



# Anil Neerukonda Institute of Technology & Sciences (Autonomous)

(Permanent Affiliation by Andhra University & Approved by AICTE  
Accredited by NBA (ECE, EEE, CSE, IT, Mech. Civil & Chemical) & NAAC)

Sangivalasa-531 162, Bheemunipatnam Mandal, Visakhapatnam District

Phone: 08933-225083/84/87

Fax: 226395

Website: [www.anits.edu.in](http://www.anits.edu.in)

email: [principal@anits.edu.in](mailto:principal@anits.edu.in)

## R23 ENGINEERING CHEMISTRY (I/IV B.Tech EEE, Mech, ECE, Chemical) WEF 2023-24

**Course Code:** 23CY1101/1102

**Instruction:** 3 periods/ 1 Tutorial per week

**End exam:** 3 hours

**Prerequisites:** Chemistry at +1 and +2 level

**Credits:** 3

**Sessional marks:** 40

**End exam marks:** 60

### Course Objective:

Emphasizing fundamental principles and key concepts in engineering chemistry course enables students to:

- Attain a deep comprehension of the course's core objectives.
- Equips students to adeptly address dynamic challenges in the evolving engineering industry.

### Course Outcomes:

**By the end of the course, students will be able to**

CO	Statement
1	Show a strong understanding of fundamental concepts in water quality, treatment; electrochemical devices, solar cells; corrosion, corrosion protection; fuels, combustion, petroleum processing; plastics, and their properties & manufacturing processes. (L2)
2	Apply acquired knowledge and skills in water quality and treatment; electrochemical devices and solar cells; corrosion and corrosion protection methods; fuels, combustion, petroleum processing and plastics, to effectively address practical scenarios, make informed decisions, and solve complex problems. (L3)
3	Assess water quality and treatment; Critically analyze principles and technologies related to electrochemical devices and solar cells; Evaluate intricate concepts and strategies in corrosion and corrosion protection and scrutinize complex concepts and processes in fuels, combustion, petroleum processing, as well as intricate applications in plastics and polymer technology. (L4)
4	Refine advanced analytical and decision-making skills across diverse areas, including water quality, treatment; electrochemical devices, solar cells; corrosion and corrosion protection; fuels, combustion, petroleum processing; plastics, and polymer technology, demonstrating expertise in principles, technologies, and practical applications. (L5)
5	Cultivate advanced problem-solving skills and creativity by synthesizing innovative solutions and strategies across diverse domains: water quality, treatment, electrochemical devices, solar cells, corrosion control, fuels, combustion, petroleum processing, and plastics and polymer technology. (L6)

### UNIT-I Water Technology

**10 Periods**

Impurities in water - Specifications of water for domestic use (ICMR and WHO) - Hardness-Types, units of hardness, Numerical problems on hardness, Disadvantages in using hard water; Boiler troubles- Sludge & Scale formation, Internal Treatment (Carbonate, Phosphate & Calgon conditioning methods), Boiler corrosion.

Water softening method - Ion exchange resin process, advantages & disadvantages; Desalination methods - Reverse Osmosis & Electrodialysis. Municipal water treatment - Sedimentation with coagulation, Sterilisation - Chlorination (break point chlorination), UV treatment.

**Learning Outcomes:**

- Identify and differentiate water hardness types, understand drawbacks of hard water, and make informed decisions on water quality for domestic and industrial settings. (L1)
- Solve numerical problems on water hardness, accurately calculate hardness concentrations, and assess their potential impact on different water systems. (L2)
- Apply ion exchange resin process for water softening, ensuring cleaner water for specific uses, and understand benefits and limitations of softening techniques. (L3)
- Evaluate and compare desalination methods for potable water production, enabling informed selection based on efficiency, cost-effectiveness, and environmental impact. (L4)

**UNIT-II Energy Storage Systems****10 periods**

Introduction to Electrode potentials, Electro Chemical Series; Batteries - Primary battery - Dry Cell, Secondary battery - Lead Acid battery, Lithium-ion batteries; Fuel cells - Hydrogen - Oxygen fuel cells, Applications.

Advanced batteries for Electrical vehicles - Lithium iron phosphate, Solid state battery - advantages & applications; Solar cells – Types - Polycrystalline and Thin film Solar cells, Principle, Working and Applications.

**Learning Outcomes:**

- Recall and identify key concepts of electrode potentials, electrochemical series, primary and secondary batteries, and fuel cells. (L1)
- Explain the principles, working mechanisms, and characteristics of batteries, fuel cells, and solar cells, showcasing a comprehensive understanding of their functions and applications. (L2)
- Analyse and compare advanced batteries in terms of advantages and applications, enabling their suitability assessment for specific requirements and contexts. (L3)
- Evaluate and synthesize knowledge of electrode potentials, battery technologies, fuel cells, and solar cells, applying critical thinking to propose innovative solutions for advancements in energy storage and sustainable energy applications. (L4)

**UNIT-III Corrosion and its prevention****10 Periods**

Corrosion & detrimental effects on buildings, machines, equipment's -Theories of corrosion - Dry and wet corrosion; Types of corrosion - Galvanic corrosion, Concentration cell corrosion, Illustrations; Factors Influencing corrosion.

Corrosion protection - Cathodic protection – sacrificial anodic and impressed current cathodic protection methods; Metallic coatings - electroplating of copper and electroless Nickel plating, Basic Concepts of Physical Vapour Deposition coating (PVD) and Chemical Vapour Deposition coating (CVD).

**Learning Outcomes:**

- Recognize corrosion principles and distinguish between dry and wet corrosion, identifying various types. (L1)
- Explain corrosion theories and influential factors. Outline cathodic protection techniques and the process of electroplating copper and electroless nickel plating. (L2)

- Critically assess the efficiency of corrosion protection methods and advanced coating technologies. Formulate suitable corrosion protection strategies for a variety of structures and applications based on the evaluation. (L3)

#### **UNIT-IV Fuels and Combustion**

**10 periods**

Introduction; Calorific Value – Lower Calorific Value, Higher Calorific Value, Determination of Calorific Value of solid fuel using Bomb Calorimeter and Gaseous fuel using Boy's Calorimeter - Numerical Problems on Combustion.

Petroleum- Refining of petroleum - Synthetic petrol - Bergius process – Fischer-Tropsch process -Biodiesel.

##### **Learning Outcomes:**

- Retrieve fundamental knowledge about calorific value, methods for determining the calorific value of solid and gaseous fuels, and the process of petroleum refining. (L1)
- Understand the principle and working of Bomb Calorimeter and Boy's Calorimeter for determining calorific values and explain process for producing synthetic petrol. (L2)
- Apply the formulas and calculations to solve numerical problems related to combustion. (L3)
- Critically evaluate the challenges and potential solutions in the production and utilization of biodiesel. (L4)

#### **UNIT-V Polymer Technology**

**10 Periods**

Introduction - Distinction between Thermoplastics and Thermosetting plastics; Preparation, Properties & Engineering applications of plastics – Poly Vinyl Chloride (PVC), Teflon, Bakelite, and Acrylo Butadiene Styrene (ABS).

Compounding of plastics, Fabrication of plastics - Compression moulding (Mobile Phone Cases), Injection moulding (Car parts, bottle caps), Transfer moulding, Extrusion moulding (Pipes Hoses), Battery Trays), blown film moulding (PET bottles); Fibre Reinforced Polymer Composites (FRPC) - Applications of polymers in sensors, self-cleaning windows.

##### **Learning Outcomes:**

- Recognize differences between thermoplastics and thermosetting plastics and identify plastic fabrication methods. (L1)
- Understand the properties and applications of specific plastics like PVC, Teflon, Bakelite, and ABS, the concept of Fiber Reinforced Polymer Composites (FRPC) (L2)
- Apply the knowledge of plastics and their properties to select appropriate materials for specific engineering applications and principles of plastic fabrication techniques to design and manufacture products. (L3)
- Apply the understanding of Fiber Reinforced Polymer Composites (FRPC) to propose innovative applications in the field of sensors and self-cleaning windows. (L3)

##### **Prescribed books**

1. P. C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai & Sons, New Delhi.

##### **Reference books**

1. S.S.Dara , "A text book of Engineering Chemistry" S.Chand & Co.New Delhi.
2. Dell, Ronald M Rand, David A J , "Understanding Batteries", ,Royal society of Chemistry.