

15ABS03-ENGINEERING CHEMISTRY
(Common for EEE, ECE and CSE)

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Course Objectives :

- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications.
- The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
- The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application.
- The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example.
- After the completion of the course, the student would understand about the concepts of chemistry in respect of Electrochemical cells, fuel cells, mechanism of corrosion and factors to influence, polymers with their applications, engineering materials and water chemistry.

UNIT.1: Water Treatment

Impurities in water, Hardness of water and its Units, Disadvantages of hard water, Estimation of hardness by EDTA method, Numerical problems on hardness, Estimation of dissolved oxygen, Alkalinity, acidity and chlorides in water, Water treatment for domestic purpose (Chlorination, Bleaching, ozonisation, U.V. treatment)

Industrial Use of water:

For steam generation, troubles of Boilers: Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion.

Treatment of Boiler Feed water:

Internal Treatment: Colloidal, Phosphate, Carbonate, Calgon and sodium aluminate treatment.

External Treatment: Ion-Exchange and Permutit processes.

Demineralsation of brackish water: Reverse Osmosis and Electrodialysis

UNIT.2: Electrochemistry

i).Review of electrochemical cells, Numerical calculations, Batteries: Rechargeable batteries (Lead acid, Ni-Cd, Lithium Ion Batteries), Fuels cells: (Hydrogen-Oxygen and Methanol-Oxygen)

ii). Voltammetry: Basic Principles and applications (Ferrous/Ferric System)

Electrochemical sensors: Potentiometric Sensors and voltammetric sensors. Examples : analysis of Glucose and urea

iii).Corrosion: Electrochemical Theory of corrosion, Factors affecting the corrosion. Prevention: Anodic and cathodic protection and electro and electroless plating.

UNIT.3: Polymers

i). Introduction: Basic concepts of polymerisation, Types of polymerisation (Chain Growth (Addition), Step growth (Condensation)), Mechanism: cationic, anionic, free radical and coordination covalent, Polydispersity Index.

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Plastomers: Thermosetting and Thermoplastics, Preparation, properties and Engineering applications , PVC, Bakelite, nylons, Polyester Elastomers (rubbers) Natural Rubber; Processing of natural rubber, Compounding of Rubber Synthetic Rubber: Preparation, properties and engineering applications of Buna-S, buna-N, Polyurethane, Polysulfide (Thiokol) rubbers
 ii). Conducting polymers: Mechanism, synthesis and applications of polyacetylene, polyaniline.
 iii). Liquid Crystals: Introduction, classification and applications
 iv). Inorganic Polymers: Introduction, Silicones, Polyphosphazins $(-R)_2-P=N-$, applications

UNIT.4: Fuel Technology

Classifications of Fuels – Characteristics of Fuels- Calorific Value – Units, Numerical Problems.

- i). Solid Fuels–Coal, Coke : Manufacture of Metallurgical Coke by Otto Hoffmann's by product oven processes.
- ii). Liquid Fuels:
 Petroleum: Refining of Petroleum, Gasoline: Octane Number, Synthetic Petrol: Bergius Processes, Fischer Troph's synthesis
 Power Alcohol: Manufacture, merits and demerits of Power Alcohol
- iii). Gaseous Fuels: Origin, Production and uses of Natural gas, Producer gas, Water gas, Coal gas and Biogas. Flue Gas analysis by Orsat's apparatus, Solving of problems on Combustion.
- iv). Bio Fuels: Biogas, Biodiesel and their significance

UNIT.V: Chemistry Of Engineering Materials

- i). Semiconducting and Superconducting materials-Principles and some examples
- ii). Magnetic materials – Principles and some examples
- iii). Cement: Composition, Setting and Hardening (Hydration and Hydrolysis)
- iv). Refractories: Classification , properties and applications
- v). Lubricants: Classification and characteristics of lubricants, Theory of lubrication.

Expected Outcomes (EO): The student is expected to:

- Understand the electrochemical sources of energy
- Understand industrially based polymers, various engineering materials.
- Differentiate between hard and soft water. Understand the disadvantages of using hard water domestically and industrially. Select and apply suitable treatments domestically and industrially.

Text Books:

1. Engineering Chemistry by KN Jayaveera, GV Subba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, New Delhi, Fourth Edition, 2013.
2. A Text Book of Engineering Chemistry, Jain and Jain, Dhanapath Rai Publishing Company, New Delhi, 15th Edition, 2012.

References:

1. A Text book of Engineering Chemistry by S.S Dhara, S.S.Umare, S. Chand Publications, New Delhi, 12th Edition, 2010.
1. Engineering Chemistry, K. Sessa Maheswaramma and Mrudula Chugh, Pearson Education, First Edition, 2013.
2. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra,
3. SCITECH, Publications India Pvt Limited, Chennai, 2nd Edition, 2012.
4. Concepts of Engineering Chemistry- Ashima Srivastava and N.N. Janhavi, Acme