

ENGINEERING CHEMISTRY

I Semester: CSE / IT/ EEE II Semester: AE / ECE / ME / CE																													
Course Code	Category	Hours / Week			Credits	Maximum Marks																							
AHSB03	Foundation	L	T	P	C	CIA	SEE	Total																					
		3	1	-	4	30	70	100																					
Contact Classes: 45		Tutorial Classes: 15		Practical Classes: Nil			Total Classes: 60																						
<p>I. COURSE OVERVIEW: The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the Intermediate level. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels.</p> <p>II. OBJECTIVES: The course should enable the students to:</p> <ul style="list-style-type: none"> I The concepts of electrochemical principles and causes of corrosion in the new development and breakthroughs efficiently in engineering and technology. II The different parameters to remove causes of hardness of water and their reaction towards the complex metric method. III The microscopic chemistry in terms of atomic, molecular orbitals and Intermolecular forces. IV The different molecular organic chemical reactions that are used in the synthesis of molecules. V The properties, separation techniques of natural gas and crude oil along with potential applications in major chemical reactions. <p>III. COURSE OUTCOMES: After successful completion of the course, students should be able to:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 10%;">CO 1</td> <td style="width: 70%;">Explain the electrochemical principles, corrosion process in metals for protection of different metals from corrosion.</td> <td style="width: 20%;">Understand</td> </tr> <tr> <td>CO 2</td> <td>Utilize electrochemical cell parameters, electrochemical active surface area, current and over potential under given condition for calculating the electromotive force and electrode potential.</td> <td>Apply</td> </tr> <tr> <td>CO 3</td> <td>Identify the hardness of water by different treatment methods for finding the hardness causing salts in water.</td> <td>Apply</td> </tr> <tr> <td>CO 4</td> <td>Illustrate the molecular orbital energy level diagrams of different molecules and theories of bonding for understanding the magnetic properties of coordination compounds.</td> <td>Understand</td> </tr> <tr> <td>CO 5</td> <td>Explain the mechanism of different chemical reactions, stereo isomers for finding the optically active compounds and synthesizing the drug molecules.</td> <td>Understand</td> </tr> <tr> <td>CO 6</td> <td>Make use of green synthesis methods, different types of solid, liquid and gaseous fuels in terms of calorific value for utilizing in industries and automobiles.</td> <td>Apply</td> </tr> </table> <p>IV. SYLLABUS:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">MODULE-I</td> <td style="width: 60%;">ELECTROCHEMISTRY AND CORROSION</td> <td style="width: 20%;">Classes: 09</td> </tr> </table> <p>Electro chemical cells: Electrode potential, standard electrode potential, types of electrodes; Calomel, Quinhydrone and glass electrode; Nernst equation; Electrochemical series and its applications; Numerical problems; Batteries: Primary (Dry cell) and secondary batteries (Lead-acid storage battery and Lithium ion battery).</p> <p>Causes and effects of corrosion: Theories of chemical and electrochemical corrosion, mechanism of electrochemical corrosion; Types of corrosion: Galvanic, water-line and pitting corrosion; Factors affecting rate of corrosion; Corrosion control methods: Cathodic protection, sacrificial anode and impressed current; Surface coatings: Metallic coatings- Methods of coating- Hot dipping, cementation, electroplating and Electro less plating of copper.</p>									CO 1	Explain the electrochemical principles, corrosion process in metals for protection of different metals from corrosion.	Understand	CO 2	Utilize electrochemical cell parameters, electrochemical active surface area, current and over potential under given condition for calculating the electromotive force and electrode potential.	Apply	CO 3	Identify the hardness of water by different treatment methods for finding the hardness causing salts in water.	Apply	CO 4	Illustrate the molecular orbital energy level diagrams of different molecules and theories of bonding for understanding the magnetic properties of coordination compounds.	Understand	CO 5	Explain the mechanism of different chemical reactions, stereo isomers for finding the optically active compounds and synthesizing the drug molecules.	Understand	CO 6	Make use of green synthesis methods, different types of solid, liquid and gaseous fuels in terms of calorific value for utilizing in industries and automobiles.	Apply	MODULE-I	ELECTROCHEMISTRY AND CORROSION	Classes: 09
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MODULE -II	WATER AND ITS TREATMENT	Classes: 08
Introduction: Hardness of water, Causes of hardness; Types of hardness: temporary and permanent, expression and units of hardness; Estimation of hardness of water by complexometric method; Potable water and its specifications, Steps involved in treatment of water, Disinfection of water by chlorination and ozonization; Boiler feed water and its treatment, Calgon conditioning, Phosphate conditioning and Colloidal conditioning; External treatment of water; Ion-exchange process; Desalination of water: Reverse osmosis, numerical problems.		
MODULE-III	MOLECULAR STRUCTURE AND THEORIES OF BONDING	Classes: 08
Shapes of Atomic orbitals, Linear Combination of Atomic orbitals (LCAO), molecular orbitals of diatomic molecules; Molecular orbital energy level diagrams of N ₂ , O ₂ , F ₂ , CO and NO molecules. Crystal Field Theory (CFT): Salient Features of CFT-Crystal Fields; Splitting of transition metal ion d- orbitals in Tetrahedral, Octahedral and square planar geometries; Band structure of solids and effect of doping on conductance.		
MODULE -IV	STEREOCHEMISTRY, REACTION MECHANISM AND SYNTHESIS OF DRUG MOLECULES	Classes: 12
Introduction to representation of 3-dimensional structures: Structural and stereoisomers, configurations, symmetry and chirality; Enantiomers, diastereomers, optical activity and Absolute configuration; Confirmation analysis of n-butane. Substitution reactions: Nucleophilic substitution reactions, Mechanism of SN ¹ , SN ² reactions; Electrophilic and nucleophilic addition reactions; Addition of HBr to propene; Markownikoff and anti Markownikoff's additions; Grignard additions on carbonyl compounds; Elimination reactions: Dehydro halogenation of alkylhalides; Saytzeff rule; Oxidation reactions: Oxidation of alcohols using KMnO ₄ and chromic acid; Reduction reactions: Reduction of carbonyl compounds using LiAlH ₄ & NaBH ₄ ; Hydroboration of olefins; Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.		
MODULE -V	FUELS AND COMBUSTION	Classes: 08
Fuels: Definition, classification of fuels and characteristics of a good fuels; Solid fuels: Coal; Analysis of coal: Proximate and ultimate analysis; Liquid fuels: Petroleum and its refining; Cracking: Fixed bed catalytic cracking; Knocking: Octane and cetane numbers; Gaseous fuels: Composition, characteristics and applications of natural gas, LPG and CNG; Combustion: Calorific value: Gross Calorific Value(GCV) and Net Calorific Value(NCV), calculation of air quantity required for complete combustion of fuel, numerical problems.		
Text Books:		
<ol style="list-style-type: none"> 1. P. C. Jain, Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, 2017. 2. Shashi Chawla, "Text Book of Engineering Chemistry", Dhantpat Rai Publishing Company, New Delhi, 2017. 2. R.T. Morrison, RN Boyd and SK Bhattacharya "Organic Chemistry", Pearson, 7th Edition, 2011. 3. K.F. Purcell and J.C. Kotz, "Inorganic Chemistry", Cengage learning, 2017. 		
Reference Books:		
<ol style="list-style-type: none"> 1. K.P.C. Volhardt and N. E. Schore, "Organic Chemistry Structure and Functions", Oxford Publications, 7th Edition. 2. B. H. Mahan, "University Chemistry", Narosa Publishers, 4th Edition, 2009. 		
Web References:		
<ol style="list-style-type: none"> 1. Engineering Chemistry (NPTEL Web-book), by B.L.Tembe, Kamaluddin and M.S.Krishnan. 		