ENGINEERING CHEMISTRY

I Semester: Common for all Branches

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHS005	Foundation	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

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.

II. OBJECTIVES:

The course should enable the students to:

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 reactions towards the complex metric method.
III	The microscopic chemistry in terms of atomic, molecular orbital's 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.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

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

IV. SYLLABUS:

UNIT-I	ELECTROCHEMISTRY AND BATTERIES	Classes: 10

Electrochemistry: Basic concepts of electrochemistry; Conductance: Specific, equivalent and molar conductance and effect of dilution on conductance; Electrochemical cells: Galvanic cell (daniel cell); Electrode potential; Electrochemical series and its applications; Nernst equation; Types of electrodes: Calomel electrode, quinhydrone electrode; Batteries: Classification of batteries, primary cells (dry cells) and secondary cells (lead-acid battery, Ni-Cd cell), applications of batteries, numerical problems.

UNIT-II	CORROSION AND ITS CONTROL	Classes: 08

Corrosion: Introduction, causes and effects of corrosion; Theories of corrosion: Chemical and electrochemical corrosion with mechanism; Factors affecting the rate of corrosion: Nature of the metal and nature of the environment; Types of corrosion: Waterline and crevice corrosion; Corrosion control methods: Cathodic protection- sacrificial anodic protection and impressed current cathodic protection; Surface coatings: Metallic coatings, methods of application of metallic coatings-hot dipping(galvanizing, tinning), electroplating(copper plating); Organic coatings: Paints, its constituents and their functions.

UNIT-III	WATER TECHNOLOGY	Classes: 09

Water: Sources and impurities of water, hardness of water, expression of hardness-units; Types of hardness: Temporary hardness, permanent hardness and numerical problems; Estimation of temporary and permanent hardness of water by EDTA method; Determination of dissolved oxygen by Winkler's method; Boiler troubles: Priming, foaming, scales, sludges and caustic embrittlement.

Treatment of water: Internal treatment of boiler feed water- carbonate, calgon and phosphate conditioning, softening of water by Zeolite process and Ion exchange process; Potable water-its specifications, steps involved in the treatment of potable water, sterilization of potable water by chlorination and ozonization, purification of water by reverse osmosis process.

UNIT-IV	MATERIALS CHEMISTRY	Classes: 10

Materials chemistry: Polymers-classification with examples, polymerization-addition, condensation and co-polymerization; Plastics: Thermoplastics and thermosetting plastics; Compounding of plastics; Preparation, properties and applications of polyvinyl chloride, Teflon, Bakelite and Nylon-6, 6; Rubbers: Natural rubber its process and vulcanization; Elastomers: Buna-s and Thiokol rubber; Fibers: Characteristics of fibers, preparation properties and applications of Dacron; Characteristics of fiber reinforced plastics; Cement: Composition of Portland cement, setting and hardening of Portland cement; Lubricants: Classification with examples; Properties: Viscosity, flash, fire, cloud and pour point; Refractories: Characteristics and classification with examples.

UNIT-V	FUELS AND COMBUSTION	Classes: 08

Fuel: 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. P. C. Jain, Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 15th Edition, 2015.
2. Shasi Chawla, "Text Book of Engineering Chemistry", Dhantpat Rai Publishing Company, New Delhi, 1st Edition, 2011.

Reference Books:

1. B. Siva Shankar, "Engineering Chemistry", Tata Mc Graw Hill Publishing Limited, 3rd Edition, 2015.
2. S. S. Dara, Mukkanti, "Text of Engineering Chemistry", S. Chand & Co., New Delhi, 12th Edition, 2006.
3. C. V. Agarwal, C. P. Murthy, A. Naidu, "Chemistry of Engineering Materials", Wiley India, 5th Edition, 2013.

4. R. P. Mani, K. N. Mishra, “Chemistry of Engineering Materials”, Cengage Learning, 3rd Edition, 2015.

Web References:

1. https://www.tndte.com
2. https://www.nptel.ac.in/downloads
3. https://www.scribd.com
4. https://www.cuiet.info
5. https://www.sbtebihar.gov.in
6. https://www.ritchennai.org

E-Text Books:

1. https://www.Corrosion.ksc.nasa.gov/electrochem_cells.htm
2. https://www.science.uwaterloo.ca/~cchieh/cact/applychem/watertreatment.html
3. https://www.acs.org/content/acs/en/careers/college-to-career/areas-of-chemistry/polymer-chemistry.html
4. https://www.darvill.clara.net/altenerg/fossil.htm
5. https://www.Library.njit.edu/research helpdesk/subject guides/chemistry.php

Course Home Page: