

**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	<i>Upon completion of this course, students will be able to</i>	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	<b>Aliphatic Compounds</b>					
	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 $\text{KMnO}_4$ 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	Alkynes: preparation, reactions - addition of hydrogen, halogen, hydrogen halide, water, $\text{HCN}$ , $\text{CH}_3\text{COOH}$ - dimerisation and cyclisation - acidity of terminal alkynes	2	Understand the preparation and properties of alkynes	Question answer session and lecture	
<b>II</b>	<b>Alicyclic Compounds</b>					
	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
	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	Formative assessment II
	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
	2	Concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, aluminothermic process	1	Understand about different concentration methods	Lecture and discussion	Formative assessment II
	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	
<b>V</b>	<b>Gas and Liquid state</b>					
	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 - viscosity - 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	

**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	<i>Upon completion of this course, students will be able to</i>	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
<b>I</b>	<b>Carbohydrates</b>					
	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	
<b>II</b>	<b>Amino Acids and Proteins</b>					
	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	
<b>III</b>	<b>Nucleic Acids and Enzymes</b>					
	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	
<b>IV</b>	<b>Lipids, Oils and Fats</b>					
	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	
<b>V</b>	<b>Vitamins and Hormones</b>					
	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	<i>Upon completion of this course, the students will be able to:</i>	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
<b>I</b>	<b>Petroleum</b>					
	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

<b>II Pharmaceuticals</b>						
	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 fumarate - 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
<b>III Cosmetics and Perfumes</b>						
	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
	2	Perfumes - ingredients - isolation of essential oils - preparation of odorous substances - vanillin - diphenyl oxide	3	Remember the preparation of perfumes	Lecture and discussion	Formative assessment II
<b>IV Matches and Explosives</b>						
	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
	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	Formative assessment II

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	
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	Formative assessment I	

Course Instructor: Dr. S. Ajith Sinthuja

HOD: Dr. G. Leema Rose

**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	<i>Upon completion of this course, the students will be able to:</i>	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	<b>Haloalkanes and Haloarenes</b>					
	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 <sub>N</sub> 2 and S <sub>N</sub> 1 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 - nucleophilic 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	
<b>II</b>	<b>Alcohols, Phenols and Ethers</b>					
	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 and t-butylmethyl ether	2	Learn the preparation of ethers and its reactions with epoxide	Lecture and discussion	
<b>III</b>	<b>Halogen family and Noble gases</b>					
	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 <sub>2</sub> ,XeF <sub>4</sub> , XeF <sub>6</sub> , XeOF <sub>2</sub> , XeOF <sub>4</sub> 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 <sub>2</sub> 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	<b>First Law of Thermodynamics and Hess's law</b>					
	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 ( $C_v$ ) and heat capacity at constant pressure ( $C_p$ ), relationship between $C_p$ and $C_v$ . 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	
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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	<i>Upon completion of this course, the students will be able to:</i>	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
<b>I</b>	<b>Introduction to green chemistry</b>					
	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
	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	Formative assessment I
	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	
<b>II</b>	<b>Green solvent</b>					
	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	
<b>III</b>	<b>Green catalyst</b>					
	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	
<b>IV</b>	<b>Green synthesis</b>					
	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, Claisen 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	
<b>V</b>	<b>Green reactions involving basic principle of green chemistry</b>					
	1	Twelve principles of green chemistry - choice of starting materials - biomimetic, 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	<i>Upon completion of this course, the students will be able to:</i>	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
<b>I</b>	<b>Thermodynamics</b>					
	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	
<b>II</b>	<b>Chemical kinetics</b>					
	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	
<b>III</b>	<b>Physical properties and structure determination</b>					
	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
	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	Formative assessment II
	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
	2	Quantum efficiency - electronic excitations - singlet and triplet states - Jablonski diagram - internal conversion - intersystem crossing	3	Know about electronic excitations	Lecture	Formative assessment II
	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 ( $\phi = 1, \phi < 1$ and $\phi > 1$ ) - 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 <sub>2</sub> and Cl <sub>2</sub> - decomposition of HI- photosensitization - photosensitizers - Chemiluminescence – bioluminescence. Lasers - 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	F o r m a t i v e a s s e s s m e n t 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

**Department of Chemistry**  
**Teaching Plan**  
**Even Semester 2019**

**Course Outcome**

Semester : VI Major Core VIII  
Name of the Course : Organic Chemistry IV  
Course code : CC1761

CO - No.	Course Outcome Upon completion of course students will be able to	PSO	CL
CO - 1	recognize optical activity and the types of isomerism	PSO - 1	R
CO - 2	interpret the principles of spectroscopy and photochemistry	PSO - 3	Ap
CO - 3	apply spectral rules to calculate $\lambda_{\max}$ values	PSO - 6	Ap
CO - 4	evaluate different spectra	PSO - 5	E
CO - 5	apply ir spectra in functional group analysis	PSO - 6	C
CO - 6	know the medicinal importance and elucidate the structure of alkaloids	PSO - 8	C
CO - 7	classify, differentiate and synthesise various dyes	PSO - 2	An

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

Unit	Section	Topic	Lecture Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
<b>I</b>	<b>Stereochemistry</b>					
	1.	Optical activity and Chirality	2	To understand the importance of optical isomerism	Lecture, Discussion	Evaluation through short test
	2.	R-S notation, enantiomers and diastereomers	3	To differentiate enantiomers and diastereomers	Lecture, Discussion	Formative assessment
	3.	Optical activity of compounds without asymmetric carbon atoms	2	To gain knowledge about optical activity	Lecture	Formative assessment
	4.	Methods of distinguishing geometrical isomers, determination of configuration of ketoximes	3	To get idea about geometrical isomerism	Lecture	Formative assessment, Short test
	5.	Conformational analysis of ethane, n-butane and cyclohexane energy diagrams.	2	To differentiate different energy diagrams	Question answer session, Lecture	Formative assessment, Assignment
<b>II</b>	<b>Spectroscopy-I</b>					
	1.	General principles, introduction to absorption and emission spectroscopy	2	To know about principles of spectroscopy	Lecture with PPT Illustration	Formative assessment
	2.	Types of electronic transitions-bathochromic and	2	To know the types of electronic transitions	Lecture, Illustration	Formative assessment

		hypsochromic shifts				
	3.	Application of Woodward Rules for calculation of $\lambda_{\text{max}}$ for different molecules	2	To understand clearly about the calculation of $\lambda_{\text{max}}$	Lecture, Discussion	Formative assessment, Short test
	4.	Photochemical reactions of ketones, Norrish type I and type II reactions	4	To study about photochemical reactions	Lecture, Discussion	Formative assessment, Online Quiz
<b>III</b>	<b>Spectroscopy-II</b>					
	1.	Molecular vibrations and origin of IR spectra - IR absorption positions of O, N and S containing functional groups	2	To know about molecular vibrations	Lecture, Illustration	Formative assessment, Assignment
	2.	Hydrogen bonding, conjugation, IR absorptions-fingerprint region	3	To learn about fingerprint region	Lecture, Illustration	Formative assessment
	3.	Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it	4	To analyse the factors influencing chemical shift	Lecture	Formative assessment Short test
	4.	Interpretation of NMR spectra of simple compounds	3	To recognise the various spectra compounds	Lecture with PPT Illustration	Seminar, Formative assessment

IV Alkaloids and Terpenoids						
	1.	Natural occurrence, structural features and isolation of alkaloids	2	To know about different alkaloids	Lecture	Formative assessment
	2.	Structural elucidation and synthesis of coniine, piperine and nicotine.	1	To understand and differentiate different alkaloids	Lecture, Discussion	Formative assessment, Short test
	3.	Significance of number of peaks and peak area. Spin-spin coupling and coupling constant.	2	To acquire knowledge about peaks and coupling constant	Lecture	Short test
	4.	Occurrence and classification of Terpenoids, isoprene rule	3	To evaluate and classify terpenoids	Lecture, Discussion	Formative assessment
	5..	Elucidation of structure and synthesis of citral, geraniol, menthol and $\alpha$ -terpeniol.	2	To know about the structure of various terpenoids	Lecture	Formative assessment
V Dyes						
	1.	Classification based on application and chemical structure with examples.	4	To know about the classification of dyes	Lecture, Discussion	Formative assessment
	2.	Colour and constitution of dyes. Chemistry of dyeing	3	To gather knowledge regarding the colour and constitution of dyes	Lecture	Formative assessment
	3.	Triphenyl methane dyes -	1	To understand the synthesis	Lecture, Illustration	Formative assessment,

		malachite green, rosaniline and crystal violet.		and application of dyes		Short test
	4	Phthalein dyes - Phenolphthalein and fluorescein. Anthraquinone dyes - Alizarin Indigo dyes- Indigo.	4	To learn the synthesis and applications of phthalein and anthraquinone dyes.	Lecture, Discussion	Formative assessment, Seminar

Course Instructor: G. Leema Rose



## Course Outcome

Semester

: VI

Major Core IX

Name of the Course

: Inorganic Chemistry III

Course code

: CC1762

CO - No.	Course Outcome Upon completion of course students will be able to	PSO	CL
CO - 1	name the coordination compounds	PSO - 1	A
CO - 2	explain the theories of coordination compounds	PSO - 1	U
CO - 3	predict the colour, magnetic properties and geometry of coordination compounds	PSO - 2	C
CO - 4	analyse the nature of bonding in coordination compounds	PSO - 3	An
CO - 5	minimize the errors in chemical estimation	PSO - 5	An
CO - 6	employ the methods to separate the inner transition elements	PSO - 4	Ap
CO - 7	compare the properties of lanthanides and actinides	PSO - 2	An
CO - 8	explain the principles of gravimetric analysis	PSO - 1	U

## Teaching Plan

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

Unit	Module	Topics	Lecture hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
<b>I</b>	<b>Co-ordination chemistry I</b>					
	1	Double salts – co-ordination compounds – difference, definition and terminology – co-ordination complexes and complex ions – central ion and ligands – co-ordination number – co-ordination sphere – charge on a complex ion.	3	Know the difference between double salts and coordination compounds.	Lecture, Showing available coordination compounds and double salts.	Evaluation through short test
	2	Types of ligands - examples for each. Nomenclature of co-ordination compounds	2	Name the coordination compounds.	Group discussion	Evaluation through short test
	3	Isomerism in co-ordination compounds, structural isomerism – ionisation, hydrate, co-ordination, linkage and co-ordination position isomerism.	2	Know the types of isomerism exhibited by coordination compounds.	Illustration Lecture	Assignment on isomerism
	4	Stereoisomerism – geometrical isomerism in tetrahedral and octahedral complexes - optical isomerism in octahedral complexes.	2	Know the types of isomerism exhibited by tetrahedral and octahedral compounds.	Lecture, Seminar	Evaluation through short test
<b>II</b>	<b>Co- ordination Chemistry – II</b>					
	1	Theories of co-ordination compounds- Werner's theory- postulates – verification of Werner's theory- cobalt ammine complexes.	4	Know the theories of coordination compounds	Question answer session	Multiple choice questions

	2	EAN rule – calculation of EAN with reference	3	Predict the stability of metal complexes.	Lecture	Short test Formative assessment – I
	3	Pauling's theory (VBT) – postulates - application of VBT to square planar and tetrahedral complexes, inner and outer complexes – merits and demerits of VBT. Shapes of d-orbitals.	4	Predict the structure of complexes using VBT.	Lecture with ppt  Group discussion	Short test Formative assessment – I
	4	Crystal field theory – Crystal field splitting of tetrahedral, square planar and octahedral systems. Factors affecting the value of CFSE – crystal field splitting energy values and its application in the stability of complexes.	5	Apply CFSE and predict the stability of complexes.	Assignment on CFSE	Multiple choice questions
<b>III</b>	<b>Co-ordination chemistry – III</b>					
	1	Molecular Orbital Theory (MOT)– MO diagrams of $ML_6$ type complexes – weak and strong field ligands – spectrochemical series.	3	Differentiate strong and weak field ligands.	Illustration, Seminar	Short test
	2	Stability of metal complexes – relation between stability constant and dissociation constant – factors affecting the stability of metal complexes from thermodynamic data. Irving William series – stabilization of unstable oxidation state.	3	Predict the stability of complexes.	Lecture, Group discussion	Assignment
	3	Substitution reactions of square planar	5	Understand the	Lecture with ppt	Assignment

		complexes – trans effect .		substitution reactions of complexes.		
	4	Metal carbonyls - classification – examples – structure and nature of M-L bond in metal carbonyls – structures of mono, di and polynuclear carbonyls of Ni, Cr, Fe, Co and Mn. Application of complexes in qualitative and quantitative analysis.	3	Apply coordination compounds in qualitative and quantitative analysis.	Lecture, Illustration	Assignment
<b>IV</b>	<b>Transition Elements:</b>					
	1	. Group discussion with special reference to electronic configuration, oxidation state, spectral and magnetic properties, colour, variable valency-polyvalency of Vanadium-magnetic and catalytic properties, ability to form complexes.	2	Know the general characteristics of transition elements.		Multiple choice questions
	2	Difference between the first, second and third transition series. Extraction, properties and uses of Cu, Co and Ni. Preparation and uses of titanium(II) oxide, vanadium (V) oxide, potassium dichromate, potassium permanganate, potassium ferrocyanide, Potassium ferricyanide, Vaska's compound, platinum	3	Differentiate the transition series.	Lecture with ppt	Formative assessment – II

		(IV) chloride, chloroplatinic acid and purple of Cassius.				
	3	<b>Inner transition Elements:</b> Electronic configuration, oxidation states, colour, spectral and magnetic properties. Causes and consequences of lanthanide contraction	3	Know the general characteristics of inner transition elements.	Lecture	Quiz
	4	Extraction of lanthanides from monazite sand - separation of lanthanides by ion-exchange method - uses of lanthanides. Comparison between lanthanides and actinides.	4	Compare lanthanides and actinides	Lecture	Quiz
	5	Extraction, properties and uses of thorium and uranium - zinc uranyl acetate, Uranium hexafluoride.	2	Know the extraction of Th and U	Lecture with ppt	Quiz
<b>V</b>	<b>Analytical Chemistry</b>					
	1	Types of errors- determinate and indeterminate errors- minimization of errors. Precision and accuracy- Comparison of precision and accuracy with example	3	Gain knowledge about errors.	Group discussion	Short test
	2	Standard deviation- mean deviation – relative mean deviation and coefficient of variance. Accuracy- absolute error- relative error- confidence limit- Rejection of a doubtful	2	Calculate standard deviation and mean deviation	Lecture.	Assignment

		value – Q Test and student T test .				
	3	Principles and requirements of gravimetric analysis, gravimetric steps- digestion, filtration, washing, drying and ignition.	2	Apply the principles of gravimetric analysis.	Demonstration	Formative assessment – III
	4	Mechanism of precipitation – factors affecting solubility of precipitate - co-precipitation- different types – prevention- post precipitation – prevention and difference between co-precipitation and post precipitation, precipitation from homogenous solution with examples.	4	Apply the principles of gravimetric analysis.	Lecture using ppt	Formative assessment – III

Course Instructor: R.Gladis Latha

## Course Outcome

Semester : VI  
Name of the Course : Physical Chemistry III  
Course code : CC1763

CO - No.	Course Outcome Upon completion of course students will be able to	PSO -	CL
CO - 1	Recall phase rule.	PSO - 1	R
CO - 2	Understand phase diagrams	PSO - 1	C
CO - 3	Differentiate various photochemical processes	PSO - 4	U
CO - 4	Interpret Jablonski diagram	PSO - 4	Ap
CO - 5	Apply the electrochemical principles in batteries	PSO - 3	Ap
CO - 6	To deduce the expressions of rate constant	PSO - 5	An
CO - 7	Evaluate pH using electrodes.	PSO - 5	E
CO - 8	Elucidate the structure of molecules using spectral data	PSO - 8	C

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

Unit	Module	Topic	Lecture Hours	Learning Outcome	Pedagogy	Assessment/Evaluation
I	<b>Phase Equilibria</b>					
	1.	Concept of phase , components and degrees of freedom (definitions and examples) Derivation of Gibb's phase rule.	2	To derive Gibb's phase rule	Lecture, Discussion	Formative assessment, Short test, Assignment, MCQ
	2.	Phase diagram for one component system – water and sulphur system	2	Construct phase diagram for water and sulphur system	Lecture	
	3.	Two component system	1	To construct phase diagram for two component system	Lecture, Discussion	
	4.	Reduced phase rule and simple eutectic systems.	1	Construct phase diagram for simple eutectic system	Ppt presentation	
	5.	Lead-silver system – Pattinson's process of de-silverisation of lead,freezing mixtures-KI-H <sub>2</sub> O system	2	Understand de-silverisation and potassium iodide-water system	Lecture	
	6.	Formation of compounds with congruent melting point	1	Understand congruent melting point	Ppt presentation	
	7.	Zinc-magnesium system and FeCl <sub>3</sub> -H <sub>2</sub> O system. Formation of compounds with incongruent melting points	2	Understand FeCl <sub>3</sub> -H <sub>2</sub> O system and incongruent melting points	Lecture	
	8.	Na <sub>2</sub> SO <sub>4</sub> -H <sub>2</sub> O system and Solid-	1	Construct Na <sub>2</sub> SO <sub>4</sub> -H <sub>2</sub> O	Lecture	



		gas equilibria		system		
	9.	CuSO <sub>4</sub> -H <sub>2</sub> O system.	1	Construct CuSO <sub>4</sub> -H <sub>2</sub> O system	Question answer session Lecture	
	10.	Efflorescence, deliquescence and hygroscopy	1	Understand and Efflorescence, deliquescence and hygroscopy	Lecture, Discussion	
<b>II</b>	<b>Chemical Kinetics</b>					
	1.	Rate of reaction, expression of rate, factors influencing rate of reaction and theories of reaction rates	2	To know factors influencing rate of reaction and theories of reaction rates	Lecture with PPT Illustration	Formative assessment, Short test, Assignment, MCQ
	2.	Order and molecularity of a reaction	1	Understand order and molecularity of a reaction	Lecture, Illustration	
	3.	Definition and examples, differences between order and molecularity of a reaction	1	Differentiate order and molecularity of a reaction	Lecture, Discussion	
	4.	Various orders of reaction and their derivation zero, first and second order reaction	2	Derive zero, first and second order reaction.	Ppt presentation	
	5.	Definition, examples and derivation of rate constant and half life period.	1	Know rate constant and half life period of a reaction	Lecture	
	6.	Methods of determining order of reaction, use of Differential, Integral, Half-life method and Ostwald's isolation	2	Determine order of reaction	Ppt presentation	

		methods.				
	7	Concept of activation energy, effect of catalyst and calculation of energy of activation (Arrhenius equation)	1	Derive Arrhenius equation	Lecture	
	8	Collision theory of bimolecular gaseous reactions( activated complex theory)	1	Derive activated complex theory	Lecture	
	9	Comparison of collision theory and activated complex theory.	1	Differentiate collision theory and activated complex theory	Question answer session Lecture	
	10	Lindeman's theory of unimolecular reactions and solving problems	2	Derive Lindeman's theory of unimolecular reactions and able to solve problems in this topic	Lecture, Discussion	
<b>III</b>	<b>Electrochemistry – I</b>					
	1.	Definition of conductance, specific conductance, equivalent conductance and molar conductance	1	Know conductance, specific conductance, equivalent conductance and molar conductance	Lecture, Illustration	Formative assessment, Short test, Assignment, MCQ
	2.	Factors affecting conductance of a solution	1	Understand factors affecting conductance of a solution	Lecture, Illustration	
	3.	Transport number , determination of transport number by Hittorf's method and moving boundary method	1	Able to determine transport number	Lecture	
	4.	Strong and weak electrolytes ,variation of	2	Able to derive Debye-Huckel theory of	Lecture with PPT Illustration	

		equivalent conductance with dilution and Debye-Huckel theory of strong electrolytes		strong electrolytes		
	5.	Debye-Huckel Onsager equation. Kohlrausch's law and its applications	2	Derive Debye-Huckel Onsager equation and Kohlrausch's law	Question answer session Lecture	
	6.	Applications of conductance measurements	2	Understand the applications of conductance measurements	Lecture, Discussion	
	7.	Determination of $\lambda$ infinity of weak acid and weak base and degree of dissociation of weak electrolytes	1	Determine degree of dissociation of weak electrolytes	Lecture, Illustration	
	8.	Solubility and solubility products of sparingly soluble salts and conductometric titrations and solving problems.	3	Understand solubility and solubility products of sparingly soluble salts and conductometric titrations. Able to solve problems in this topic	Lecture	
<b>IV</b>	<b>Electrochemistry – II</b>					
	1.	Electrochemical cells, chemical cells, reversible and irreversible cells and determination of EMF of cells	2	Understand Electrochemical cells – chemical cells – reversible and irreversible cells – EMF of cells	Lecture	Formative assessment, Short test, Assignment, MCQ
	2.	Cell representation, single electrode	1	Know various types of electrodes	Lecture, Discussion	

		potential, types of electrodes, metal-metal ion electrodes, amalgam electrodes and gas electrodes.			
	3.	Insoluble metal salt electrodes and oxidation – reduction electrodes. Standard hydrogen electrode (SHE) and calomel electrode	2	Understand standard hydrogen electrode (SHE) and calomel electrode	Lecture
	4.	Derivation of Nernst equation	1	Derive Nernst equation for emf of cells	Lecture, Discussion
	5.	Standard electrode potential, electrochemical series, thermodynamics of galvanic cells, $\Delta G$ , $\Delta H$ , $\Delta S$ and equilibrium constant (K).	2	To know electrochemical series and thermodynamics of galvanic cells $\Delta G$ , $\Delta H$ and $\Delta S$ and equilibrium constant (K)	Lecture with PPT Illustration
	6.	Concentration cells – with transference and without transference, liquid junction potential and its elimination.	1	Understand Concentration cells with transference and without transference and liquid junction potential and its elimination	Question answer session Lecture
	7.	Applications of EMF measurements, determination of transport number, valency of an ion, pH of a solution using hydrogen, quinhydrone and glass electrode.	2	Able to grasp Applications of EMF measurements, determination of transport number, valency of an ion, pH of a solution using	Lecture, Discussion

				hydrogen, quinhydrone and glass electrode.		
	8	Potentiometric titrations - acid-base, oxidation reduction and precipitation titrations.	1	Understand Potentiometric titrations	Lecture, Illustration	
	9	Decomposition potential and overvoltage and solving Problems	2	Know decomposition potential and overvoltage. Can able to solve problems from this topic	Lecture	
<b>V</b>	<b>Spectroscopy</b>					
	1.	Different regions of EMR spectrum, Born-Openheimer approximation ,types of molecular spectra – microwave (rotational) spectra theoretical principle, selection rule and applications in the determination of bond distance in diatomic molecules	4	To classify different regions of EMR and know about microwave spectroscopy.	Lecture, Discussion	Formative assessment, Short test, Assignment, MCQ
	2.	Vibrational (IR) spectra – theoretical principle, harmonic oscillator and unharmonicity – selection rule, intensity, modes of vibrations and types , force constant , applications of IR– hydrogen bonding	3	To gather knowledge regarding Vibrational spectra(IR)	Lecture	

		,Inter and Intramolecular hydrogen bonding				
	3.	Fermi resonance, overtones and combination bands.	1	To understand Fermi resonance, overtones and combination bands	Lecture, Illustration	
	4	Electronic spectra - selection rules, Frank types of transitions and applications. Raman spectra - theoretical principle, Stokes and anti-Stokes lines	2	To know Electronic and Raman spectra	Lecture, Discussion	
	5.	Comparison of IR & Raman Spectroscopy.	1	Differentiate between Raman spectra and IR Spectra.	Lecture, Discussion	
	6.	ESR spectra - theory and principle and hyperfine splitting ESR spectra of methyl radical.	2	To understand ESR Spectra	Lecture, Illustration	

Course Instructor: M. Anitha Malbi

