

VAAGDEVI COLLEGE OF ENGINEERING
(AUTONOMOUS)
ENGINEERING CHEMISTRY

B.Tech. I Year I Sem.

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Pre-requisites: Chemistry Knowledge at pre-university level**Course Objectives:**

- To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
- To include the importance of water in industrial usage, fundamental aspects of battery chemistry, significance of corrosion its control to protect the structures.
- To imbibe the basic concepts of petroleum and its products.
- To acquire required knowledge about engineering materials like cement, smart materials and Lubricants.

UNIT - I: Water and its treatment: [8]

Introduction to hardness of water – Estimation of hardness of water by complexometric method and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and breakpoint chlorination. Defluoridation of water by Nalgonda technique.

Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion-exchange processes. Desalination of water – Reverse osmosis.

UNIT – II Battery Chemistry & Corrosion [8]

Introduction - Classification of batteries- primary, secondary and reserve batteries with examples. Characteristics of batteries. Construction, working and applications of: Zn-air and Lithium ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell, Construction and applications of Methanol Oxygen fuel cell and Solid oxide fuel cell. Solar cells - Introduction and applications of Solar cells.

Corrosion: 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 methods.

UNIT - III: Polymeric materials: [8]

Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples – Nylon 6:6, Terylene.

Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Teflon.

Rubbers: Natural rubber and its vulcanization.

Elastomers: Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.

Conducting polymers: Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

Biodegradable polymers: Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

UNIT - IV: Energy Sources: [8]

Introduction, Calorific value of fuel – HCV, LCV- Dulong's formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages.

UNIT - V: Engineering Materials: [8]

Cement: Portland cement, its composition, setting and hardening.

Smart materials and their engineering applications

Shape memory materials- Poly L- Lactic acid. Thermo response materials- Polyacryl amides, Poly vinyl amides

Lubricants: Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

Course Outcomes:

- CO-1: Students will acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
- CO-2: The students are able to understand the basic properties of water and its usage in domestic and industrial purposes.
- CO-3: They can learn the fundamentals and general properties of polymers and other engineering materials.
- CO-4: They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, 2016
3. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K. Shashikala, Pearson Publications, 2021.
4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.

REFERENCE BOOKS:

1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi

VAAGDEVI COLLEGE OF ENGINEERING
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ENGINEERING CHEMISTRY LABORATORY

B.Tech. I Year I Sem.

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Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

- Estimation of hardness and chloride content of water to check its suitability for drinking purpose.
- Students are able to perform estimations of acids and bases using conductometry, potentiometry methods.
- Students will learn to prepare polymers such as Bakelite and nylon-6,6 in the laboratory.
- Students will learn skills related to the lubricant properties such as saponification value and viscosity of oils.

List of Experiments:

I. Volumetric Analysis: Estimation of Hardness of water by EDTA Complexometry method.

II. Conductometry: Estimation of the concentration of an acid by Conductometry.

III. Potentiometry: Estimation of the amount of Fe^{+2} by Potentiometry.

IV. Determination of P^{H} : Determination of P^{H} of unknown acid solution by using Quinhydrone electrode.

V. Preparations:

1. Preparation of Bakelite.
2. Preparation Nylon - 6,6.

VI. Lubricants:

1. Estimation of acid value of given lubricant oil.
2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

VII. Determination of surface tension of a given liquid using Stalagmometer.

VIII. Virtual lab experiments

1. Construction of Fuel cell and its working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

Course Outcomes: The experiments will make the student gain skills on:

- CO-1: Able to determine the hardness of water
- CO-2: Able to perform methods such as conductometry, and potentiometry in order to find out the concentrations or equivalence points of acid, and P^{H} of unknown solutions.
- CO-3: Students are able to prepare polymers like bakelite and nylon-6,6.
- CO-4: Estimations saponification value, and viscosity of lubricant oils.

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).