reinforcing techniques of polymers.
7. Illustrate synthetic rubber with examples.
8. How are the properties of polymer improved by additives?
9. What is the principle of hydrolytic and oxidative degradations? Explain.

Head of the Department

Dr. M. Anitha Malbi

Course Instructor

Dr. M. Shirley Treasa

Teaching plan

Department : Chemistry
Class : II M. Sc Chemistry
Title of the Course : Elective IV (a)–Energy for Future
Semester : IV
Course Code : PG2044

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PG2044	4	-	-	4	4	60	40	60	100

Objectives

- To acquire knowledge on conventional and non-conventional energy sources.
- To enlighten the students with knowledge of solar radiation and its measurement.
- To gain knowledge on wind energy, biogas and hydrogen energy.

Course Outcomes (COs)

CO	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive level
CO-1	understand the importance of various sources of non-conventional energy	PSO-1	K2(U)
CO-2	apply the principle of energy conversion to the production of energy for the future	PSO-2,3,4	K3(Ap)
CO-3	analyze the advantages and disadvantages of different non-conventional energy sources	PSO-2,3	K4(An)
CO-4	evaluate solar energy radiation, wind energy data and conversion efficiency of fuel cells	PSO-2,3	K5(E)
CO-5	create fuel cells	PSO-3,5	K6(6)

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	Introduction to Energy Sources					
	1	Introduction - conventional energy sources - coal - oil - gas - agricultural and organic wastes	3	K2(U)	Lecture using Chalk and talk, PPT(Gamma)	Evaluation through short test,
	2	water power - thermal power and nuclear power	2	K3(Ap)	Flipped classroom and lecture using chalk and talk	Class test MCQ (Nearpod)
	3	Non-conventional energy sources - solar energy - wind energy	2	K4(An)	Lecture using Chalk and talk,PPT, Group Discussion	Slip test and MCQ (Slido)
	4	Energy from bio-mass and bio-gas-ocean thermal energy - tidal energy	2	K2(U)	Lecture using videos and ppt	Recall steps, Concept definitions
	5	Geothermal energy and hydrogen energy. Advantages of renewable energy.	3	K3(Ap)	Lecture using chalk and talk and Group discussion	Group discussion and short test
II	Solar Energy					
	1	Solar radiation and its measurement -introduction - solar constant - solar radiation at the earth's surface.	3	K2(U)	Lecture using videos and ppt(Gamma)	Short summary or overview
	2	Solar radiation geometry and solar radiation data.	2	K2(U)	Lecture using chalk and talk	MCQ (Near pod)
	3	Solar energy collectors - introduction-physical principles of the conversion of solar radiation into heat	3	K3(Ap)	Group discussion and problem solving	Problem solving
	4	Flat plate and concentration collectors. Advantages and disadvantages of	2	K4(An)	Lecture using chalk and talk	Short test and quiz(Slido)

		concentration collectors over flat collectors.				
	5	Energy balance equation and collector efficiency.	2	K5(E)	Lecture using chalk and talk	Problem solving
III	Wind Energy					
	1	Introduction - basic principles of wind energy conversion - power of the wing and forces on the blades.	3	K2(U)	Lecture using chalk and talk, Videos	Evaluation through short test,
	2	Wind energy conversion - wind data and estimation - site selection	2	K4(An)	Lecture using chalk and talk	MCQ using slido
	3	Types of wind machines - horizontal axis and vertical axis machines. Analysis of aerodynamic forces acting on the blade and performance of wind machines.	3	K4(An)	Lecture using chalk and talk	Short summary or overview
	4	Generating systems - introduction - schemes of electric generation.	2	K2(U)	Lecture using chalk and talk	Slip test and quiz (Nearpod)
	5	Generator control - load control and energy storage. Application of wind energy.	2	K3(Ap)	Lecture using ppt (Gamma)	Group discussion
IV	Bio-energy					
	1	Introduction - biomass conversion techniques - wet processes and dry processes. Biogas generation..	3	K2(U)	Lecture using videos and ppt (Gamma)	Concept explanations and short summary
	2	. Classification of biogas plants - floating drum plant and fixed dome type plant..	2	K4(An)	Lecture using chalk and talk	MCQ (Quizziz)
	3	Biogas from plant waste. Materials used for biogas generation.	2	K2(U)	Lecture using chalk and talk	Short test
	4	Selection of site for a biogas plant and digester design.	2	K4(An)	Lecture using chalk and talk,	Group discussion and class test

	5	Problems related with biogas plants. Fuel properties of biogas and utilization of biogas.	3	K4(An)	Mind mapping and group discussion	Concept explanation and short test
V	Chemical Energy Sources					
	1	Fuel cells -introduction - conversion efficiency of fuel cells - types of electrodes -.	3	K3(Ap)	Group discussion and Lecture using chalk and talk	MCQ (Slido)
	2	Work output and EMF of fuel cells. Applications of fuel cells	2	K3(Ap)	Lecture with chalk and talk,PPT (Gamma)	Discussion and slip test
	3	Hydrogen energy. Hydrogen production - electrolysis - thermo-chemical - fossil fuel and solar energy methods..	3	K3(Ap)	Lecture with chalk and talk,PPT	Concept explanation and short test
	4	Hydrogen storage and hydrogen transportation. Utilization of hydrogen gas.	2	K2(U)	Group discussion and Lecture using chalk and talk	Concept explanations and short summary
	5	Hydrogen as an alternative fuel for motor vehicles. Safety and management.	2	K6(C)	Lecture with chalk and talk,videos	Discussion and slip test

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Employability and Skill Development

Activities (Em/SD): Poster Presentation

Assignment:

Topic: Advantages of renewable energy.

Seminar Topic

Unit I

Non-conventional energy sources - solar energy - wind energy - energy from bio-mass and bio-gas - ocean thermal energy - tidal energy - geothermal energy and hydrogen energy.

Unit II

. Solar energy collectors - introduction - physical principles of the conversion of solar radiation into heat - flat plate and concentration collectors. Advantages and disadvantages of concentration collectors over flat collectors.

Unit IV

Biogas from plant waste. Materials used for biogas generation - selection of site for a biogas plant and digester design. Problems related with biogas plants. Fuel properties of biogas and utilization of biogas.

Sample questions

Part A

1. Supplementary sources are defined as those whose net energy is_____
2. Coal,oil,uranium are examples for
 - a. (a)primary energy sources (b) secondary fuels (c) supplementary sources (d)none of the above
3. Solar energy, wind energy, water energy etc. are examples of _____ sources of energy.
4. Assertion (A): It is difficult to classify solar energy under primary energy source.

Reason (R) :Because of the dilute nature of solar energy.

 - (a) A and R are true,R is the correct explanation of A
 - (b) A and R are true ,R is not the correct explanation of A
 - (c) Both A and R are true
 - (d) Both A and R are false
5. The basis for wind energy conversion is_____and_____.
6. The major contribution to the wind power available at a given site is actually made by winds with speeds above the average.(True/False)
7. A site should have _____ annual wind speed

(a) high (b) low (c) medium (d) None of the above

Part: B

1. Differentiate primary and secondary energy sources.
2. Distinguish conventional energy sources from non-conventional energy sources..
3. What are the obstacles in the implementation of renewable energy sources.
4. .Enlist the characteristics of wind energy.
5. Differentiate small producers and large producers.
6. Discuss the lift and drag.
7. Write a note on energy estimation
8. Discuss the aerodynamic forces acting on the blades.
9. Discuss in detail about the generating systems.
10. Distinguish active polarization and concentration polarization. An UV
11. .Comparebiophotolysis with electro photolysis.

Part: C

1. Derive the energy balance equation and collector efficiency.
2. Evaluate the advantages and disadvantages of concentrating collectors over flat plate type collectors.
3. Explain briefly about the horizontal wind mills with neat sketch.
4. Discuss the essential features of a probable site for a wind farm.
5. With a neat diagram, explain how wind energy can be converted into electrical energy.
6. Explain with a neat diagram the working of various types of wind generators.
7. Determine the work output and emf of fuel cell.
8. Evaluate Hydrogen as an alternative fuel for motor vehicles.

Head of the Department:Dr. M. Anitha Malbi

Course Instructor: Dr. S.LizyRoselet