ENGINEERING CHEMISTRY

I Semester: CSE / IT / EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSB03	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

The course should enable the students to:

I. Apply the electrochemical principles in batteries, understand the fundamentals of corrosion.
II. Analysis of water for its various parameters and its significance in industrial and domestic Applications.
III. Analyze microscopic chemistry in terms of atomic, molecular orbitals and Intermolecular forces
IV. Analysis of major chemical reactions that are used in the synthesis of molecules.
V. Understand the chemistry of various fuels and their combustion.

COURSE OUTCOMES (COs):

CO 1: Describe and understand the operation of electrochemical systems for the production of electric energy, i.e. batteries.
CO 2: Explain the mode by which potable water is produced through the processes of screening, micro Straining, aeration, coagulation and flocculation, sedimentation, flotation, filtration and disinfection.
CO 3: Recognize that molecular orbital theory is a method used by chemists to determine the energy of the electron in a molecule as well as its geometry.
CO 4: Demonstrate an ability to design, implement, and evaluate the results of experimentation using standard scientific methodologies such as hypothesis formulation and testing.
CO 5: Understand and analyze the combustion mechanisms of various fuels.

COURSE LEARNING OUTCOMES (CLOs):

1. Extrapolate the knowledge of electrolytic cell, electrochemical cell, electrode Potential and reference electrodes.
2. Use of primary and secondary batteries in various fields such as automobiles, railways, medical devices, aircrafts and day to day life.
3. Explain the characteristic factors of a metal and environment influencing the rate of Corrosion.
4. Use innovative methods to improve the quality of soft water for Potable and industrial purpose at cheaper cost.
5. Evaluate the quality and utility of suitable water for industrial as well as domestic applications.
6. Use innovative methods to improve the quality of soft water for Potable and industrial purpose at cheaper cost.
7. Understand the basic tenets of molecular orbital theories.
8. Understand the different approaches to types of chemical bonding.
9. Recognize and draw structural isomers, stereoisomers including enantiomers and diastereomers and racemic mixture.
10. Understand the mechanisms of major classes of organic reactions, including substitutions, eliminations and additions
11. Retrieve and critically review information on drugs, including how to synthesize them, from literature resources
12. Demonstrate comprehensive knowledge of conventional fuel properties on engine performance.
13. Understand the importance of cracking, knocking in IC engines and operations involved in petroleum refining.
14. Describe the physical and chemical properties of alternate fuels like natural gas, LPG and CNG
15. Determine efficiency of the fuel in terms of calorific value and combustion reactions of the fuel.

MODULE-I	ELECTROCHEMISTRY AND CORROSION	Classes: 09

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).
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 Electroless plating of copper.

MODULE-II	WATER AND ITS TREATMENT	Classes: 09

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: 09

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: 09

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 chromicacid; 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: 09

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:

1. Bharathi Kumari, "Engineering Chemistry", VGS Book Links, 10th Edition, 2018.
2. P. C. Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, 2017.
3. Shashi Chawla, "Text Book of Engineering Chemistry" Dhanat Rai and Company, 2017.
4. R.T. Morrison, RN Boyd and SK Bhattacharya, "Organic Chemistry", Pearson, 7th Edition, 2011.

Reference Books:

1. Prashanth rath, B.Rama Devi, Ch.Venkata Ramana Reddy, Subhendu Chakroborty, Cengage Learning Publishers, 1st Edition, 2018.
2. K. P. C. Volhardt and N. E. Schore, "Organic Chemistry Structure and Functions", Oxford Publications, 7th Edition 2010.
3. B. H. Mahan, "University Chemistry", Narosa Publishers, 4th Edition, 2009.

Web References:

1. Engineering Chemistry (NPTEL Web-book), by B.L.Tembe, Kamaluddin and M.S.Krishnan.