Semester – II
Major Core – II: GENERAL CHEMISTRY - II
Course Code: CC2021

Hours Per week	Credits	Total Hours	Marks
4	4	60	100

Objectives

1. To learn the preparation, properties and importance of aliphatic hydrocarbons and alicyclic compounds.
2. To understand the principles and theories of chemical bonding metallurgical processes.
3. To study the gas laws , physical properties of liquids and the classification of liquid crystals

Course Outcome

COs	*Upon completion of this course, students will be able to*	PSO Addressed	Cognitive Level
CO - 1	understand the preparation, properties of organic compounds	PSO-1	U
CO - 2	apply the theories in the preparation of compounds	PSO-6	A
CO - 3	prepare and evaluate compounds based on their application and structure	PSO-4	E
CO - 4	predict the properties of elements and the principles of volumetric analysis	PSO-6	Y
CO - 5	analyse the properties of matter	PSO-2	Y
CO - 6	learn the basics of metallurgy and the theories about gases	PSO-1	U

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

Unit	Module	Topic	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
I	**Aliphatic Compounds**					
	1	Alkanes - preparation, physical properties, reactions, reactions with radical mechanism for substitution reaction	3	Understand the preparation and properties of alkanes	Lecture and discussion	Evaluation through Multiple choice questions, short test, quiz and class test
	2	Alkenes: Preparation from alcohol, haloalkane, dihaloalkanes and alkynes - reactions of alkenes	3	Know about alkenes and the reactions	Lecture and discussion	

	3	Hydroboration, hydroxylation, ozonolysis and epoxidation - peroxide effect - allylic substitution, oxidation by KMnO4 and polymerization	2	Gain knowledge about the reactions of alkenes	Lecture	Formative assessment I
	4	Synthesis of - Dibenzyl, cis and trans 2-butene, propanal and 1-methyl cyclohexanol	2	Prepare various compounds from alkenes	Lecture	
	5	Akynes: preparation, reactions - addition of hydrogen, halogen, hydrogen halide, water, HCN, CH_3COOH - dimerisation and cyclisation - acidity of terminal alkynes	2	Understand the preparation and properties of alkynes	Question answer session and lecture	
II	**Alicyclic Compounds**					
	1	Cycloalkanes: Preparation - reactions -cycloaddition, dehalogenation, pyrolysis of calcium salt of dicarboxylic acid	3	Know about preparation and reactions of cycloalkanes	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Wurtz reaction -stability of cycloalkanes - Baeyer's strain theory. Cycloalkenes: Preparation and reactions	3	Know the stability of cycloalkanes	Lecture with illustration	
	3	Preparation of conjugate dienes - reactions - 1,2 and 1,4 addition and Diels-Alder reaction, Synthesis of trans 2-chloro cyclopentanol	3	Understand clearly about the reactions and synthesis of compounds	Lecture, Discussion	
	4	Synthesis trans-2 methylcyclopentanol, cis and trans 1,2cyclohexanediol, cyclohexene, 2,3-butanedione and adipic acid	2	Study the synthesis of compounds	Lecture, Discussion	

III	**Chemical bonding**					
	1	Ionic bond - Properties of ionic compounds, factors favoring the ionic bond formation - ionization potential - electron affinity - electronegativity - Lattice energy - Born-Haber Cycle - Polarizing power and Polarizability	3	Understand clearly about ionic bond and lattice energy	Lecture with illustration	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Transition from ionic to covalent character and vice versa - Fajan's rules - Covalent bond - Properties of covalent compounds - structure and bonding of homo and heteronuclear molecules	3	Learn covalent bonding	Lecture with illustration	
	3	Hydrogen bonding - types, effect on properties - Hybridisation - sp^3,sp^2, sp,dsp^2,d^2sp^3,d^3sp^3- Examples - $BeCl_2$, BF_3, $SiCl_4$, PCl_5, SF_6, IF_7,H_2O, NH_3, XeF_6	3	Analyze the effects of hydrogen bonding and types of hybridization	Lecture	
	4	VSEPR Theory – Postulates – MO Theory – Bonding and anti-bonding orbitals – Applications of MO theory H_2, He, N_2, O_2, HF and CO molecules – Comparison of VB and MO theories	3	Know about VSEPR and MO theories	Lecture with power point presentation and illustration	
IV	**Metallurgy**					
	1	Occurrence of metals – basic metallurgical operations and metallurgy process – General methods involved in extraction of metals	2	Know about various metallurgical processes	Lecture	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, aluminothermic process	1	Understand about different concentration methods	Lecture and discussion	
	3	Extraction processes– Chemical reduction – electrolytic reduction – metal displacement	2	Acquire knowledge about extraction processes	Lecture	

	4	Refining methods - distillation - fractional crystallization - electrolysis. Zone refining van Arkel de Boer methods	1	Know about various refining methods	Lecture and discussion	
	5	Electrolytic refining - ion exchange method - extraction - chemical properties and uses of Ti, W, Mo, V, and Ni	4	Study the extraction and properties of different metals	Lecture with power point presentation	
V	**Gas and Liquid state**					
	1	Ideal gas: Kinetic theory of gases - Postulates and derivation of kinetic gas equation, derivation of gas laws-Maxwell's distribution of molecular velocities	3	Know about the theory of gases and derivation of gas equation	Lecture and discussion	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Types of molecular velocities - collision diameter - collision frequency - mean free path	2	Know about molecular velocities	Lecture	
	3	Degrees of freedom - translational, rotational and vibrational - Principle of equipartition of energy - Behaviour of real gas - Vander Waals equation of state - derivation	3	Understand the different degrees of freedom and behaviour of real gases	Lecture with Illustration	
	4	Liquid state: Physical properties - Trouton's rule - surface tension - Effect of temperature on surface tension - viscocity - effect of pressure and temperature - refraction - refractive index - specific and molar refraction	2	Learn about liquid state	Lecture and discussion	
	5	Liquid crystals: Vapour pressure temperature diagram – thermography – classification of thermotropic liquid crystals – nematic, smetic and cholesteric liquid crystals with examples.	2	Know about different types of liquid crystals.	Lecture and discussion	

Course Instructor: Ms. L. Deva Vijila HOD: Dr. G. Leema Rose

Allied Chemistry - Botany and Zoology Major
Chemistry of Biomolecules
Course Code: CA2021

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	**3**	**60**	**100**

Objectives:

1. To acquire knowledge about the chemistry of biomolecules
2. To understand the structure and functions of biomolecules

Course Outcome

COs	*Upon completion of this course, students will be able to*	PSO Addressed	Cognitive Level
CO-1	remember the classification of biomolecules	PSO-1	R
CO-2	understand the structure, function and metabolism of biomolecules	PSO-1	U
CO-3	apply the chemistry of biomolecules in industry and medicine	PSO-6	A
CO-4	analyse and identify biomolecules	PSO-2	Y

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

Unit	Module	Topics	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
I	**Carbohydrates**					
	1	Introduction - sources of carbohydrates in the diet - classification and functions	2	Understand the sources, classification and functions of carbohydrates in the diet	Lecture with illustration	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Glucose and fructose - reactions - interconversions and mutarotation	1	Gather knowledge on the reaction interconversions and mutarotation of glucose and fructose	Lecture and discussion	
	3	Tests for carbohydrates - Molisch's, Benedict and Fehlings tests	1	Know the tests for carbohydrates	Lecture with power point presentation	
	4	Digestion - absorption - metabolism of carbohydrates	3	Understand the metabolism of carbohydrates.	Lecture and discussion	
	5	Regulation of blood sugar - diabetes mellitus	1	Study the regulation of blood sugar	Lecture and discussion	

	6	Properties and uses of sucrose, starch and cellulose	2	Know the properties and uses of sucrose, starch and cellulose.	Lecture with power point discussion	
	7	Differences between starch and cellulose	2	Differentiate between starch and cellulose	Lecture with power point discussion	
II	**Amino Acids and Proteins**					
	1	Amino acids - classification - isolation from proteins - Zwitter ion formation and isoelectric point	2	Understand the classification of amino acids	Lecture and discussion	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Synthesis of glycine, alanine and phenyl alanine	2	Study the synthesis of amino acids	Lecture and discussion	
	3	Peptides - peptide bond - synthesis of dipeptides	2	Know the synthesis of peptides	Lecture with power point discussion	
	4	Proteins - classification based on structure and functions	2	Study the classification of proteins	Lecture with power point discussion	
	5	Primary, secondary, tertiary and quaternary structure of proteins	2	Acquire knowledge on structure of proteins.	Lecture and discussion	
	6	Denaturation of proteins - Tests for proteins - Ninhydrin and biuret tests	2	Understand denaturation of proteins	Lecture with power point discussion	
III	**Nucleic Acids and Enzymes**					
	1	Nucleic acids - nucleosides and nucleotides. Structure of DNA - denaturation and renaturation of DNA - replication of DNA	3	Know the structure of DNA	Lecture and discussion	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Hydrogen bonding in DNA. Stabilizing forces in protein and DNA -Vander waal's forces, dipole-dipole and dipole-induced dipole interactions	2	Study the bonding in DNA molecules	Lecture with power point discussion	
	3	Structure of RNA - Types of RNA. Difference between DNA and RNA	2	Acquire knowledge on structure of RNA	Lecture with power point discussion	

	4	Enzymes - classification and characteristics - Mechanism of enzyme action -factors influencing enzyme activity	2	Understand the classification of enzymes	Lecture and discussion	
	5	Cofactors and coenzymes. Enzyme inhibitors - reversible and non-reversible inhibitors	2	Know the importance of cofactors and coenzymes	Lecture with power point discussion	
	6	Industrial and medical application of enzymes	1	Study the application of enzymes	Lecture and discussion	
IV	**Lipids, Oils and Fats**					
	1	Lipids - classification - properties - biological functions	1	Classify lipids and its properties	Lecture with power point discussion	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Biological functions of phospholipids and glycolipids	2	Understand the functions of phospholipids and glycolipids	Lecture and power point discussion	
	3	Oils and fats - definition - characteristics and uses	1	Describe the characteristics and uses of oils and fats	Lecture and discussion	
	4	Common fatty acids in oils and fats - extraction and refining of oils	2	Understand the process of extraction and refining of oils	Lecture with power point discussion	
	5	Estimation of fats and oils - acid value, saponification value and Iodine value	3	Determine the saponification and iodine value of fats and oils	Lecture and discussion	
	6	Distinction between animal and vegetable fats. Hydrogenation and Rancidity	3	Differentiate animal and vegetable fats	Lecture with power point presentation	
V	**Vitamins and Hormones**					
	1	Vitamins -introduction - classification - Sources - biological function	3	Understand the classification and biological functions of vitamins	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Deficiency diseases of Vitamin A, B, C, D, E and K	2	Recognize the diseases caused by vitamin deficiency	Lecture with power point presentation	
	3	Hormones introduction and classification	2	Classify hormones	Lecture with power point presentation	

	4	Structure and functions of thyroxin, adrenaline, bile acids, progesterone, testosterone and oestrone	3	Explain the structure and functions of hormones	Lecture	
	5	Effect of hormone activity on biological functions.	2	Understand the effect of hormone on biological functions	Lecture	

Course Instructor: Dr. M. Anitha Malbi HOD: Dr. G. Leema Rose

Semester - II

Part IV: NME

Applied Chemistry - II

Course Code: CNM202

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
2	**2**	**30**	**100**

Objectives:

1. To acquire knowledge on petroleum and petroleum products
2. To know about the preparation of cosmetics and perfumes
3. To understand the manufacture of matches and characteristics of paints and pigments

Course Outcome

COs	*Upon completion of this course, the students will be able to*:	PSO Addressed	Cognitive Level
CO-1	remember the refining of petroleum and manufacture of petroleum products	PSO-4	R
CO-2	analyse the therapeutic uses of pharmaceuticals	PSO-7	Y
CO-3	understand the process of manufacture of cosmetics and perfumes	PSO-8	U
CO-4	analyse the characteristics of matches, explosives, paints and pigments	PSO-2	Y

Total contact hours: 30 (Including lectures, assignments and tests)

Unit	Module	Topics	Hours	Learning outcome	Pedagogy	Assessment / Evaluation
I	**Petroleum**					
	1	Petroleum - refining of petroleum - fractional distillation - cracking - thermal and catalytic cracking - advantages of catalytic cracking - octane rating - anti knock agents - cetane rating	3	Know the process of refining of petroleum and the importance of cracking	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz
	2	Petrochemicals - direct and indirect petrochemicals - methods involved in manufacture of petrochemicals - alkylation - pyrolysis	3	Understand the methods involved in the manufacture of petrochemicals	Lecture and discussion	Formative assessment I

II	**Pharmaceuticals**					
	1	Preparation and therapeutic uses of the following: Antiseptics - alum - zinc oxide - boric acid. Mouth wash - hydrogen peroxide. Antacid - aluminium hydroxide. Analgesics - aspirin - paracetamol. Haematinics - ferrous fumerate - ferrous gluconate. Laxatives - epsom salt - milk of magnesia	6	Acquire knowledge about the therapeutic uses of pharmaceuticals	Lecture	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
III	**Cosmetics and Perfumes**					
	1	Preparation and uses - shampoo - hair dye - face cream - sun screen lotion - nail polish - nail polish removers - lipsticks	3	Acquire knowledge about cosmetics	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Perfumes - ingredients - isolation of essential oils - preparation of odorous substances - vanillin - diphenyl oxide	3	Remember the preparation of perfumes	Lecture and discussion	
IV	**Matches and Explosives**					
	1	Safety matches - classification - composition - manufacture of safety matches. Pyrotechny - composition of fireworks	3	Understand the process of manufacture and uses of safety matches and fire works	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Explosives - characteristics - classification - low explosives - gun powder - smokeless powder - primary explosives - preparation and uses of lead azide - mercury fulminate - high explosives - picric acid -dynamite	3	Gain knowledge about the classification of explosives	Lecture and discussion	

V	**Paints and Pigments**					
	1	Paints - general characteristics - constituents - pigment - vehicle - thinners - driers - plasticizers - fillers - anti-skinning agents - mechanism of film formation - paint removers - constituents.	3	Gain knowledge about the characteristics and constituents of paints.	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Pigments - manufacture of white lead - lithopone - titanium dioxide - ultra marine blue - red lead - chrome yellow- Prussian blue.	3	Know the methods of manufacturing pigments.	Peer group teaching	

Course Instructor: Dr. S. Ajith Sinthuja HOD: Dr. G. Leema Rose

Semester - IV

Core IV: General Chemistry IV
Course Code: CC2041

Hours / week	Credits	Total hours	Marks
4	4	60	100

Objectives

- To study the preparation and chemical reactions of alkyl and aryl halides, alcohols, phenols, ethers and epoxides with mechanism
- To know the chemistry of halogens and noble gases.
- To understand the basics of first and second law of thermodynamics and related relationship.

Course outcome

COs	*Upon completion of this course, the students will be able to:*	PSO addressed	Cognitive level
CO - 1	know the mechanism of important name reactions	PSO - 1	U
CO - 2	apply the reaction mechanisms in the synthesis of components used in industrial and medicinal fields	PSO - 2	An
CO - 3	evaluate the characteristics of halogens and noble gases	PSO - 3	E
CO - 4	classify the non-aqueous solvents and know the theories of acids and bases	PSO - 3	E
CO - 5	list out the applications of first and second law of thermodynamics	PSO - 3	R

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

Unit	Module	Topic	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
I	**Haloalkanes and Haloarenes**					
	1	Classification of alkyl halides, methods of formation from alcohols, alkanes, alkenes. Allylic/ benzylic bromination and chlorination	2	Understand the preparation and properties of alkyl halides	Lecture and discussion	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Hundiecker reaction, Finkelstein reaction and Swart's reaction	2	Know about the mechanisms of the reactions	Lecture and discussion	

	3	Nucleophilic substitution reactions and its mechanisms. S_N2 and S_N1 reactions with energy profile diagrams and its difference	2	Gain knowledge about the nucleophilic substitution reactions	Lecture	
	4	Dehydrohalogenation with mechanism, Hoffmann and Saytzeff's rules, Reaction with metals, Wurtz reaction and formation of Grignard reagent	2	Understand the mechanisms of named reactions and formation of Grignard reagent	Lecture	
	5	Methods of formation of aryl halides - nucleophilc substitution reactions of aryl halides - addition-elimination and the elimination-addition mechanisms	2	Understand the preparation and properties of alkynes	Question answer session and lecture	
	6	Electrophilic substitution - Ullmann reaction and Wurtz-Fittig reaction. Relative reactivities of alkyl, allyl, vinyl and aryl halides	1	Study the synthesis of compounds	Lecture and discussion	
	7	Synthesis and uses of DDT and BHC	1	Know the synthesis and uses of some compounds	Lecture and discussion	
II	**Alcohols, Phenols and Ethers**					
	1	Preparation of alcohols through reduction, hydroboration, hydration, oxymercuration and Grignard reaction	2	Know about preparation and reactions of alcohols	Lecture with illustration	Evaluation through Multiple choice questions, short test, quiz Formative assessment I

	2	Reactions of alcohol with metals, esterification with mechanism, oxidation, dehydration, conversion to alkyl halides	2	Understand the reactions of alcohol with metals	Lecture with illustration	
	3	Preparation of Phenols its acidity and relative acid strength of substituted phenols	2	Understand clearly about the reactions and synthesis of compounds	Lecture and discussion	
	4	Reactions of phenols - esterification, oxidation, Kolbe's, Reimer-Tiemann, Gattermann, electrophilic substitution reactions	2	Study the reactions of phenols	Lecture and discussion	
	5	Dihydric and trihydric phenols-preparation and properties	2	Know about the preparation and properties of dihydric and trihydric phenols	Lecture and illustration	
	6	Preparation of ethers, reactions with epoxide. Synthesis of aspirin, 3 and 4-nitro phenol nd t-butylmethyl ether	2	Learn the preparation of ethers and its reactions with epoxide	Lecture and discussion	
III	**Halogen family and Noble gases**					
	1.	General characteristics of halogen with reference of electro negativity, electron affinity, oxidation states, and oxidizing power	2	Understand clearly about the general characteristics of halogen	Lecture with illustration	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2.	Peculiarities of fluorine its hydrides and oxides oxo acids of halogens	2	Learn about peculiarities of fluorine compounds	Lecture with illustration	

	3.	Interhalogen compounds, polyhalide ions, pseudohalogens, preparation, properties and structure of interhalogen compounds	2	Analyse the properties and structure of interhalogen compounds	Lecture	
	4.	Inert gases , position in the periodic table , isolation from atmosphere , General characteristics, Structure and shape of xenon compounds XeF_2,XeF_4, XeF_6, $XeOF_2$, $XeOF_4$ its uses of noble gases	2	Know the characteristics, structure and shape of Inert gases	Lecture with power point presentation	
	5.	Protic & Aprotic solvents, non-aqueous solvents, Classification of solvents, General properties of ionizing solvents-chemical reactions. Liquid ammonia and liquid SO_2 as solvents	2	Learn about protic & aprotic solvents its classification and general properties	Lecture and discussion	
	6.	Acid Base Chemistry, Theories of acids and bases, Arrhenius, Bronsted, Lowry theory proton donor - acceptor system. HSAB principle and Usanovich concept	2	Know the various theories of acids and bases	Lecture and discussion	
IV	**First Law of Thermodynamics and Hess's law**					
	1.	Chemical thermodynamics, importance of thermodynamics, basic terms- system, boundary and surroundings. Types of systems - open, closed and isolated	2	Know the importance of thermodynamics	Lecture	Evaluation through Multiple choice questions, short test, quiz Formative assessment II

	2.	Types of processes - isothermal, adiabatic, isobaric and isochoric, reversible and irreversible process. Difference between reversible and irreversible process. First law of thermodynamics- mathematical form	2	Understand the different types of processes	Lecture and discussion	
	3.	Heat capacity of a system, heat capacity at constant volume (Cv) and heat capacity at constant pressure (Cp), relationship between Cp and Cv. Calculations of w, q, dE and dH for the reversible expansion of ideal gases under isothermal and adiabatic conditions	2	Acquire knowledge heat capacity of a system	Lecture	
	4.	Joule- Thomson effect, derivation of Joule- Thomson coefficient for ideal gases and real gases, inversion temperatures	2	Derive Joule-Thomson coefficient	Lecture and discussion	
	5.	Hess's law and its applications. Variation of enthalpy change of reaction with temperature (Kirchoff's equation)	2	Understand the variation of enthalpy	Lecture	
	6.	Second law of thermodynamics, Need for second law, statements of Second law, Carnot theorem, Carnot cycle, Efficiency of heat engine	2	Study the need for second law of thermodynamics	Lecture and power point presentation	

V	**Thermodynamics – II**					
	1.	Third law of thermodynamics, concept of entropy, State function, entropy change in isothermal expansion of ideal gas, entropy change in reversible and irreversible process	2	Know about the Third law of thermodynamics and the concept of entropy	Lecture, Discussion	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2.	Entropy change accompanying by change of phase, calculation of entropy change of an ideal gas with changes in pressure, volume and temperature, Entropy of mixing	2	Gather knowledge on entropy change accompanying change of phase	Lecture	
	3.	Physical significance of entropy. Gibbs free energy , Work function, Variation of free energy change with temperature and pressure , Criteria for spontaneity , Gibbs Helmholtz equation	2	Understand the physical significance of entropy	Lecture, Illustration	
	4	Partial molar properties, Clapeyron Clausius equation and its applications. Van't Hoff reaction isotherm and its significance	2	Learn Clapeyron Clausius equation, Van't Hoff reaction and its applications.	Lecture, Discussion	
	5	Van't Hoff isochore and significance. Fugacity, concept , determination of fugacity of real gases	2	Gain knowledge on Van't Hoff isochore and fugacity	Lecture	

	6	Variation of fugacity with temperature and pressure. Physical significance of fugacity. Activity, activity coefficient Nernst Heat theorem and its applications. Zeroth law of thermodynamics	2	Understand the variation of fugacity with temperature and pressure	Lecture, Discussion	

Course Instructor: Sr. K. Francy HOD: Dr. G. Leema Rose

Semester – IV
Elective II a - Green Chemistry
Course Code: CC2042

Hours / week	Credits	Total hours	Marks
4	3	60	100

Objectives

1. To know the principles of green chemistry.
2. To study the important techniques and green synthesis of compounds.
3. To study the concept of atom economy in chemical synthesis.

Course outcome

COs	*Upon completion of this course, the students will be able to:*	PSO addressed	Cognitive level
CO - 1	know the principles of green chemistry	PSO - 1	R
CO - 2	design green synthesis	PSO - 5	C
CO - 3	interpret green method for organic synthesis	PSO - 3	E
CO - 4	synthesize various compounds by microwave and ultrasound assisted methods	PSO - 4	C
CO - 5	analyze the important techniques and directions in practicing green chemistry	PSO - 2	An
CO - 6	identify the importance of Green chemistry in day to day life	PSO - 8	Ap

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

Unit	Module	Topics	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
I	**Introduction to green chemistry**					
	1	Definition, need for green chemistry and scope of green chemistry	2	Know the need for green chemistry	Lecture with power point presentation and group discussion	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Concept of atom economy, yield, mass intensity and atom economy. Calculation of atom economy, mass intensity, mass productivity and carbon efficiency	4	Calculate the atom economy, mass intensity, mass productivity and carbon efficiency	Seminar	
	3	Different types of reactions and atom economy, addition, substitution, elimination and rearrangements	2	Differentiate the types of reactions	Illustration and seminar	

	4	Concept of selectivity, enantioselectivity and chemoselectivity	2	Understand the concept of selectivity	Lecture with power point presentation	
	5	Regioselectivity and diastereoselectivity	2	Know the different types of selectivity	Lecture and group discussion	
II	**Green solvent**					
	1	Super critical fluids, Introduction, extraction of super critical fluids, solvents of super critical fluid, advantages and applications Carbon dioxide as a super critical fluid	4	Learn the extraction and advantages of super critical fluids	Question answer session	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Features of technique for using super critical carbon dioxide, advantages and application. Chemical reaction in supercritical water and Near, Critical Water (NCW), Region	4	Understand the features of technique for using super critical carbon dioxide	Lecture	
	3	Extraction natural products, dry cleaning, supercritical polymerization, hydrogenation and hydroformylation. Ionic liquid as green solvent: Introduction, synthesis of ionic liquids, acidic ionic liquid and neutral ionic liquids, applications in organic synthesis	4	Know the process of extraction of natural products and applications	Lecture with power point presentation and group discussion	
III	**Green catalyst**					
	1	Catalysis over view, acid catalyst, basic catalyst, oxidation catalyst, polymer supported catalyst, photosensitized super acid catalyst and Tetra Amido Macrocylic Ligand (TAML) catalyst	3	Understand the different types of catalyst	Seminar	Evaluation through Multiple choice questions, short test, quiz Formative assessment II

	2	Biocatalyst, microbial oxidation, microbial reduction, enzyme catalyzed hydrolytic process, per fluorinated catalyst and modified biocatalyst	4	Know the action of Biocatalyst	Assignment	
	3	Development of mesoporous supports by liquid crystal templating, neutral templating methods, heterogeneous catalyst, solid supported catalyst	5	Compare the Development of mesoporous supports by various methods	Lecture with power point presentation and group discussion	
IV	**Green synthesis**					
	1	Green synthesis of the following compounds, Adipic acid, Catechol, Benzoyl bromide, Acetaldehyde, Citral, Ibruprofen and Paracetamol	3	Synthesize different compounds by Green synthesis method	Illustration and seminar	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Microwave assisted reactions in water, Hoffmann Elimination, Hydrolysis of benzyl chloride and methyl benzoate, oxidation of toluene and alcohols	3	Learn the different microwave assisted reactions in water	Lecture and group discussion	
	3	Microwave assisted reactions in organic solvents, Esterification, Fries rearrangement, Clasien Rearrangement, Diels - Alder Reaction and Decarboxylation	3	Understand the different microwave assisted reactions in organic solvents	Lecture with power point presentation	
	4	Ultra sound assisted reactions, Esterification, Saponification, alkylation, oxidation, reduction, coupling reactions and Cannizaro reactions	3	Learn the different ultra sound assisted reactions	Lecture and illustration	
V	**Green reactions involving basic principle of green chemistry**					
	1	Twelve principles of green chemistry - choice of starting materials - biomimitic, multifunctional reagents materials reagents.	4	Know the twelve principles of green chemistry	Lecture, Quiz	Evaluation through Multiple choice questions, short test, quiz Formative

	2	Combinatorial green chemistry, Green Chemistry in sustainable developments	4	Understand the importance of Green Chemistry in sustainable developments	Lecture with power point presentation	assessment I
	3	Importance of Green chemistry in day to day life, versatile bleaching agents and analgesic drugs	4	Learn the Importance of Green chemistry in day to day life	Lecture and group discussion	

Course Instructor: Dr. S. Ajith Sinthuja HOD: Dr. G. Leema Rose

Allied Chemistry for Physics Major
Semester IV
Physical Chemistry
Course Code: CA2032

Hours / week	Credits	Total hours	Marks
4	**4**	**60**	**100**

Objectives

1. To understand the basic concepts of thermodynamics and nano chemistry
2. To enable them to apply concepts related to chemistry in their careers
3. To know the basic principles of kinetics and photochemistry

Course Outcome

COs	*Upon completion of this course, the students will be able to:*	PSO addressed	Cognitive level
CO-1	remember the theories and the factors influencing rate of reaction	PSO-1	R
CO-2	understand the laws and theories that govern photochemistry	PSO-1	U
CO-3	apply the principles of physical properties for structural determination	PSO-6	A
CO-4	understand the different laws of thermodynamics	PSO-1	U
CO-5	analyse the importance of nano chemistry in various fields	PSO-2	Y

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

Unit	Module	Topics	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
I	**Thermodynamics**					
	1	Thermodynamics - importance - basic terms - system, boundary and surroundings - types of systems - open - closed - isolated - homogeneous and heterogeneous	2	Know about the basics in thermodynamics	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz
	2	Types of processes - isothermal, adiabatic, isobaric, isochoric, reversible and irreversible process- difference between reversible and irreversible process - state and path functions	2	Differentiate the different processes	Lecture with power point presentation	Formative assessment I

	3	First law of thermodynamics - different statements - mathematical derivation - heat capacity of a system - heat capacity at constant volume (C_v) - heat capacity at constant pressure (C_p) - thermodynamic relationship between C_p and C_v	2	Derive the expressions for heat capacities	Lecture and power point presentation	
	4	Variation of enthalpy of a reaction with temperature - Kirchoff's equation, Joule Thomson effect	2	Learn about Joule Thomson effect	Lecture and seminar	
	5	Expression for Joule Thomson coefficient for an ideal gas and vanderwaal's gas - derivation - inversion temperature - significance	2	Know to derive expression for Joule Thomson coefficient for an ideal gas and vanderwaal's gas	Lecture with power point presentation	
	6	Second law of thermodynamics - need for second law of thermodynamics - different statements - Carnot's cycle	2	Learn Carnot's cycle	Lecture with power point presentation	
II	**Chemical kinetics**					
	1	Rate of reaction - expression of rate - factors influencing rate of reaction - order and molecularity of a reaction - definition and examples	3	Know about reaction rate and factors influencing rate of reaction	Question answer session	Evaluation through Multiple choice questions, short test, quiz Formative assessment I
	2	Difference between order and molecularity - zero, first and second order reactions - examples derivation of rate constant and half-life period	3	Differentiate order and molecularity	Lecture	
	3	Methods of determining order of reaction - use of differential - integral - half-life method and Ostwald's methods	3	Learn about different methods of determining order of reaction	Lecture with power point presentation and group discussion	

	4	Arrhenius theory -concept of activation energy - effect of catalyst - calculation of energy of activation. Theories of reaction rates - collision theory of bimolecular gaseous reactions - activated complex theory	3	Know about activation energy	Lecture with power point presentation	
III	**Physical properties and structure determination**					
	1	Dipole moment - definition and expression for dipole moment - applications - molecular geometry - cis-trans isomerism and disubstituted benzene derivatives	2	Know about dipole moment and isomerism	Seminar and power point presentation	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Dia, para and ferro magnetism - magnetic susceptibility and magnetic moment - measurement using Guoy balance - application of magnetic properties	2	Learn about dia , para and ferro magnetism	Lecture and power point presentation	
	3	Thermogravimetric analysis - principles - applications. Chromatography - classification	2	Know about thermogravimetric analysis	Lecture and power point presentation	
	4	Column chromatography - principle - experimental techniques - factors affecting column efficiency and applications	2	Gather knowledge regarding column chromatography	Power point presentation with videos	
	5	TLC principle - experimental techniques - advantages - limitations - applications. GC - principle - experimental techniques - applications	2	Distinguish between TLC and GC	Illustration, seminar and power point presentation	
	6	HPLC - principle and experimental techniques	2	Know about the principles of HPLC	Lecture and power point presentation	

IV	**Photochemistry**					
	1	Importance of photochemistry - difference between thermal and photochemical reactions - laws of photo chemistry - Beer-Lambert's Law - Grother's - Drapers law - Stark-Einstein's law	3	Understand about photo chemical laws.	Power point presentation with videos	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Quantum efficiency - electronic excitations - singlet and triplet states - Jablonski diagram - internal conversion - intersystem crossing	3	Know about electronic excitations	Lecture	
	3	Fluorescence - phosphorescence - difference between fluorescence and phosphorescence	2	Differentiate between fluorescence and phosphorescence	Lecture	
	4	Types of photo chemical reactions based on quantum efficiency (ϕ = 1, ϕ< 1 and ϕ> 1) - primary and secondary process of photo chemical reaction - photo chemical rate law	2	Learn the types of photo chemical reactions	Lecture and power point presentation	
	5	Kinetics of photo chemical reactions - combination of H_2 and Cl_2 - decomposition of HI- photosensitization - photosensitizers - Chemiluminescence – bioluminescence. Lazers - principle - uses	2	Understand the kinetics of photo chemical reactions	Lecture and power point presentation	
V	**Chemistry of Nanomaterials**					
	1	Nanotechnology - introduction, fundamental principles - nano particles - size - nano particles of metals - semiconductors and oxides	3	Understand the fundamental principles of nanochemistry	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz

	2	Synthesis of nano sized compounds - reduction methods by sodium citrate and borohydride - Sol-gel method and chemical vapour deposition method - properties - optical and electrical	3	Gather knowledge regarding synthesis of nano particles	Lecture with videos	Formative assessment I
	3	Sol-gel method and chemical vapour deposition method - properties - optical and electrical	2	Learn about synthesis of nano particles	Seminar	
	4	Nano clusters - carbon nano tubes - single walled nano tubes and multi-walled nanotubes	2	Know about nano clusters and carbon nano tubes	Power point presentation and seminar	
	5	Properties of carbon nanotubes - applications - Application of nano chemistry in various fields	2	Understand the applications of nano chemistry	Lecture with videos	

Course Instructor: Dr. S. Ajith Sinthuja HOD: Dr. G. Leema Rose

Semester - VI

Major Core VIII: ORGANIC CHEMISTRY - II

Course Code: CC2061

Hours per week	Credits	Total hours	Marks
6	5	90	100

Objectives:

- To know the synthesis and structure of carbohydrates, alkaloids, terpenoids and dyes
- To understand the rearrangements, synthetic strategies and terminologies involved in organic synthesis and the role of reagents in organic synthesis.
- To study the basic principles of UV, IR and NMR spectroscopy and instrumentation.

Course Outcome

COs	*Upon completion of course students will be able to*	PSO Addressed	Cognitive Level
CO - 1	understand the synthetic methodology, reagents and rearrangements in organic chemistry	PSO-1	U
CO - 2	elucidate the structure of carbohydrates, alkaloids and terpenoids	PSO-6	C
CO - 3	synthesize dyes and compounds of synthetic importance	PSO-4	A
CO - 4	analyse the strategies and terminologies involved in organic synthesis leading to new products	PSO-5	An
CO - 5	apply the spectral techniques in structural determination	PSO-6	A

Total Hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
I	**Carbohydrates**					
	1	Carbohydrates: Definition - classification with suitable examples - classification of sugars as reducing and non-reducing sugars - stereochemistry of carbohydrates: D- and L-configurations - erythro and threodiastereomers - anomers and epimers with suitable examples	3	Classify carbohydrates and its stereochemistry	Lecture with videos	Evaluation through quiz, slip test, group discussion Formative assessment I

	2	Monosaccharides: Classification of monosaccharides with suitable examples – glucose - properties of glucose - epimerisation of glucose - anomers of glucose and mutarotation - fructose and its properties	3	Analyze the classification and properties of monosaccharides	Lecture	
	3	Conversion of aldose to ketose and ketose to aldose - formation of osazone and glycosides - Fischer open structure and evidences for open structure - Haworth projection cyclic structures - pyranose and furanose and evidences for cyclic structures of glucose and fructose	3	Understand the conversion and structure of glucose and fructose	Lecture	
	4	Stepping up - Kiliani-Fischer synthesis and stepping down - Ruff degradation of monosaccharides	3	Recognize the degradation of monosaccharides	Lecture	
	5	Disaccharides: α - and β - glucosidic linkages with suitable examples - 1,4’ and 1,5’ linkages with suitable examples - Structure and properties of sucrose	3	Identify the linkages in disaccharides and explain the structure and properties of sucrose	Lecture	
	6	Polysaccharides: Cellulose and starch - reactions and structure	3	Compare cellulose and starch	Lecture with power point presentation	
II	**Synthetic methodology and reagents**					
	1	Synthetic terminology - Disconnection, synthon, synthetic equivalent (SE), functional group interconversion (FGI), target molecule (TM)	3	Understand the synthetic terminologies of retrosynthesis	Lecture	Evaluation through quiz, slip test and group discussion
	2	Retro synthetic analysis - Linear, convergent and combinatorial syntheses	3	Compare linear, convergent and combinatorial syntheses	Lecture	Formative assessment I

	3	Retrosynthesisof 4-methyl acetophenone, methylcyclohex-3-enecarboxylate, phenylethylbromide, 2-methylcyclopentene and 2-allyl phenol	4	Illustrate the retrosynthesis of the given organic compounds	Lecture	
	4	Role of following reagents in organic synthesis: DIBAL, NBS, DCC, trimethylsillyl chloride and methyl lithium - List of nucleophilic reagents and electrophilic reagents	4	Analyze the role of the given reagents in organic synthesis	Lecture and group discussion	
	5	Malonic ester and acetoacetic ester in the synthesis of monocarboxylic acids - dicarboxylic acids - α,ß-unsaturated carboxylic acids and heterocyclic compounds	4	Explain the role of malonic ester and acetoacetic ester in organic synthesis	Lecture	
III	**Natural Products and Dyes**					
	1	Alkaloids: Definition - classification with suitable examples for each class - properties - structural determination - Hoffman exhaustive methylation	3	Understand the classification, properties and structure of alkaloids	Lecture	Evaluation through class test, quiz and group discussion
	2	Sources, isolation, physiological activities and structural elucidation of conine, piperine and nicotine.	4	Elucidate the structure of conine, piperine and nicotine	Lecture	Formative assessment II
	3	Terpenoids: Definition, classification, isoprene and special isoprene rule	2	Explain terpenoids, isoprene and special isoprene rule	Lecture	
	4	Sources, isolation, structural elucidation and uses of citral, geraniol and limonene	3	Elucidate the structure of citral, geraniol and limonene	Lecture	

	5	Dyes: Theory of color and constitution - chromophore, auxochrome, classification according to application and structure.	3	Categorize dyes based on their application and structure	Lecture with videos	
	6	Preparation and uses of methyl orange, congo red, malachite green, phenolphthalein, fluorescein, indigotin and alizarin.	3	Describe the preparation and uses of the given dyes	Lecture with power point presentation	
IV	**Rearrangements**					
	1	Rearrangement to electron-deficient carbon - 1,2 shift - Wagner-Meerwein rearrangement, pinacol-pinacolone rearrangement, dienone-phenol rearrangement; Wolff rearrangement, benzil-benzilic acid rearrangement	5	Understand the mechanism of nucleophilic rearrangement	Lecture	Evaluation through class test, quiz and group discussion Formative assessment II
	2	Rearrangements from oxygen to ring carbon - Fries rearrangement, Claisen rearrangement and benzidine rearrangement.	3	Explain the mechanism of rearrangement reactions	Lecture	
	3	Rearrangement to electron-deficient nitrogen - Beckmann rearrangement, Schmidt rearrangement, Hofmann rearrangement, Lossen rearrangement and Curtius rearrangement.	5	Apply the mechanism of nucleophilic rearrangement	Lecture	
	4	Rearrangement to electron-deficient oxygen: Baeyer-Villiger oxidation, Dakin reaction, cumenehydroper-oxide-phenol rearrangement	5	Analyze the mechanism of nucleophilic rearrangement	Lecture	

V	**Spectroscopy**					
	1	UV Spectroscopy: Electromagnetic spectrum - Types of electronic transitions - λmax, chromophores and auxochromes. Bathochromic and hypsochromic shifts. Intensity of absorption - hyper chromic and hypo chromic shifts	3	Understand the concepts of UV spectroscopy	Lecture with videos	Evaluation through class test, quiz, group discussion and problem solving Formative assessment I
	2	Application of Woodward-Fieser rules for calculation of λmax for α, β unsaturated aldehydes, ketones, carboxylic acids and esters. Conjugated dienes - acyclic, homoannular and heteroannular, extended conjugated systems-aldehydes, ketones and dienes	4	Predict the λ_{max} value of the given compounds using Woodward-Fieser rule	Lecture and problem solving	
	3	IR Spectroscopy: Molecular vibrations and origin of IR spectra, IR absorptions- fingerprint region and its significance. H-bonding- inter and intramolecular hydrogen bonding	3	Explain the concept of IR spectroscopy	Lecture with videos	Evaluation through class test, quiz and group discussion Formative assessment II
	4	Application in functional group analysis. IR spectrum of alkane, alkene, alkyne, alkyl halide, alcohols and carbonyl compounds	2	Interpret the IR spectrum of the given compounds	Lecture with power point presentation	
	5	NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it. Significance of number of peaks and peak area. Spin-spin coupling and coupling constant	3	Describe the principle and concept of NMR Spectroscopy	Lecture with videos	

	6	Interpretation of NMR spectra of simple compounds- ethyl alcohol, benzene, methyl chloride, benzaldehyde and mesitylene	3	Interpret the NMR spectrum of simple organic compounds	Lecture with power point presentation	

Course Instructor: Dr. Sr. Francy HOD: Dr. M. Anitha Malbi

Semester - VI
Major Core IX: INORGANIC CHEMISTRY II
Course Code: CC2062

Hours per week	Number of Credit	Total Hours	Marks
5	5	75	100

Objectives

- To understand the concepts and applications of nuclear reactions.
- To know the characteristics of solids and its applications.
- To gain knowledge about the development and uses of bioinorganic compounds.

Course Outcome

COs	*Upon completion of course students will be able to*	PSO Addressed	Cognitive Level
CO - 1	understand the types of nuclear reactions and their applications	PSO - 1	U
CO - 2	know about natural and artificial radioactivity	PSO - 2	R
CO - 3	classify crystal systems and their structures	PSO - 1	An
CO - 4	predict the role of bioinorganic compounds in biological systems	PSO - 2	E
CO - 5	use the solid materials for specific purposes	PSO - 6	A

Total Contact hours: 75 (Including lectures, assignments and tests)

Unit	Module	Topics	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
I	**Nuclear Chemistry I**					
	1	Introduction - composition of nucleus and nuclear forces - nuclear stability - mass defect - binding energy - packing fraction	3	Know about the basics in nuclear chemistry	Lecture and power point presentation	Evaluation through class test, quiz and group discussion
	2	N/P ratio - magic numbers - nuclear models - liquid drop - Shell and collective model	3	Learn about magic numbers	Lecture and power point presentation	
	3	Isotopes - detection and separation - deviation of atomic weights from whole numbers - isobars, isotones and isomers	3	Differentiate between isotopes, isobars and isotones	Illustration and lecture	Formative assessment I
	4	Radioactive decay and equilibrium - nuclear isomerism - internal conversion	3	Learn about Joule Thomson effect	Lecture and seminar	

	5	Nuclear Q-value - threshold energy - cross sections, types of reactions - fission and fusion - modes of radioactive decay	3	Know to derive Calculate Q value and threshold energy	Lecture and power point presentation	
II	**Nuclear Chemistry II**					
	1	Natural and induced radioactivity - radioactive decay - half-life period - radioactive displacement law - radioactive series - Radioactive techniques - Geiger Muller and ionization counters	4	Know about radioactivity	Question answer session	Evaluation through class test, quiz and group discussion
	2	Natural radioactivity - Detection and measurement of radioactivity - radioactive series including neptunium series - group displacement law - Rate of disintegration and half-life period - Average life period	4	Differentiate between various radioactive series	Lecture	Formative assessment I
	3	Artificial radioactivity - induced radioactivity - transmutation of elements- hazards of radiations - nuclear energy - nuclear reactors - fission products and fission yields - spallation - photonuclear and thermo nuclear reactions - energy source of the sun and stars - carbon dating - rock dating	4	Learn about different nuclear reactions	Lecture with power point presentation and group discussion	
	4	Radioactive waste disposal - applications of nuclear science in agriculture, biology and medicine - Atomic power projects in India	3	Know about the disposal of radioactive wastes	Lecture and power point presentation	

III	**Solid State Chemistry**					
	1	Amorphous and crystalline solids - Laws of crystallography Elements of symmetry Weiss and Miller indices Crystal systems and Bravais lattices - derivation of Bragg's equation	3	Know about the laws of crystallography	Seminar and power point presentation	Evaluation through class test, quiz and group discussion
	2	Ionic bonding lattice energy Born equation and its derivation, radius ratio rules structures of some ionic crystals Structure of solids comparison of X-ray and Neutron diffraction	3	Learn about ionic bonding	Lecture and power point presentation	Formative assessment II
	3	Crystal structure of NaCl powder method - Electrical, Magnetic and optical properties of solids band theory semiconductors superconductors. Solid state electrolytes	3	Know about the structure of crystals	Lecture and problem solving	
	4	Types of magnetic behavior, dia, para, ferro, antiferro and ferrimagnetism Hysterisis Solid state lasers inorganic phosphors ferrites	3	Gather knowledge regarding types of magnetic behavior	Problem solving	
	5	Crystaldefects- Schotkydefect Frenkel defect - metal excess defect - metal deficiency defect f centres	3	Distinguish between various defects	Illustration, Seminar and power point presentation	
IV	**Bioinorganic Chemistry**					
	1	Metal ions in biology- role of sodium - potassium- calcium - magnesium - copper - molybdenum and their vital role in the active site	4	Understand about the role of different metal ions.	Power point presentation with videos	Evaluation through class test, quiz and group discussion

	2	Metallo proteins - types and functions - metalloenzymes - structure and characteristic features of Vitamin B_{12}	4	Know about proteins and vitamins	Lecture	Formative assessment II
	3	Biological functions of haemoglobin and myoglobin, - sodium / potassium pump- cytochromes and ferredoxins	3	Differentiate between haemoglobin and myoglobin	Lecture	
	4	Metal complexes of copper and platinum as therapeutic agents - Biological nitrogen fixation, Photosynthesis: Photosystem-I	4	Learn the types different therapeutic agents	Lecture and power point presentation	
V	**Material Chemistry**					
	1	Ionic conductors - sodium, β- alumina, sodium-sulphur battery. Intercalation - layered compounds - graphitic compounds	3	Understand about ionic conductors	Lecture and power point presentation	Evaluation through class test, quiz and group discussion Formative assessment I
	2	Special applications of solid state materials. High energy battery, lithium cells	3	Explain the applications of solid state materials	Lecture with videos	
	3	Introduction - techniques for synthesis of nanophase materials - sol-gel synthesis- electro deposition - inert gas condensation	3	Learn about nano materials	Seminar	
	4	mechanical alloying - properties of nanophase materials - applications of nanophase materials, composite materials	3	Know about applications of nanophase materials	Power point presentation and seminar	
	5	Superconductivity - introduction - examples of superconducting oxides - applications of superconducting materials	3	Understand the applications of nano chemistry	Demonstration	

Course Instructor: Dr. R. Gladis Latha HOD: Dr. M. Anitha Malbi

Semester - VI

Major Core XI: PHYSICAL CHEMISTRY

Course Code: CC2063

Hours per week	Credits	Total hours	Marks
5	5	75	100

Objectives:

- To understand the theories of reaction rate, adsorption and catalysis
- To learn phase rule and phase equilibria
- To know the concepts of symmetry elements, symmetry operations and point groups

Course Outcome

COs	*Upon completion of course students will be able to*	PSO Addressed	Cognitive Level
CO - 1	understand the theories of reaction rate, adsorption and catalysis	PSO - 1	U
CO - 2	construct phase diagrams for one and two component systems	PSO - 3	C
CO - 3	recall colligative properties and their applications	PSO - 2	R
CO - 4	predict the point groups of molecules	PSO - 3	E
CO - 5	construct group multiplication table for simple molecules	PSO - 7	C

***Total Hours: 75 (Including lectures, assignments and tests)**

Unit	Module	Topic	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
I	**Chemical kinetics**					
	1	Rate of reaction, expression of rate, factors influencing rate of reaction, order and molecularity	3	Know the factors influencing rate of reaction	Lecture with videos	Evaluation through class test, quiz, group discussion and problem solving. Formative assessment I
	2	Differences between order and molecularity, zero, first and second order reaction, definition- examples, derivation of rate constant and half-life period	3	Analyze the differences between order and molecularity	Lecture	

	3	Methods of determining order of reaction, differential, integral, half-life and Ostwald's isolation methods. Temperature dependence of reaction rates , Arrhenius equation, significance	3	Understand the methods of determining order of reaction	Lecture	
	4	Temperature coefficient, energy of activation, effect of catalyst, calculation of energy of activation	2	Recognize the energy of activation and effect of catalyst	Lecture	
	5	Theories of reaction rates, collision theory of bimolecular gaseous reactions, activated complex theory, comparison of collision theory	2	Understand the theories of reaction rates	Lecture	
	6	Activated complex theory. Lindeman's theory of unimolecular reactions	2	Compare activated complex theory and Lindeman's theory	Lecture with power point presentation	
II	**Phase Equilibria**					
	1	Concept of phase, components , degrees of freedom , definitions and examples, derivation of Gibb's phase rule	2	Understand the concept of phase and components	Lecture	Evaluation through class test, quiz and group discussion
	2	Phase diagram for one component system, water and sulphur systems. Two component system, reduced phase rule	2	Compare phase diagrams for one and two component system	Lecture with power point presentation	Formative assessment I
	3	Simple eutectic system, lead-silver system, Pattinson's process of de-silverisation of lead, freezing mixtures, KI-H_2O system	4	Illustrate the phase diagrams of simple eutectic systems	Lecture	
	4	Formation of compounds with congruent melting point, zinc-magnesium system and $FeCl_3$-H_2O system	4	Analyze the formation of compounds with congruent melting point	Lecture and group discussion	

	5	Formation of compounds with incongruent melting points, Na_2SO_4-H_2O system. Solid-gas equilibria, $CuSO_4$-H_2O system. Efflorescence, deliquescence and hygroscopy	3	Explain the formation of compounds with incongruent melting points	Lecture	
III	**Catalysis and Adsorption**					
	1	Catalysis , characteristics, different types , homogeneous, heterogeneous, acid-base catalysis and auto catalysis	2	Understand the different types of catalysis	Lecture	Evaluation through class test, quiz , group discussion and problem solving Formative assessment II
	2	Theories of catalysis, intermediate compound formation theory and adsorption theory	3	Know the theories of catalysis	Lecture	
	3	Kinetics of enzyme catalysis, Michaelis-Menten equation, derivation and applications of catalysis	2	Acquire knowledge on applications of catalysis	Lecture	
	4	Adsorption, definition-physisorption and chemisorption, differences, factors influencing adsorption of gases on solids	3	Elucidate the factors influencing adsorption of gases on solids	Lecture	
	5	Adsorption isotherms, types, Freundlich and Langmuir monolayer adsorption isotherms	2	Categorize the types of adsorption isotherms	Lecture with videos	
	6	Gibbs adsorption isotherm, BET theory of multilayer adsorption, applications of adsorption. Adsorption indicators	3	Describe the applications of adsorption	Lecture with power point presentation	
IV	**Solutions and Colligative Properties**					
	1	Solutions of non-electrolytes, solutions of liquids in liquids, vapour pressure of non-ideal solutions, type I, type II and type III	3	Illustrate the vapour pressure of non-ideal solutions	Lecture	Evaluation through class test, quiz, group discussion and

	2	Vapour pressure, composition and boiling point, composition curves of completely miscible binary solutions, type I, type II and type III. Theory of fractional, azeotropic and steam distillations	3	Understand the composition curves of completely miscible binary solutions	Lecture	problem solving Formative assessment II
	3	Solubility of partially miscible liquids - phenol-water system, triethylamine – water system and nicotine water system. Colligative properties, definition and examples	2	Explain the solubility of partially miscible liquids	Lecture	
	4	Osmotic pressure, Laws of osmotic pressure, van'tHoff theory of dilute solutions, isotonic solution. Elevation of boiling point, molal boiling point elevation constant or ebullioscopic constant	2	Describe osmotic pressure and elevation of boiling point	Lecture	
	5	Determination of molar mass from elevation of boiling point. Depression of freezing point,molal freezing point depression constant or cryoscopic constant	3	Understand depression of freezing point	Lecture with power point presentation	
	6	Determination of molar mass by depression of freezing point. Abnormal results and van't Hoff factor	2	Know to determine molar mass by depression of freezing point	Lecture with power point Presentation	
V	**Group theory**					
	1	Symmetry elements and symmetry operations, definition of identity (E), proper rotational axis (n), mirror plane (σ), inversion centre (i) and rotation reflection axis (Sn)	3	Understand symmetry elements and symmetry operations	Lecture with videos	Evaluation through class test, quiz and group discussion

	2	Symmetry operations generated by symmetry elements- H_2O, NH_3, BF_3, $[PtCl_4]^{2-}$, H_2O_2 (cis and trans) and CH_4 as examples	4	Know the symmetry operations generated by symmetry elements	Lecture and problem solving	Formative assessment I
	3	Matrix representation of symmetry operations. Comparison of molecular and crystallographic symmetry	3	Explain the symmetry operations	Lecture with videos	
	4	Group postulates, abelian and cyclic groups, group multiplication table, molecular point groups	2	Interpret cyclic groups and point groups	Lecture with power point presentation	
	5	Point group assignment to simple molecules like H_2, HCl, CO, H_2O, NH_3 and CO_2. Determination of point groups	3	Determine the point groups for simple molecules	Lecture with videos	

Course Instructor: Dr. M. Anitha Malbi