INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ENGINEERING CHEMISTRY

I Semester: CSE/ IT
II Semester: AE / ME / CE / ECE / EEE/ CSE (AI & ML) /CSE(DS)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AHSE03	Foundation	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Basic principles of chemistry								

I. COURSE OVERVIEW:

The course focuses on the fundamental concepts of chemistry and then builds an interface with their industrial applications. It deals with the electrochemical principles in batteries, corrosion of metallic structures and preventive methods to control corrosion in metals, water purification processes, renewable and non-renewable energy resources, engineering materials such as plastics, elastomers, biodegradable polymers, nanomaterials, smart materials, biosensors and its applications, It cultivates the students to identify chemistry in each piece of finely engineered products used in industries.

II. COURSES OBJECTIVES:

The students will try to learn

I.   The different parameters to remove causes of hardness of water and their reactions towards complexometric method.
II. The concepts of electrochemical principles and causes of corrosion in the new developments and breakthroughs efficiently in engineering and technology.
III. The fundamental knowledge of conventional and non conventional energy sources and their applications in engineering.
IV. The different types of materials with respect to mechanisms and its significance in industrial applications.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO1   Interpret the water quality characteristics for its usage in domestic and industrial purposes.
CO2   Use complexometry for calculation of hardness of water to avoid industrial problems.
CO3   Implement the principles of electrochemical systems to control the corrosion in metals.
CO4   Extend the applications of polymers based on their degradability and properties.
CO5   Choose the appropriate fuel based on their calorific value for energy efficient processes.
CO6   Predict the knowledge on viability of advanced materials for technological improvements in various sectors.

IV. COURSE CONTENT:

MODULE-I: WATER AND ITS TREATMENT (09)

Introduction: Hardness, types, degree of hardness and units ; estimation of temporary and permanent hardness of water by complexometric method, numerical problems; Potable water and its specifications (WHO), steps involved in treatment of potable water, disinfection of potable water by chlorination and breakpoint chlorination; Internal treatment of boiler feed water: Calgon conditioning, phosphate conditioning and colloidal conditioning; external treatment methods: Softening of water by ion-exchange processes; desalination of brackish water, reverse osmosis.

MODULE-II: ELECTROCHEMISTRY AND CORROSION (09)

Introduction: Electrode potential, standard electrode potential, Nernst equation (no derivation); Electrochemical cells: Galvanic cell, cell representation, EMF of cell, numerical problems; Batteries: classification of batteries, construction, working and applications of Zinc-air and Li-ion battery; Corrosion: Definition, Causes and effects of corrosion; Theories of corrosion: Chemical and electrochemical theories of corrosion; Corrosion control methods: Cathodic protection methods, sacrificial anode and impressed current methods.

MODULE-III: POLYMERS (09)

Polymers: Classification of polymers; types of polymerization-addition and condensation polymerization; Plastics, elastomers and fibers: Preparation, properties and applications of PVC, Buna-S and Nylon 6,6; Differences between thermoplastics and thermosetting plastics; Conducting polymers: Definition, classification with examples, mechanism of conduction in trans poly acetylene and applications of conducting polymers; Biodegradable polymers: poly lactic acid and their applications.

MODULE–IV: ENERGY SOURCES (09)

Introduction and characteristics of good fuel; Fossil fuels: Introduction, classification, petroleum, refining of crude oil; Cracking: Definition, types of cracking, moving bed catalytic cracking. LPG and CNG composition and uses; Synthetic fuel: Fischer-Tropsch process; Alternative and non-conventional sources of energy: solar, wind and hydropower advantages and disadvantages; Calorific value: units, HCV and LCV and Dulongs formula, numerical problems.

MODULE-V: ADVANCED FUNCTIONAL MATERIALS (09)

Nanomaterials: Introduction, preparation of nanomaterials by sol-gel method, chemical reduction method and applications of nanomaterials. Biosensors: Definition, Amperometric glucose monitor sensor; IR spectroscopy in night vision-security; Pollution Under Control, CO sensor, Passive Infrared detection; Raman spectroscopy application, Tumour detection in medical applications; Lubricants: characteristics of a good lubricant; properties of lubricants: viscosity, flash and fire point, cloud and pour point.

V. TEXT BOOKS:

1. JAIN &JAIN, P.C. Jain, Monika Jain, *Engineering Chemistry* , Dhanpat Rai publishing Company (P) limited, 17th edition, 2022.
2. Shashi Chawla, *Text Book of Engineering Chemistry*, Dhanat Rai and Company (P) Limited, 1st Edition, 2017.

VI. REFERENCE BOOKS:

1. Ramadevi, Dr, P Aparna and Rath, Cengage learning, 13th edition, 2025.
2. Donald. J Leo, Wiley, Engineering analysis of smart material systems, 1st Edition, 2007.
3. Nitin K Puri**,** Nanomaterials Synthesis Properties and Applications**,** I K international publishing house pvt Ltd,1st edition 2021.

VII. ELECTRONICS RESOURCES:

1. Engineering chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan.http://www.cdeep.iitb.ac.in/webpage_data/nptel/Core%20Science/Engineering%20Che mistry%20I/About- Faculty.html
2. https://books.google.co.in/books?id=R1JtyILNIsAC&pg=PR3&source=gbs_selected_pages&cad=3 #v=onepage&q&f=false
3. https://books.google.co.in/books?id=eQTLCgAAQBAJ&pg=SA1PA53&source=gbs_selected_pages&cad =3#v=onepage&q&f=false

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper - II
9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation