

**Semester - I**  
**Major Core I: GENERAL CHEMISTRY - I**  
**Course Code: CC2011**

Hours Per week	Credits	Total Hours	Marks
4	4	60	100

**Objectives**

- To gain basic knowledge on classification nomenclature of organic compounds
- To understand the quantum theory and wave mechanical concept
- To understand the chemistry of s - block elements and the principles of volumetric analysis

**Course Outcome**

COs	<i>Upon completion of this course, students will be able to</i>	PSO Addressed	Cognitive Level
CO - 1	understand the structure and naming of various organic compounds	PSO-1	U
CO - 2	interpret various electronic effects and chemical bonding	PSO-3	An
CO - 3	analyse the periodic properties of elements	PSO-2	An
CO - 4	apply wave mechanical concept in other fields	PSO-6	A
CO - 5	predict the properties of elements and the principle behind volumetric analysis	PSO-6	An

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

Unit	Module	Topics	Hours	Learning Outcome	Pedagogy	Assessment/Evaluation
<b>I</b>	<b>Classification and Nomenclature</b>					
	1	Classification of organic compounds - based on the nature of carbon skeleton and functional groups - classification of C and H atoms of organic compounds (primary/secondary/tertiary)	2	Classify organic compounds	Lecture and power point presentation	Evaluation through Multiple choice questions, short test, quiz, slip test and group discussion
	2	IUPAC system of nomenclature of common organic compounds (upto C-10) - alkanes, alkenes and alkynes. Naming of cycloalkanes, bicycloalkanes with and without bridges and aromatic compounds	4	Know about the IUPAC nomenclature of organic compounds	Lecture and power point presentation	Formative assessment I

	3	Naming of organic compounds with one functional group - halogen compounds, alcohols, phenol, aldehydes, ketones, carboxylic acids and its derivatives, cyano compounds, amines, nitro compounds	3	Learn to name organic compounds with one functional group	Lecture and seminar	
	4	Naming of compounds with two functional groups - naming of compounds with more than one carbon chain. Naming of heterocyclic compounds containing one and two hetero atoms present in five/six membered rings	3	Know to name organic compounds	Lecture with power point presentation	
<b>II</b>	<b>Bonding in Organic Molecules</b>					
	1	Hybridization and geometry - bond angle, bond length, bond strength of C-H and C-C bonds - Van der Waal's interactions, Inter & Intra molecular forces and their effects on physical properties	3	Classify the elements based on the force of attraction and properties.	Question answer session	Evaluation through Multiple choice questions, short test, quiz and slip test
	2	Electronic effects - inductive effect, resonance effect - drawing of resonance structures - conditions for resonance - stability of resonance structures	3	Know about various types of electronic effects	Lecture	Formative assessment I
	3	Hyper conjugation, electromeric effect, steric effect - steric overcrowding - steric inhibition of resonance - steric relief (with examples)	3	Distinguish various effects	Lecture with power point presentation and Group discussion	
	4	Dissociation of bonds - homolysis and heterolysis - radicals, carbocations, carbanions - electrophiles and nucleophiles - Influence of electronic effects - dipole moment - relative strengths of acids and bases - stability of olefins - stability of radicals, carbocations and carbanions	3	Know about electrophiles, nucleophiles and stability of different ions	Lecture with power point presentation	

<b>III Periodic Properties</b>						
	1	Atomic orbitals - Quantum numbers- Principal, Azimuthal, Magnetic and Spin quantum numbers and their significance	2	Know about various quantum numbers and filling up of atomic orbitals	Seminar and power point presentation	Evaluation through Multiple choice questions, short test, quiz and class test  Formative assessment II
	2	Principles governing the occupancy of electrons in various quantum levels- Pauli's exclusion principle - Hund's rule- Aufbau Principle, (n+1) rule	2	Learn about different principles governing the occupancy of electrons	Lecture and Problem solving	
	3	Stability of half-filled and completely filled orbitals- inert pair effect. Variation of metallic characters - Factors affecting the periodic properties	2	Remember the factors affecting the periodic properties	Lecture and Problem solving	
	4	Anomalies and variations in atomic radius, ionic radius, electronic configuration	2	Calculate the atomic radius and ionic radius	Problem solving	
	5	Variation of electron affinity and electro negativity, ionization energy, metallic character of elements along the group and periods	2	Distinguish various periodic properties	Illustration, Seminar and Power point presentation	
	6	Influence of various characters on stability, colour, coordination number, geometry, physical and chemical properties	2	Calculate coordination number	Power point presentation	
<b>IV Atomic Structure</b>						
	1	Planck's quantum theory - Photoelectric effect, Compton effect	2	Understand the Plank's quantum theory	Power point presentation and videos	Evaluation through Multiple choice questions, short test, quiz and class test
	2	Bohr's model of hydrogen atom	2	Know Bohr's model of hydrogen atom	Lecture	
	3	Wave particle duality, de Broglie equation, Heisenberg uncertainty principle	2	Learn to derive de Broglie equation	Lecture	

	4	Eigen function and Eigen value - Postulates of Quantum mechanics	2	Differentiate Eigen function and Eigen value	Problem solving	Formative assessment II
	5	Schrodinger's time independent wave equation (no derivation), wave functions and its physical properties -Normalization and Orthogonal function	4	Understand the importance of Schrodinger's wave equation	Lecture	
<b>V</b>	<b>i) s - block elements</b>					
	<b>ii) Principles of Volumetric Analysis</b>					
	1	Position of hydrogen in the periodic table, General characteristics of s - block elements. Compounds of s-block metals - oxides, hydroxides, peroxides, superoxide's-preparation and properties - oxo salts - carbonates - bicarbonates - nitrates - halides and polyhalides	3	Recognize the various metals, oxides and hydroxides	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz and class test  Formative assessment I
	2	Extraction of Be and Mg - physical and chemical properties - Uses	2	Understand the extraction process	Lecture with videos	
	3	Complexes of s-block metals - complexes with crown ethers - biological importance sodium and potassium - Organometallic compounds of Li and Be	1	Explicate the biological importance of sodium and potassium	Seminar	
	4	General principles of volumetric Analysis, Types of titrations. Requirements for titrimetric analysis. Concentration systems	1	Know about the principles of volumetric analysis	Power point presentation, seminar	
	5	Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point	2	Understand the criteria of preparation of standard solutions	Demonstration	
	6	Neutralisation-titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange	1	Acquire knowledge about the use of indicators.	Demonstration	

	7	Complexometric titrations: Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics. Problems based on titrimetric analysis	2	Analyse the stability of complexes	Problem solving	
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Course Instructor: Dr. R. Gladis Latha

HOD: Dr. G. Leema Rose

**Semester I**  
**Allied Chemistry - Botany and Zoology Major**  
**Chemistry for Life Sciences**  
**Course Code: CA2011**

Hours Per week	Credits	Total Hours	Marks
4	3	60	100

**Objectives:**

- To acquire knowledge on atomic structure and bonding
- To understand the importance of photochemistry and catalysis
- To apply the principles of chromatography techniques

**Course Outcome**

COs	<i>Upon completion of this course, the students will be able to:</i>	PSO Addressed	Cognitive Level
CO-1	remember the structure and bonding in atoms and molecules	PSO-1	R
CO-2	analyse the types of bonding and the ways of expressing concentration in molecules	PSO-2	An
CO-2	understand the concepts of biophysical analysis, catalysis and buffer action	PSO-1	U
CO-3	apply the concepts of photochemistry and chromatography to various chemical processes.	PSO-6	A

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

Unit	Module	Topics	Hours	Learning Outcome	Pedagogy	Assessment/Evaluation
<b>I</b>	<b>Atomic Structure</b>					
	1	Dual nature of electron, de-Broglie equation	2	Acquire knowledge on Dual nature of electron and de-Broglie equation	Lecture, power point presentation and videos	Evaluation through Multiple choice questions, short test, quiz
	2	Davisson and Germer experiment	1	Understand Davisson and Germer experiment	Lecture and power point presentation	
	3	Heisenberg's uncertainty principle and its significance	1	Understand Heisenberg's uncertainty principle and its significance	Lecture, power point presentation and discussion	Formative assessment I

	4	Compton effect - Schrodinger's wave equation and its significance, eigen values and eigen functions, quantum numbers and their significance	3	Distinguish eigen values and eigen functions	Lecture and power point presentation	
	5	Atomic orbitals - significance, shapes, difference between orbit and orbital	1	Differentiate between orbit and orbital	Lecture, power point presentation and illustration	
	6	Rules for filling up of orbitals - Pauli's exclusion principle, Aufbau principle and Hund's rule	2	Know about different principles governing the filling up of orbitals	Lecture and power point presentation	
	7	Electronic configuration of elements up to 20	2	Gain knowledge on the filling up of atomic orbitals	Lecture and power point presentation	
<b>II</b>	<b>Chemical bonding</b>					
	1	Ionic bond, formation of ionic bond, general characteristics of ionic compounds	1	Know about ionic bond and its characteristics	Lecture and power point presentation	Evaluation through Multiple choice questions, short test, quiz
	2	Lattice energy, Born-Haber cycle and its applications	2	Understand lattice energy	Lecture and power point presentation	
	3	Covalent bond - formation of covalent bond with examples characteristics of covalent compounds	2	Gain Knowledge about Covalent bond	Lecture and power point presentation	Formative assessment I
	4	Ionic character in covalent compounds, Fajan's rule	1	Acquire knowledge about Ionic character and Fajan's rule	Lecture and power point presentation	
	5	Coordinate bond - formation of coordinate bond with examples.	2	Understand Coordinate bond formation	Lecture and Power point presentation	
	6	Metallic bond -band theory, conductors, insulators and semiconductors.	2	Explicate the difference between conductors, insulators, semiconductors	Lecture with power point presentation	

	7	Hydrogen bonding - types - inter and intramolecular and effect of hydrogen bonding.	2	Understand Hydrogen bonding and its effect	Lecture with power point presentation	
<b>III</b>	<b>Photochemistry</b>					
	1	Importance of photochemistry, difference between thermal and photochemical reactions. Laws of photochemistry - Beer-Lambert's Law, Grother's- Drapers law and Stark-Einstein's law	3	Differentiate between thermal and photochemical reactions	Lecture and power point presentation	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 - fluorescence, phosphorescence. Difference between fluorescence and phosphorescence	3	Understand various electronic excitations	Lecture and power point presentation	
	3	Types of photochemical reactions based on quantum efficiency ( $\phi = 1$ , $\phi < 1$ and $\phi > 1$ ) - primary and secondary process of photochemical reactions	2	Differentiate primary and secondary process of photochemical reactions	Lecture and power point presentation	
	4	Photochemical rate law - kinetics of photochemical combination of H <sub>2</sub> and Cl <sub>2</sub> and decomposition of HI	2	Acquire knowledge about kinetics of photochemical combination of H <sub>2</sub> and Cl <sub>2</sub> - decomposition of HI	Lecture with power point presentation	
	5	Photosensitization, photosensitizers, chemiluminescence and bioluminescence	2	Differentiate chemiluminescence and bioluminescence.	Lecture with power point presentation	



<b>IV Biophysical Analysis and Catalysis</b>						
	1	Osmosis, osmotic pressure and isotonic solutions	1	Understand Osmosis, osmotic pressure, isotonic solutions	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II
	2	Determination of molar mass by osmotic pressure measurement	2	Acquire knowledge on molar mass by osmotic pressure measurement	Lecture with power point presentation	
	3	Reverse osmosis	1	Understand reverse osmosis	Lecture and power point presentation	
	4	Adsorption - types, factors influencing adsorption and applications of adsorption	2	Acquire knowledge on adsorption, types, factors influencing adsorption and its applications	Lecture and power point presentation	
	5	Catalysis - types, theories, intermediate compound formation theory and adsorption theory	3	Understand catalysis, types and theories	Lecture and power point presentation	
	6	Enzyme catalysis - Michaelis-Menten equation and theory	3	Understand Enzyme catalysis, Michaelis, Menten equation	Lecture and power point presentation	
<b>V Analytical Chemistry</b>						
	1	Methods of expressing concentration - normality, molarity, molality, mole fraction, ppm and ppb	2	Understand methods of expressing concentration of solution	Lecture and power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Ionic product of water - pH and pOH	1	Acquire knowledge about Ionic product of water, pH and pOH	Lecture and power point presentation	
	3	Strength of acids and bases - $K_a$ and $K_b$ , $pK_a$ and $pK_b$	2	Understand strength of acids and bases	Lecture and power point presentation	
	4	Buffer solutions - examples and theory of buffer action	1	Know about buffer solutions and theory of buffer action	Lecture and power point presentation	

5	Chromatography - classification, Column chromatography - principle, experimental techniques, factors affecting column efficiency and its applications	2	Understand chromatography and column chromatography	Lecture with videos
6	TLC - principle, experimental techniques, advantages, limitations and applications	1	Know about TLC	Lecture with videos
7	GC – principle, experimental techniques and applications	2	Acquire knowledge about GC	Lecture with videos
8	HPLC - principle and experimental technique	1	Understand HPLC	Lecture with videos

Course Instructor: Dr. S. Ajith Sinthuja

HOD: Dr. G. Leema Rose

**Semester - I**  
**Part IV: NME**  
**Applied Chemistry - I**  
**Course Code: CNM201**

Hours Per week	Credits	Total Hours	Marks
2	2	30	100

**Objectives:**

- To know the preparation and importance of agrochemicals
- To acquire knowledge about soaps and sugar
- To understand the chemicals used in day to day articles

**Course Outcome**

CO	<i>Upon completion of this course, the students will be able to:</i>	PSO Addressed	Cognitive Level
CO-1	remember the importance of soaps and detergents	PSO-2	R
CO-2	analyse the characteristics and advantages of agrochemicals	PSO-2	An
CO-2	understand the process of manufacture of sugar and paper	PSO-4	U
CO-3	apply the chemical reactions to synthesize day to day articles	PSO-4	A

**Total Number of Contact hours: 30 (Including lectures, assignments and tests)**

Unit	Section	Topics	Hours	Learning outcome	Pedagogy	Assessment / Evaluation
<b>I</b>	<b>Fertilizers</b>					
	1	Plant nutrients - macronutrients - micronutrients -need for fertilizers - characteristics of a good fertilizer -role of N, P and K in plant growth	2	Know the role of nutrients and fertilizers in plants	Lecture and power point presentation	Evaluation through Multiple choice questions, short test, quiz
	2	Classification of fertilizers - natural fertilizers - artificial fertilizers - manufacture and uses of artificial fertilizers -urea - calcium cyanamide	2	Classify fertilizers and understand the method of manufacturing	Lecture and discussion	Formative assessment I

	3	Calcium ammonium nitrate - superphosphate of lime- triple superphosphate - potassium chloride. Biofertilizers and their advantages	2	Remember the methods of manufacture of fertilizers	Explanation using equations	
<b>II</b>	<b>Pesticides</b>					
	1	Pesticides- classification based on the use and chemical composition. Insecticides- structure and uses of lead arsenate - calcium arsenate - methoxychlor - baygon - malathion- D.D.T. - BHC	2	Classify and know the structure and uses of pesticides	Lecture	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Fungicides - preparation and uses of limesulphur - bordeaux mixture - sodium sulphate - thallium sulphate	2	Remember the uses and methods of preparation of fungicides	Lecture and group discussion	
	3	Weedicides - structure and uses of butachlor - eptam - DNOC. Rodenticides - preparation and uses of zinc phosphide - aluminium phosphide - warfarin	2	Analyse the characteristics and advantages of weedicides and rodenticides	Lecture and power point presentation	
<b>III</b>	<b>Soaps and detergents</b>					
	1	Soaps -classification -hard soap - soft soap - raw materials -manufacture of toilet soap - transparent soap - liquid soap - medicated soap - herbal soap - cleansing action of soap	3	Acquire knowledge about soaps	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II

	2	Detergents - classification - examples- advantages of detergents over soaps -detergent action -detergent chemicals-additives - excipients - colors - flavours - environmental hazards	3	Remember the importance of detergents	Lecture and group discussion	
<b>IV</b>	<b>Sugar and Paper industry</b>					
	1	Sugar -manufacture - double sulphitation process - refining and grading of sugar-sugar substitute - saccharin - synthesis and uses - manufacture of ethanol from molasses.	2	Understand the process of manufacture and uses of sugar and sugar substitute	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II
	2	Paper - manufacture - production of wood pulp by sulphate process - processing - blending - beating - refining and calendaring -	2	Understand the process of manufacture of paper	Lecture and discussion	
	3	Types of paper - printing paper – newsprint paper - writing paper - wrapping paper - bond paper - art paper - blotting paper - tissue paper - parchment paper - cardboard.	2	Remember the types of paper	Peer group teaching	
<b>V</b>	<b>Chemicals in day-to-day life</b>					
	1	Ingredients and preparation of tooth powder - tooth paste - writing inks - gum paste - boot polish - talcum powder	3	Apply chemical principles to prepare articles of day - to-day life.	Lecture with power point presentation	Evaluation through Multiple choice questions, short test,

	2	Ingredients and preparation of sealing wax - agar agar - chalk crayons -liquid blues - camphor tablets - agar battis - phenoyl- moth balls.	3	Apply chemical principles to prepare articles of day - to-day life	Peer group teaching	quiz Formative assessment I
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Course Instructor: Ms. L. Deva Vijila

HOD: Dr. G. Leema Rose

**Semester – III**  
**Major Core – III : GENERAL CHEMISTRY - III**  
**Course Code: CC2031**

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

**Objectives**

- To gain knowledge on aromaticity, aromatic compounds and electrophilic substitution reactions.
- To understand the characteristics of (Group 13 and 14) Group 14 and 15)
- To gain knowledge on different colloids and photochemical processes

**Course Outcome**

COs	Upon completion of this course, the students will be able to:	PSO Addressed	Cognitive Level
CO - 1	gain knowledge on aromatic compounds	PSO -1	U
CO - 2	synthesize aromatic compounds	PSO -4	Ap
CO - 3	remember the characteristics of group 13 and 14 elements	PSO -2	U
CO - 4	predict the chemistry of nitrogen and oxygen family	PSO -2	E
CO - 5	to understand the different colloidal systems	PSO -1	Ap
CO - 6	explain the various photochemical processes	PSO -1	U

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

Unit	Module	Topic	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
I	<b>Aromatic Compounds</b>					
	1	Aromaticity - definition - Huckel's rule - consequence of aromaticity-structure of benzene - stability, carbon-carbon bond lengths in benzene ring - resonance energy	3	Understand about aromaticity, stability of benzene and resonance energy	Lecture and discussion	Evaluation through Multiple choice questions, short test, quiz
	2	Aromatic electrophilic substitution - general pattern of the mechanism involving $\sigma$ and $\pi$ complexes, mechanism of nitration, halogenation, sulphonation	3	Know about Aromatic electrophilic substitution reactions	Lecture and discussion	Formative assessment I

	3	Mercuration, formylation and Friedel-Crafts reaction - Energy profile diagrams. Activating and deactivating substituents - orientation in mono substituted benzenes	2	Gain knowledge about activating and deactivating substituents	Lecture	
	4	Reactions of aromatic side chain - halogenation and oxidation - methods of formation and Chemical reactions of alkylbenzenes	2	Know about reactions of aromatic compounds	Lecture	
	5	Biphenyl, naphthalene and anthracene - synthesis of 3-nitrotoluene, 4-bromonitro benzene, 4-bromoacetophenone, 3-(4-nitrophenyl)prop-1-ene, 3-nitrostyrene	2	Understand about the synthesis of benzene compounds	Question answer session and lecture	
<b>II</b>	<b>p-block elements – Boron and Carbon family (Group 13 and 14)</b>					
	1	General characteristics of elements of Group 13 - extraction of boron physical and chemical properties of boron	3	Know about characteristic, extraction and properties of boron	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Compounds of boron - borax, boric acid, diborane, boron nitride- extraction of Al -physical and chemical properties - uses	3	Know the compounds of boron along with uses	Lecture and illustration	
	3	Compounds of aluminium -Al <sub>2</sub> O <sub>3</sub> , AlCl <sub>3</sub> , alums - alloys of Aluminium. General characteristics of elements of Group 14 - allotropic forms of carbon - structure of graphite, diamond and fullerene	3	Understand clearly about the Allotropic forms of carbon	Lecture and discussion	
	4	Chemistry of charcoal-chemistry of oxides of carbon-preparation of silicon - physical and chemical properties of Si - uses -oxides of silicon - structures of silicates - chemistry of silicones	2	Study about chemistry of silicones	Lecture and discussion	



	5	Manufacture of glass - types of glasses - ceramics - extraction of lead - physical and chemical properties - uses - lead pigments	2	Understand about the extraction, properties and uses of lead	Question answer session and lecture	
III	<b>p-block elements – Nitrogen and Oxygen family (group 15 and 16)</b>					
	1	General characteristics of elements of group 15 - Preparation of nitrogen - physical and chemical properties of nitrogen – uses	2	Know about Characteristic, extraction, properties and uses of nitrogen	Lecture and illustration	Evaluation through Multiple choice questions, short test, quiz
	2	Chemistry of nitrogen - hydrazine, hydroxylamine, hydrazoic acid, nitric acid - nitrogen cycle. Preparation, physical and chemical properties and uses of phosphorus	3	Learn about chemistry of nitrogen compounds	Lecture and illustration	Formative assessment II
	3	Chemistry of $\text{PH}_3$ , $\text{PCl}_3$ , $\text{PCl}_5$ , $\text{POCl}_3$ , $\text{P}_2\text{O}_5$ and oxyacids of phosphorous - phosphate fertilizers - super phosphate of lime-triple super phosphate	1	Analyse the effects of phosphate fertilizers and super phosphate	Lecture	
	4	Oxides of nitrogen and Phosphorous - oxoacids of nitrogen and phosphorus. Anomalous behavior of oxygen - allotropy of oxygen and phosphorous	3	Know about allotropy of oxygen and its anomalous behaviour	Lecture with power point Illustration	
	5	Structure of ozone, oxides - peroxides, suboxides, basic oxides, amphoteric oxides, acidic oxides, neutral oxides - oxides of sulphur - oxoacids of sulphur - sulfuryl compounds - extraction - uses - selenium and tellurium	3	Understand about oxides and oxoacids of sulphur	Question answer session and lecture	

IV	Colloids					
	1	Definition -classifications - lyophobic and lyophilic colloids - differences. True solutions, colloidal solutions and suspension - definition and characteristics	3	Know about true, colloidal solutions and suspensions	Lecture	Evaluation through Multiple choice questions, short test, quiz
	2	Preparation of colloidal solutions - dispersion methods and condensation methods- purification of colloidal solutions- optical properties-Tyndall effect	3	Understand about different methods of colloidal solutions	Lecture and discussion	Formative assessment II
	3	Kinetic properties - Brownian motion- electrical properties- Helmholtz and diffuse double layers - electro kinetic or zeta potential - electrophoresis - applications -coagulation	3	Acquire knowledge about kinetic and electric properties	Lecture	
	4	Methods- Hardy Schultz law -Hofmeister series - protective colloids - protective action - gold number -applications	2	Know about methods of colloids	Lecture and discussion	
	5	Emulsions - classification, preparation, Gels - preparation - properties - thixotropy -syneresis- imbibitions - application of colloids	1	Study about emulsions, gels and applications of colloids.	Lecture with power point presentation	
V	<b>Photo Chemistry</b>					
	1	Introduction-comparison of thermal and photochemical reactions Laws of photochemistry - Beer-Lamberts law- Grothus-Drapper law - Stark-Einstein law of photochemical equivalence	3	Know about the Laws of photochemistry	Lecture and discussion	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I

2	Quantum efficiency - determination of quantum efficiency - chemical actinometry -consequence of light absorption - Jablonski diagram	3	Gather knowledge regarding quantum efficiency and Jablonski diagram	Lecture	
3	Radiative and non-radiative transitions- primary and secondary processes-fluorescence-phosphoresence – photochemical reactions	1	Understand about primary and secondary processes	Lecture and Illustration	
4	Photochemical rate law- kinetics of photochemical combination of H <sub>2</sub> and Cl <sub>2</sub> , H <sub>2</sub> and Br <sub>2</sub> and decomposition of HI – energy transfer in photochemical reactions	2	Learn about kinetics of photochemical reactions.	Lecture and Discussion	
5	Photosensitization - photosynthesis in plants – chemiluminescence - thermoluminescence- bioluminescence. Lasers- principle-types- applications.	2	Know about different types of lasers	Lecture wit power point presentation	

Course Instructor: Dr. G. Leema Rose

HOD: Dr. G. Leema Rose

**Semester - III**  
**Major Elective I a– Pharmaceutical Chemistry**  
**Course Code: CC2032**

Hours / Week	Credits	Total hours	Marks
4	3	60	100

**Objectives:**

- To understand the classification, sources, design and action of common drugs.
- To impart knowledge on various diseases and treatment.

**Course Outcome**

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO-1	to understand the characteristics, classification and sources of drugs	PSO-1	U
CO-2	interpret the chemical structure and pharmacological activities of drugs	PSO-3	E
CO-3	compare the action of various drugs	PSO-2	An
CO-4	design common drugs and interpret their therapeutic uses	PSO-5	Ap
CO-5	identify common diseases, their causes and treatment	PSO-2	An

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

Unit	Module	Topics	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
<b>I</b>	<b>Classification and sources of drugs</b>					
	1	Important terminologies used in pharmaceutical chemistry - pharmacy - pharmacology - pharmacodynamics - pharmacokinetics- pharmacophore-metabolites- antimetabolites-action mycetes- chemotherapy-pharmacopoeia- pharmacognosy- pharmacotherapeutics	3	Gain knowledge about the various terminologies used in pharmaceutical chemistry	Lecture	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Classification of drugs -drugs acting on central and peripheral nervous system- chemotherapeutic drugs - pharmacodynamic agents	2	Understand the action of drugs and classify them	Lecture	

	3	Drugs for metabolic diseases and endocrine function. Nature and sources of drugs - various sources of drugs	2	Know the sources, nature, functions of drugs	Lecture with power point presentation	
	4	Drug development -pre-clinical and clinical trials	3	Understand the various steps involved in drug development	Lecture	
	5	Patenting and legal issues - chemical and process development	2	Gain knowledge about the importance of patenting	Lecture with power point presentation	
<b>II</b>	<b>Drug Design and chemicals in medicine</b>					
	1	Introduction- physical and chemical properties of drugs	3	Recall the physical and chemical properties of drugs	Question answer session	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Designing of drugs procedures followed lead component methods of lead discovery lead modification	3	Understand the steps involved in designing of drugs	Lecture	
	3	Prodrugs types-applications drawbacks soft drug advantages. Physical and chemical factors of drug design	2	Explain about prodrugs	Lecture with group discussion	
	4.	Chemical structure and pharmacological activities of drugs	2	Draw the structure of various drugs	Group discussion	
	5.	Preparation, properties and uses of alum-aluminium hydroxide gel -phosphoric acid -arsenous anhydride-ferrous fumarate – ferric ammonium citrate - mercury with chalk (Grew powder)	2	Understand the methods of preparing drugs and recall their properties and uses	Lecture method	
<b>III</b>	<b>Drug Action and Metabolism of drugs</b>					
	1	General principles - assay of drugs - biological assay	2	Get idea about general principles and assay of drugs	Seminar	Evaluation through Multiple choice questions,

	2	Absorption - drug distribution - drug metabolism	2	Predict the mechanism of drug absorption	Lecture and power point presentation	short test, quiz Formative assessment II
	3	Biological role of salts of sodium, potassium, calcium, zinc and iodine. Agonist and antagonist. Receptor forces - types - theories	3	Recognize the role of salts in drugs	Lecture	
	4	Mechanism of drug action - actions at extra cellular site - actions at cellular site. Mechanism of different types of drug action	2	Write the mechanisms of drug action	Lecture	
	5	Time response relationships - dose response relationship - biotransformation of drugs. Metabolism of drugs - oxidation -reduction -hydrolysis - conjugation	3	Know the metabolism of drugs	Lecture	
<b>IV</b>	<b>Common Drugs</b>					
	1	Antibacterial drugs -preparation and therapeutic uses of sulpha drugs - sulphanilamide - sulphadiazine - sulphathiazole-sulphafurazole -prontosil. Mechanism of action of sulpha drugs	3	Know about antibacterial drugs	Lecture and Seminar	Evaluation through Multiple choice questions, short test, quiz Formative assessment II
	2	Antibiotics - classification based on chemical structure and biological action - structure and therapeutic uses of chloramphenicol - Penicillin - Streptomycin - Tetracyclin - Erythromycin	3	Know the importance of antibiotics	Lecture and group discussion with power point	
	3	Antiseptics and Disinfectant- distinction between antiseptics and disinfectants. Disinfectant- definition - examples - phenol -preparation and uses -chloroxylenol- structure - properties and uses. Antiseptics- Chloramine T - preparation and uses -crystal violet -structure and uses	3	Differentiate and know the importance of antiseptics and disinfectants.	Lecture	

	5	Antipyretics - definition - examples - aspirin -methyl salicylate -paracetamol, phenacetin - preparation and therapeutic uses	3	Understand the importance of antipyretics	Lecture	
<b>V</b>	<b>Common diseases and treatment</b>					
	1	Insect borne diseases - malaria and filariasis. Airborne diseases - diphtheria-influenza and TB. Waterborne diseases - cholera and typhoid	2	Know about insects borne diseases	Lecture and discussion	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Blood pressure - definition- factors affecting blood pressure- systolic pressure - diastolic pressure - pulse pressure - blood pressure levels. Hyper tension- types - control antihypertensive agents. Hypotension - measurement	3	Understand the reasons and methods of treating blood pressure	Lecture with power point presentation	
	3	Anaemia - symptoms and causes - types - antianaemic drugs - types	3	Realize the causes and symptoms of anaemia	Lecture and group discussion	
	4	Cardio-vascular drugs cardiac-glycosides- cardiovascular action - antiarrhythmic drugs- functions -therapeutic uses	2	Gain knowledge about cardio - vascular drugs	Lecture with power point presentation	
	5	Vasodilators or vasopressor - definition- examples - antianginal drugs -example. Cancer -causes -antineoplastic agents-cis-platin-vinblastine and mustine	2	Explain the importance of vasodilators and antineoplastic drugs	Lecture	

Course Instructor: Ms. L. Deva Vijila

HOD: Dr. G. Leema Rose

**Allied Chemistry for Physics Major**  
**Semester III**  
**Inorganic and Physical Chemistry**  
**Course Code: CA2031**

Hours / week	Credits	Total hours	Marks
4	4	60	100

**Objectives**

1. To acquire knowledge on atomic structure and bonding
2. To know about metallurgy and the structure of solids
3. To understand the principles of nuclear reactions

**Course Outcome**

CO	<i>Upon completion of this course, the students will be able to:</i>	PSO addressed	Cognitive level
CO-1	remember the structure and bonding in atoms and molecules	PSO-1	R
CO-2	know about different types of bonding	PSO-2	Y
CO-2	understand the metallurgical processes and the methods of purification of metals	PSO-6	A
CO-3	understand the concepts of solid state chemistry and nuclear chemistry	PSO-1	U

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

Unit	Module	Topics	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
<b>I</b>	<b>Atomic Structure</b>					
	1	Dual nature of electron - de-Broglie equation	2	Acquire knowledge on Dual nature of electron and de-Broglie equation	Lecture and power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Davisson and Germer experiment	1	Learn Davisson and Germer experiment	Lecture and power point presentation	
	3	Heisenberg's uncertainty principle and its significance.	1	Understand Heisenberg's uncertainty principle and its significance	Lecture and power point presentation	
	4	Compton effect - Schrodinger's wave equation and its significance	1	Understand Schrodinger's wave equation	Lecture and power point presentation	
	5	eigen values and eigen functions	1	Distinguish eigen values and eigen functions	Lecture and power point presentation	



	6	quantum numbers and their significance	2	Understand the various quantum numbers	Lecture and power point presentation	
	7	Atomic orbitals - shapes - significance - difference between orbit and orbital	1	Differentiate between orbit and orbital	Lecture and power point presentation	
	8	Rules for filling up of orbitals - Pauli's exclusion principle - Aufbau principle - Hund's rule	2	Know about different principle Governing the filling up of orbitals	Lecture and power point presentation	
	9	Electronic configuration of elements	1	Know about the filling up of atomic orbital	Lecture and power point presentation	
<b>II</b>	<b>Chemical bonding</b>					
	1	Ionic bond, formation of ionic bond, general characteristics of ionic compounds	1	Know about ionic bond and its characteristics	Lecture and power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Lattice energy, Born-Haber cycle and its applications	1	Understand Lattice energy	Lecture and power point presentation	
	3	Covalent bond, formation of covalent bond with examples, general characteristics of covalent compounds	1	Gain knowledge about covalent bond	Lecture and power point presentation	
	4	Ionic character in covalent compounds, M.O. theory	1	Acquire knowledge about Ionic character	Lecture and power point presentation	
	5	Fajan's rule. percentage of ionic character and bond moment	1	Understand Fajan's rule	Lecture and power point presentation	
	6	bonding, antibonding and non-bonding molecular orbitals	1	Explicate the difference between bonding, antibonding and non-bonding molecular orbitals	Lecture and power point presentation	
	7	M.O diagram of H <sub>2</sub> , N <sub>2</sub> , O <sub>2</sub> and F <sub>2</sub> , bond order	2	Draw the M.O diagram of H <sub>2</sub> , N <sub>2</sub> , O <sub>2</sub> and F <sub>2</sub>	Lecture and power point presentation	
	8	Coordinate bond - formation of coordinate bond with examples	1	Understand Coordinate bond formation	Lecture and power point presentation	

	9	Metallic bond, band theory, conductors, insulators and semiconductors	1	Explicate the difference between conductors, insulators and semiconductors	Lecture and power point presentation	
	10	Hydrogen bonding types - inter and intramolecular, effect of hydrogen bonding	2	Understand Hydrogen bonding and its effect	Lecture and power point presentation	
<b>III</b>	<b>Metallurgy and Alloys</b>					
	1	Difference between minerals and ores, metallurgical processes, gravity separation and magnetic separation	3	Differentiate minerals and ores	Lecture and power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II
	2	Froth floatation process, roasting, calcination, smelting	1	Understand various ore dressing methods	Lecture and power point presentation	
	3	purification of metals, electrolytic refining and zone refining	1	Understand various purification methods	Lecture and power point presentation	
	4	Van - Arkel de-Boer process, Kroll's process. Extraction and uses of Ti ,V, W and Mo	2	Understand the extraction of metals	Lecture and discussion	
	5	Purpose of making alloys, types of alloys - ferrous alloys and non-ferrous alloys and preparation of alloys	2	Gain knowledge on alloys.	Lecture and power point presentation	
	6	Heat treatment of alloys, composition and uses of bronze and german silver	1	Understand the types of alloys.	Lecture and discussion	
	7	Nichrome, monel metal, stainless steel, gun metal and bell metal	2	Gain knowledge on types of metals.	Lecture and discussion	
<b>IV</b>	<b>Solid State Chemistry</b>					
	1	Amorphous and crystalline solids, difference between amorphous and crystalline solids	2	Differentiate amorphous and crystalline solids	Lecture and power point presentation	Evaluation through Multiple choice questions, short test,

	2	Isotropy and anisotropy, elements of symmetry, plane of symmetry, axis of symmetry, centre of symmetry and law of rational indices	2	Understand various symmetry elements	Lecture and power point presentation	quiz  Formative assessment II
	3	Miller indices and elements of symmetry of a cubic crystal	1	Gain knowledge on miller indices	Lecture and power point presentation	
	4	Point groups and seven basic crystal system, Bravais lattice	2	Understand basic crystal system.	Lecture and power point presentation	
	5	Bragg's equation-derivation, determination of crystal structure by powder method	3	Gain knowledge on determination of crystal structure	Lecture and power point presentation	
	6	Structure of crystals - diamond, graphite and fullerene. Imperfections in a crystal - Point defect, Schottky defect, Frenkel defect, metal excess defect, metal deficiency defect	2	Understand the structure of graphite and diamond	Lecture and power point presentation	
<b>V</b>	<b>Nuclear Chemistry</b>					
	1	Nuclear forces, nuclear size, atomic mass unit, N/P ratio, packing fraction, mass defect and binding energy	2	Understand packing fraction and binding energy	Lecture and power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Radioactivity - $\alpha$ , $\beta$ , $\gamma$ radiations and properties, Soddy's group displacement law	1	Knowledge on $\alpha$ , $\beta$ and $\gamma$ radiations	Lecture and power point presentation	
	3	Natural radioactivity - detection and measurement of radioactivity by Geiger-Muller method	2	Know the detection and measurement of radioactivity	Lecture and power point presentation	
	4	Rate of radioactive disintegration, decay constant, half-life period and average life period	1	Gain knowledge on decay constant and half life	Lecture and power point presentation	

	5	Nuclear reactions - nuclear fission, principle of atom bomb, nuclear reactor, radioactive hazards and disposal of radioactive waste from nuclear reactors	2	Understand the types of nuclear reactions and nuclear hazards	Lecture and power point presentation	
	6	Nuclear fusion - principle of hydrogen bomb and stellar energy	1	Understand hydrogen bomb	Lecture and power point presentation	
	7	Principle and working of cyclotron. Applications of radio activity	2	Gain knowledge on cyclotron	Lecture and power point presentation	
	8	Radioactive tracers in agriculture, medicine and industry. Radiocarbon dating	1	Gain knowledge on various applications of radioactivity	Lecture and power point presentation	

Course Instructor: Dr. M. Anitha Malbi

HOD: Dr. G. Leema Rose

**Semester - V**  
**Major Core V: ORGANIC CHEMISTRY- I**  
**Course Code: CC2051**

Hours Per week	Credits	Total hours	Marks
5	5	75	100

**Objectives:**

- To understand symmetry elements, stereo isomerism and conformational analysis of organic compounds.
- To know the methods of synthesis and the reactions of carbonyl, nitrogen containing and heterocyclic compounds.

**Course Outcome**

COs	Upon completion of course students will be able to	PSO Addressed	Cognitive Level
CO - 1	understand the concept of optical activity, stereoisomerism and stereo isomers.	PSO-1	U
CO - 2	remember the preparation and synthesis of carbonyl, Nitrogen containing and heterocyclic compounds.	PSO-4	R
CO - 3	apply the synthetic methods to synthesize new compounds	PSO-4	A
CO - 4	analyze the synthetic importance of different organic compounds	PSO-2	An
CO - 5	create alternate routes to prepare new compounds.	PSO-5	C

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

Unit	Module	Topic	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
<b>I</b>	<b>Stereochemistry</b>					
	1	Optical activity-elements of symmetry, optical activity of compounds containing asymmetric carbon atoms - lactic and tartaric acids. Chirality-achiral carbon molecules - (+), (-) and D, L notations	2	Understand the concept of optical activity	Lecture with models	Evaluation through quiz, slip test, group discussion and problem solving
	2	Projection formulae - Newmann, Fischer, Flying wedge, Sawhorse and projection formulae notation for optical isomers, Cahn - Ingold and Prelog rules, R-S notation	3	Predict the projection formulae and R-S notation of optical isomers	Lecture and group discussion	

	3	Enantiomers and diastereomers, racemic and mesoforms. Racemisation-resolution of racemic mixtures. Walden inversion and asymmetric synthesis	2	Categorize optical isomers and define the racemization and asymmetric synthesis	Lecture	Formative assessment I
	4	Optical activity of compounds without asymmetric carbon atoms-biphenyl, allenes and spiranes	2	Illustrate the optical activity of biphenyls, allenes and spiranes	Lecture with power point presentation	
	5	Geometrical isomerism: Maleic and fumaric acid-aldoximes and ketoximes. Methods of distinguishing geometrical isomers, determination of configuration of ketoximes -Beckmann rearrangement, E-Z notation	3	Differentiate geometrical isomers and determine its E-Z notation	Lecture with power point presentation	
	6	Conformational analysis: Introduction of terms-configuration and conformation, dihedral angle, torsional strain, conformational analysis of ethane, n- butane, 1,2-dichloro ethane and cyclohexane	3	Describe the conformational analysis of simple organic compounds	Lecture with models	
<b>II</b>	<b>Carbonyl Compounds - I (Aldehydes and Ketones)</b>					
	1	Synthesis of aldehydes from acid chlorides, Stephen's reduction - Gattermann - Koch and Etard reactions	2	Synthesize aldehydes from the given reactions	Lecture	Evaluation through quiz, slip test and group discussion
	2	Synthesis of ketones from nitriles, dialkylcadmium, alkyl lithium and lithium dialkylcuprate and Friedel-Crafts and Hoesch reactions	3	Synthesize ketones from the given reagents and reactions	Lecture	
	3	Mechanism of nucleophilic additions to carbonyl group - addition of HCN, alcohols, thiols, sodium bisulfite, Grignard reagents - condensation with ammonia and its derivatives	2	Illustrate the mechanism of nucleophilic additions to carbonyl group	Lecture	Formative assessment I

	4	Aldol, Perkin, Benzoin and Knoevenagel condensations, Wittig reaction, Mannich reaction, Reformatsky reaction and Cannizzaro reaction	4	Explain the reactions of carbonyl compounds	Lecture	
	5	Oxidation by Tollen's reagent, $\text{KMnO}_4$ , hypohalite, $\text{SeO}_2$ and peracids. Reduction by $\text{H}_2/\text{Ni}$ , $\text{H}_2/\text{Pd-C}$ , $\text{NaBH}_4$ , $\text{LiAlH}_4$ , MPV, Clemmenson and Wolff-Kishner reductions, $\alpha$ , $\beta$ unsaturated aldehydes and ketones - preparation and reactions	4	Understand the oxidation and reduction reactions of carbonyl compounds	Lecture	
<b>III</b>	<b>Carbonyl Compounds – II (Carboxylic acids and their derivatives)</b>					
	1	Preparation of carboxylic acids, acidity of carboxylic acids, effects of substituents on acid strength, acidity of aliphatic and aromatic acids	3	Analyze the preparation and properties of carboxylic acids	Lecture with videos	Evaluation through class test, quiz and group discussion  Formative assessment II
	2	Reactions of carboxylic acids - Hell-Volhard-Zelinsky reaction, Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids, methods and mechanism of decarboxylation	3	Know the reactions of carboxylic acids	Lecture	
	3	Methods of preparation and chemical reactions of halo acids - Hydroxy acids - malic, tartaric and citric acids - unsaturated monocarboxylic acids - dicarboxylic acids	3	Explain the preparation and properties of carboxylic acids	Lecture	
	4	Preparation and reactivity of carboxylic acid derivatives - acid chlorides, esters, amides and anhydrides - Mechanisms of esterification and hydrolysis - acid catalysed reactions	3	Describe the preparation and reactivity of carboxylic acid derivatives	Lecture	
	5	Relative stability of acyl derivatives interconversion of acid derivatives by nucleophilic acyl substitution	3	Understand the relative stability and interconversion of acid derivatives	Lecture with power point presentation	

<b>IV Nitrogen Containing Compounds</b>						
	1	Preparation of nitroalkanes and nitroarenes - Chemical reactions of nitroalkanes and nitroarenes - reduction in acidic, neutral and alkaline media	3	Compare the preparation and reactions of nitroalkanes and nitroarenes	Lecture	Evaluation through class test, quiz and group discussion  Formative assessment II
	2	Methods of preparation of alkyl and aryl amines - Ritter reaction, Hofmann ammonolysis - Hofmann degradation - Schmidt, Curtius reaction - Leuckart reaction - Ullmann reaction - Gabriel phthalimide reaction and Hofmann reaction	4	Illustrate the methods of preparation of alkyl and aryl amines	Lecture	
	3	Separation of a mixture of primary, secondary and tertiary amines - Hinsberg's and Hofmann's method	3	Understand the separation of primary, secondary and tertiary amines	Lecture with videos	
	4	Basicity of amines - basicity of aliphatic and aromatic amines - reactions of amines	2	Explain the basicity and reactions of aliphatic and aromatic amines	Lecture	
	5	Aryl diazonium salts – benzene diazonium chloride -preparation, reactions and synthetic transformations	3	Describe the synthetic transformations of aryl diazonium salts	Lecture	
<b>V Heterocyclic Compounds</b>						
	1	Aromatic characteristics of pyrrole, furan, thiophene and pyridine	2	Understand the aromaticity of heterocyclic compounds	Lecture	Evaluation through class test, quiz and group discussion  Formative assessment I
	2	Comparison of the basicity of pyridine, piperidine and pyrrole	2	Compare the basicity of heterocyclic compounds	Lecture with power point presentation	
	3	Methods of synthesis and chemical reactions with special emphasis on the mechanism of electrophilic substitution and mechanism of nucleophilic substitution reaction in pyridine derivatives	3	Analyze the mechanism of substitution reactions of pyridine derivatives	Lecture	



	4	Preparation and reactions of indole, quinoline and isoquinoline - Fischer indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis	4	Explain the synthesis and reactions of indole, quinoline and isoquinoline	Lecture	
	5	Reactions and mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline	4	Describe the electrophilic substitution reactions of indole, quinoline and isoquinoline	Lecture and group discussion	

Course Instructor: Sr. K. Francy

HOD: Dr. M. Anitha Malbi

**Semester - V**  
**Major Core VI: INORGANIC CHEMISTRY- I**  
**Course code: CC2052**

Hours per week	Credits	Total hours	Marks
5	5	75	100

**Objectives**

- To understand the chemistry of transition, inner transition elements and organometallic compounds
- To know the nomenclature and isomerism in co-ordination compounds
- To learn the principles of analytical chemistry

**Course Outcome**

COs	<i>Upon completion of course students will be able to</i>	PSO Addressed	Cognitive Level
CO - 1	acquire knowledge on transition and inner transition elements	PSO – 1	U
CO - 2	name the co-ordination compounds	PSO – 5	R
CO – 3	analyse the nature of bonding in co-ordination and organometallic compounds	PSO – 2	An
CO – 4	predict the geometry and colour and spin of co-ordination compounds	PSO – 4	E
CO – 5	minimize the errors in chemical analysis	PSO – 2	A

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

Unit	Module	Topics	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
<b>I</b>	<b>d and f-block Elements</b>					
	1	General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties and ability to form complexes	3	Know about the group trends	Lecture and power point presentation	Evaluation through short test, assignment quiz
	2	Difference between the first, second and third transition series. Extraction, properties and uses of Ti, V, Mo and W. Toxicity of Cd and Hg - oxides, mixed oxides, halides, and oxohalides of transition metals	3	Differentiate between different transition series	Lecture and power point presentation	Formative assessment I

	3	Synthesis, reactivity and uses of vanadates, chromates, dichromate, molybdates, tungstates, tungsten bronzes, manganate, permanganate, ferrocyanide, ferricyanide, platinum(IV)chloride, chloroplatinic acid and purple of Cassius	3	Know about different salts	Illustration and lecture	
	4	Interstitial compounds - nitrides, carbides, hydrides, borides of Ti, V, Cr, W and their industrial uses	2	Learn about interstitial compounds	Lecture and seminar	
	5	Electronic configuration, oxidation states, colour, spectral and magnetic properties. Causes and consequences of lanthanide contraction - uses of lanthanides	2	Know about lanthanide contraction	Lecture with power point presentation	
	6	Comparison between lanthanides and actinides. Extraction, properties and uses of thorium and uranium, compounds of uranium-zinc uranyl acetate and uranium hexa fluoride	2	Able to compare between lanthanides and actinides.	Lecture and power point presentation	
<b>II</b>	<b>Co-ordination Chemistry - I</b>					
	1	Double salts and co-ordination compounds-differences - types of ligands. Nomenclature, and isomerism- structural isomerism - ionization, hydrate, co-ordination, linkage and co-ordination position isomerism	4	Know about the nomenclature and isomerism	Question answer session	Evaluation through Multiple choice questions, short test, quiz
	2	Stereoisomerism - geometrical isomerism in tetrahedral and octahedral complexes - optical isomerism in octahedral complexes. Theories of co-ordination compounds	4	Differentiate octahedral and tetrahedral complexes	Lecture	Formative assessment I
	3	Werner's theory- postulates - verification of Werner's theory - cobalt ammine complexes. EAN rule - calculation of EAN in metal complexes and carbonyls. Pauling's theory (VBT) - postulates	4	Learn about different theories	Lecture with power point presentation and group discussion	
	4	Application of VBT to square planar and tetrahedral complexes, inner and outer complexes - merits and demerits of VBT	3	Know about inner and outer complexes	Lecture with power point presentation	

<b>III Co-ordination Chemistry – II</b>						
	1	Shapes of d-orbitals. Crystal field theory - Crystal field splitting of tetrahedral, square planar and octahedral complexes. Factors affecting crystal field stabilisation energy CFSE crystal field splitting energy values and stability of complexes	5	Know about Crystal field theory and factors affecting CFSE	Seminar and power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II
	2	Weak and strong field ligands - spectrochemical series. Distortion from perfect symmetry - Jahn-Teller theorem and its effect	3	Learn about weak and strong field ligands	Lecture and problem solving	
	3	Molecular Orbital Theory (MOT) MO diagrams of $ML_6$ type complexes. Stability of metal complexes	3	Know about MO diagrams different complexes	Lecture and problem solving	
	4	Relation between stability constant and dissociation constant - factors affecting the stability of metal complexes from thermodynamic data	2	Gather knowledge regarding stability constant and dissociation	Problem solving	
	5	Irving William series - stabilization of unstable oxidation state. Substitution reactions of square planar complexes - trans effect	2	Learn about square planar complexes	Illustration, seminar and power point presentation	
<b>IV Analytical Chemistry</b>						
	1	Types of errors- determinate and indeterminate errors - minimization of errors. Precision and accuracy- ways of expressing precision	2	Understand about different types of errors	Power point presentation with videos	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Standard deviation- mean deviation - relative mean deviation and coefficient of variance	3	Know about standard deviation and mean deviation	Lecture	
	3	Accuracy - absolute error- relative error- confidence limit- Rejection of a doubtful value - Q Test and related problems	3	Differentiate between absolute error and relative error	Lecture	
	4	Principles and requirements of gravimetric analysis- mechanism of precipitation - digestion, filtration, washing, drying and ignition	3	Learn the steps in gravimetric analysis	Lecture and power point presentation	

	5	Factors affecting solubility of precipitate - co-precipitation and post precipitation - prevention and difference between co-precipitation and post precipitation, precipitation from homogenous solution	3	Understand the principles of co-precipitation and post precipitation	Lecture with power point presentation	
<b>V</b>	<b>Organometallic Chemistry</b>					
	1	Introduction - structure and application of metal carbonyls - mono and poly nuclear carbonyls of Ni, Fe, Cr, Co and Mn - synthesis and structure -nitrosyl compounds	3	Understand the structure and application of metal carbonyls	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II
	2	Classification, preparation and properties -structure of nitrosyl chloride and sodium nitroprusside.	3	Gather knowledge regarding the properties of compounds	Lecture with videos	
	3	Nomenclature of organometallic compounds, 16- and 18- electron rule. Structure and bonding in transition metal carbonyls- polynuclear carbonyls.	3	Learn about the nomenclature of organometallic compounds	Seminar	
	4	Bridging and terminal carbonyls, transition metal alkyls, carbenes, and carbynes, and metallocenes. Photochemistry of organometallic compounds.	3	Know about carbonyls	Power point presentation and seminar	
	5	Wilkinson's catalyst and alkene hydrogenation, hydroformylation, Monsanto acetic acid process, Ziegler – Natta catalyst and polymerization of olefins.	3	Understand about different catalysts and reactions	Demonstration	

Course Instructor: Dr. R. Gladis Latha

HOD: Dr. M. Anitha Malbi

**Semester - V**

**Major Core VII: PHYSICAL CHEMISTRY**

**Course code: CC2053**

Hours per week	Credits	Total hours	Marks
6	5	90	100

**Objectives:**

- To know the concepts of conductance, strong and weak electrolytes
- To understand the working of electro chemical cells, EMF measurement and their applications
- To learn the basic principles and applications of spectroscopy

**Course Outcome**

COs	<i>Upon completion of course students will be able to</i>	PSO Addressed	Cognitive Level
CO - 1	understand the basic principles of electrochemistry	PSO - 1	U
CO - 2	apply EMF measurements in different fields of chemistry	PSO - 2	A
CO - 3	analyze the working of electrical appliances in day to day life	PSO - 5	An
CO - 4	remember the principle and applications of the different spectral techniques	PSO - 7	R
CO - 5	interpret the IR,NMR and ESR spectra of simple molecules	PSO - 3	E

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

Unit	Module	Topic	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
<b>I</b>	<b>Electrochemistry – I</b>					
	1	Conductance, specific conductance, equivalent conductance and molar conductance, factors affecting conductance of a solution	3	Understand the factors affecting conductance of a solution	Lecture	Evaluation through Multiple choice questions, short test, quiz
	2	Strong and weak electrolytes, variation of equivalent conductance with dilution. Debye-Huckel theory of strong electrolytes, Debye-Huckel-Onsagar equation	3	Know the differences between strong and weak electrolytes	Lecture and group discussion	Formative assessment I

	3	Kohlrausch's law and its applications. Applications of conductance measurements, Determination of $\lambda_{\infty}$ of weak acid and weak base, degree of dissociation of weak electrolytes, solubility and solubility products of sparingly soluble salts and conductometric titrations	2	Understand the applications of conductance measurements	Lecture	
	4	Transport number, determination of transport number by Hittorff's method and moving boundary method	3	Determine the transport number	Lecture with power point presentation	
	5	Hydrolysis, hydrolysis constant, degree of hydrolysis of salts of weak acids and strong bases, weak bases and strong acids	4	Illustrate the hydrolysis of salts	Lecture with power point	
	6	Determination of degree of hydrolysis, conduction and distribution methods	3	Describe the degree of hydrolysis	Lecture	
<b>II</b>	<b>Electrochemistry – II</b>					
	1	Electrochemical cells, reversible and irreversible cells, EMF of cells, determination, cell representation	3	Determine EMF of cells	Lecture	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Single electrode potential, types of electrodes, metal-metal ion electrodes, amalgam electrodes, gas electrodes, metal-insoluble metal salt electrodes and oxidation-reduction electrodes, standard hydrogen electrode (SHE) and calomel electrode	3	Know the types of electrodes	Lecture	
	3	Nernst equation for electrode potential, Nernst equation for emf of cells, standard electrode potential determination	3	Derive Nernst equation	Lecture with tutorials	

	4	Electro chemical series, thermodynamics of galvanic cells, $\Delta G$ , $\Delta H$ , $\Delta S$ and equilibrium constant (K). Concentration cells with transference and without transference, liquid junction potential and its elimination	3	Explain the thermodynamics of galvanic cells	Lecture	
	5	Applications of EMF measurements, determination of transport number, valency of an ion, pH of a solution using hydrogen, quinhydrone and glass electrode	3	Know the applications of EMF measurements	Lecture with tutorials	
	6	Potentiometric titrations, acid-base, oxidation-reduction and precipitation titrations. Decomposition potential and overvoltage	3	Illustrate the principle of potentiometric titrations	Lecture with power point presentation	
<b>III</b>	<b>Applied Electro Chemistry</b>					
	1	Application of electrochemical principle in inorganic chemistry, manufacture of NaOH and H <sub>2</sub> O <sub>2</sub> . Organic electro chemistry	3	Know the applications of electrochemical principle in inorganic chemistry	Lecture with videos	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II
	2	Electro chemical oxidation, Kolbe's synthesis, electro reduction of carbonyl compounds, adiponitrile synthesis	3	Understand the electro chemical reactions	Lecture	
	3	Electroplating, principle, electro plating of copper, nickel and cadmium, types of coating, protection of pipelines, protection of ships in sea	4	Explain the principle of electroplating	Lecture	
	4	Power sources, primary cells, Leclanche cell, principle, selection of anode and cathode, alkaline MnO <sub>2</sub> cells	3	Describe the principle and working of power sources	Lecture	
	5	Secondary cells, characteristics, lead storage, lithium and nickel-cadmium battery	3	Understand the characteristics of secondary cells	Lecture with power point presentation	



	6	Fuel cells, principle, hydrogen - oxygen fuel cells and alkaline fuel cells	2	Acquire knowledge on the principle and working of fuel cells	Lecture with power point	
<b>IV</b>	<b>Spectroscopy –I</b>					
	1	Electromagnetic radiation, electromagnetic spectrum, general spectroscopic methods, Born-Oppenheimer approximation, types of molecular spectra	3	Understand the characteristics of electromagnetic radiation	Lecture	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II
	2	Microwave spectra, principle, intensity, selection rule and applications determination of bond distances in diatomic molecules	4	Illustrate the principle of microwave spectra	Lecture	
	3	Infra-Red spectra , principle of harmonic oscillator, unharmonicity, selection rules, intensity, modes of vibrations and types, force constant, determination	3	Understand the principle of harmonic oscillator	Lecture with videos	
	4	Applications of IR, important functional groups and elucidation of structure, hydrogen bonding, Fermi resonance, overtones and combination bands	4	Explain the applications of IR spectroscopy	Lecture	
	5	Electronic spectra, selection rules, Frank Condon Principle, types of transitions, applications.	4	Describe the applications of electronic spectra	Lecture	
<b>V</b>	<b>Spectroscopy –II</b>					
	1	NMR, introduction, conditions, principle, type, origin, Larmor procession, signals, chemical shift, screening constant, spin-spin coupling	3	Understand the principle of NMR spectroscopy	Lecture	Evaluation through Multiple choice questions, short test, quiz

	2	Applications of NMR- elucidation of molecular structure, hydrogen bonding, tautomerism, study of water of crystallization in solids and Nuclear magnetic resonance imaging	4	Know the applications of NMR	Lecture with power point presentation	Formative assessment I
	3	ESR spectroscopy, principle, hyperfine structure, application of ESR to hydrogen and methyl radicals	4	Analyze the ESR spectrum of hydrogen and methyl radicals	Lecture	
	4	Raman Spectra, introduction, Rayleigh scattering, quantum theory, Raman effect, Raman scattering	4	Explain Rayleigh scattering , quantum theory and Raman effect	Lecture	
	5	Conditions for Raman spectra, selection rule, mutual exclusion principle, Raman spectra of CO <sub>2</sub> and HCN - differences between Raman and IR spectra	3	Know the conditions of Raman spectra		

Course Instructor: Dr. S. Ajith Sinthuja

HOD: Dr. M. Anitha Malbi

**Semester - V**

**Elective III: BIO CHEMISTRY**

**Course code: CC2054**

Hours per week	Credits	Total hours	Marks
4	3	60	100

**Objectives:**

- To understand the biological action of carbohydrates
- To know the functions of lipids, amino acids , proteins and nucleic acids

**Course Outcome**

COs	<i>Upon completion of course students will be able to</i>	PSO Addressed	Cognitive Level
CO - 1	understand the function and metabolism of biomolecules	PSO - 1	U
CO - 2	recall the importance of biomolecules	PSO - 2	R
CO - 3	compare DNA and RNA	PSO - 5	An
CO - 4	elucidate the structure of different biomolecules	PSO - 2	A
CO - 5	illustrate the industrial and medical applications of enzymes	PSO - 8	U

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

Unit	Module	Topic	Hours	Learning Outcome	Pedagogy	Assessment/ Evaluation
<b>I</b>	<b>Carbohydrate</b>					
	1	Carbohydrates -definition and classification. Glycosides physiological significance. Amino sugars - importance	3	Understand the classification and importance of carbohydrates	Lecture	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Chemistry of poly saccharides - starch, glycogen, cellulose, inuline, hemi-celluloses, chitin, pectin and lignin	3	Know the structure and functions of polysaccharides	Lecture and group discussion	
	3	Glycosaminoglycans - hyaluronic acid, chondroitin sulphate, keratin sulphate, heparin and dermatan sulphate	3	Explain the structure and functions of glycosamino glycans	Lecture with power point presentation	
	4	Blood group substances. Carbohydrate metabolism - Embden - Meyerhof pathway- TCA cycle	3	Illustrate carbohydrate metabolism	Lecture with power point presentation	

<b>II</b>		<b>Lipids</b>				
	1	Lipids - definition and classification. Types of fatty acids - saturated, unsaturated, unusual and essential fatty acids	2	Classify lipids and fatty acids	Lecture	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Triacylglycerols - chemistry. Characterization - saponification number, iodine number, acid number, RM value and acetyl value	4	Determine the characteristics of lipids	Lecture	
	3	Chemistry and functions of phospholipids - lecithin and cephalin. Sphingolipids - sphingomyelin.	3	Understand the functions of phospholipids, sphingolipids and sphingomyelin	Lecture with tutorials	
	4	Glycolipids - cerebroside, ganglioside Cholesterol - spot tests and structure. Biochemical functions of cholesterol	3	Explain the structure and functions of glycolipids and cholesterol	Lecture	
<b>III</b>		<b>Amino acids and Proteins</b>				
	1	Amino acids and proteins - structure, classification and biochemical importance - one method each to identify 'C' terminal and N terminal amino acids	3	Know the classification, structure and the importance of amino acids and proteins	Lecture with videos	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II
	2	Secondary, tertiary and quaternary structures	3	Analyze the structures of proteins	Lecture	
	3	Abbreviated names - structure and importance of simple peptide - glutathione, carnosine, anserine, vasopressin and oxytocin	3	Explain the structure and the importance of peptides	Lecture	
	4	Peptide antibiotics - Geramicidin, bacitracin and actinomycin. Transamination - deamination - urea cycle	3	Describe the properties of peptide antibiotics and urea cycle	Lecture	

<b>IV</b>	<b>Nucleic Acids</b>					
	1	Components of nucleic acid - organic nitrogeneous bases - Purines - pyrimidines - sugars - deoxyribose - ribose	3	Describe the components of nucleic acid	Lecture with power point presentation	Evaluation through Multiple choice questions, short test, quiz  Formative assessment II
	2	Nucelosides - ribonucleoside- deoxyribonucleoside. Nucleotides- ribonucleotide- deoxyribonucleotide- cyclic nucleotides	3	Differentiate nucleosides and nucleotides	Lecture	
	3	DNA - Structure and functions - RNA - types (m-RNA, t-RNA and r-RNA). Nucleases- Endonucleases - DNase - RNase- Exonucleases	3	Compare the structure and functions of DNA, RNA and nucleases	Lecture with videos	
	4	Cyclic nucleotides - functions of cyclic AMP - and cyclic GMP - Nucleoproteins - nucleohistones - nucleoprotamines	3	Explain cyclic nucleotides, nucleoproteins, nucleohistones and nucleoprotamine	Lecture	
<b>V</b>	<b>Enzymes</b>					
	1	Enzymes - characteristics - classification, enzyme specificity. Factors affecting enzyme reaction	4	Understand the classification and characteristics of enzymes	Lecture	Evaluation through Multiple choice questions, short test, quiz  Formative assessment I
	2	Michaelis-Menten equation - derivation - inhibition of enzyme action - competitive, non - competitive and uncompetitive coenzymes	4	Explain Michaelis-Menten equation and inhibition of enzymes	Lecture with power point presentation	
	3	Mechanism of NAD <sup>+</sup> and PLP. Immobilisation of enzymes - industrial and medical application of enzymes	4	Mechanism and applications of enzymes	Lecture	

Course Instructor: Dr. Sheeba Daniel

HOD: Dr. M. Anitha Malbi