

ENGINEERING CHEMISTRY

I B. Tech. - I Semester
Course Code: A3HS09

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COURSE OVERVIEW:

This course will involve minimum lecturing, content will be delivered through assigned reading and reinforced with large and small group discussions, as well as assigned in class (and occasional out of class) group activities. Water and its treatment for various purposes, engineering materials such as plastics, composites, ceramic, abrasives, their preparation, properties and applications, conventional and non-conventional energy sources, nuclear, solar, various batteries, combustion calculations, corrosion and control of metallic materials.

COURSE OBJECTIVES:

1. Discover the importance of electrical energy originated from chemical reactions articulate and utilize corrosion prevention strategies and estimate corrosion behavior of materials and components.
2. Describe the role of water as an engineering material in steam and power generation.
3. Substantiate the utility of polymers in chemical and hardware industries. Inculcate knowledge of basic construction materials with its vital role.
4. Extrapolate the application of fuels in day to day life.
5. Focus on the behavior of different alloys in metallurgy. Understand the concept of colloid and extrapolate their applications in industry.

COURSE OUTCOMES:

Upon successful completion of this course, student will be able to:

1. Extrapolate the knowledge of cell, electrode, cathode, anode, electrolysis, electromotive force and reference electrode including corrosion of metals.
2. Under standing and explore the engineering applications of polymeric materials, cement, lubricants and refractories
3. Interpret the vitality of phase rule in metallurgy.
4. Summarize the application of colloids and nanoparticles on industry level in controlling pollution.

SYLLABUS

UNIT – I

ELECTROCHEMISTRY: Introduction, Conductance-Specific, Equivalent and Molar conductance, Effect of dilution on electrolytic conductance. EMF: Galvanic Cells, Nernst equation, numerical problems. Concept of concentration cells, electro chemical series-applications. **BATTERIES:** Primary cells (dry cells) and secondary cells (lead-Acid cell). Applications of batteries. **Fuel cells** – Hydrogen – Oxygen fuel cell; Advantages and Applications.

CORROSION AND ITS CONTROL: Introduction, causes of corrosion, theories of corrosion – Chemical, Electrochemical corrosion. Corrosion control methods: Cathodic protection, sacrificial anode, impressed current cathode methods. Surface coatings: Electroplating(Copper plating), Hot dipping (galvanization & tinning), metal cladding.

UNIT–

II

WATER AND ITS TREATMENT: Introduction – Hardness of water - its causes, expression of hardness- units. Types of hardness. Boiler troubles – Scale, sludges and caustic embrittlement. Treatment of boiler feed water: Internal treatment(Phosphate, Colloidal and Calgon conditioning). External treatments: Ion exchange and Zeolite processes. Desalination of brackish water by Reverse osmosis. Numerical problems. Potable water – its specification – steps involved in treatment of potable water- Sterilization by chlorination and ozonization

UNIT–III

MATERIALS CHEMISTRY: Lubricants: characteristics of a good lubricant- classification with examples of lubricants. Mechanism of lubrication (thick film , thin film and extreme pressure).

Nanotechnology: Origin of Nanotechnology - Surface to Volume Ratio, Preparation of Nano materials by Sol-gel Process and Chemical Vapor Deposition methods. Physical, Chemical, Optical properties and Applications of Nano materials.

ENGINEERING MATERIALS: HIGH POLYMERS: Classification of polymers. **Plastics:** Thermoplastics & Thermosets. Preparation, properties and engineering applications of plastics: Poly vinyl chloride and Bakelite.

Rubbers: Natural rubber and its vulcanization.

Synthetic rubbers: Buna-S.

Fibers: preparation, properties and applications of Polyester and Nylon. Conducting Polymers: mechanism of conduction in polyacetylene and applications of Conducting Polymers.

UNIT-IV

ENERGY SOURCES: Classification of fuels,

Solid fuels: Coal- its analysis by proximate and ultimate analysis.

Liquid fuels: Petroleum and its refining. Cracking- Fixed bed catalytic cracking, Knocking- Octane and Cetane rating.

Gaseous fuels: LPG, CNG and their applications.

Combustion- Calorific value- LCV & HCV. Calculation of air quantity required for combustion of fuel.

UNIT-V

PHASE RULE: Gibb's phase rule equation. Definition of Terms: Phase, Components and Degrees of Freedom. Significance and limitations of phase rule. Phase diagrams: One component system- Water system. Two component system- Silver- lead system.

SURFACE CHEMISTRY: Adsorption: Types of adsorption. Adsorption isotherm: Langmuir adsorption isotherm, applications of adsorption. Colloids: Classification of colloids. Properties of colloids- Electrical & optical properties- Applications of colloids.

TEXT BOOKS:

1. PC Jain & Monica Jain, (2010). Engineering Chemistry, Dhanpatrai Publishing Company. New Delhi

REFERENCE BOOKS:

1. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rathan, Cengage Learning, New Delhi (2016).
2. S.S Dara & Mukkanti, (2006). Engineering Chemistry, S. Chand & Co. New Delhi.
3. J.C Kuriacase & J Raja ram (2004), Engineering Chemistry, Tata McGraw Hills Co. New Delhi.
4. Engineering Chemistry by M Tirumala Chary & E. Laxminarayana (Second Edition), Scitech Publications, Chennai.