

22CT103 ENGINEERING CHEMISTRY

Hours Per Week :

L	T	P	C
2	0	2	3



Image source:
<https://www.rsc.org/journals-books-databases/about-journals/reaction-chemistry-engineering/>

PREREQUISITE KNOWLEDGE: Concept of bonding, chemical reactions and electrochemical cell

COURSE DESCRIPTION AND OBJECTIVES:

The course aims to cover the importance of chemistry and its applications in engineering disciplines particularly focusing on developing new engineering materials (such as polymers, nanomaterials etc.) and understanding their property for scientific and engineering applications. In addition, the students are also expected to acquire knowledge on electrochemistry and construction of batteries and fuel cells.

MODULE-1**UNIT-1****8L+0T+8P=16 Hours****POLYMERS:**

Introduction, classification, molecular weight determination, (Mw & Mn), types of polymerization, preparation, properties and applications of PE, PMA, Nylon-6,6; Rubber-vulcanization, synthetic rubbers – Neoprene, Introduction to polymer composites, glass fiber and metal oxide/metal composites.

UNIT-2**8L+0T+8P=16 Hours****NANOMATERIALS & ENGINEERING MATERIALS:**

Nanomaterials: Introduction, classification, properties, Top-down (Ball Milling) and Bottom-up (Sol-Gel) synthetic methods; Synthesis, properties and applications of Carbon Nanotubes and Graphene.

Engineering Materials: Lubricants – classification, viscosity, viscosity index, flash and fire points, cloud and pour points and mechanical stability; Refractories – classification, refractoriness RUL, chemical & thermal stability.

PRACTICES:

- Synthesis of Nanoparticles.
- Synthesis of Bakelite.
- Determination of viscosity of oil (Biodiesel, castor oil and coconut oil).
- Water Analysis.
- Synthesis of Iron oxide nanoparticles.
- Synthesis of Au/Ag nanoparticles using plant extract.
- Preparation of Nylon-6,6.
- Preparation of Polystyrene.

MODULE-2**UNIT-1****8L+0T+8P=16 Hours****ELECTROCHEMISTRY & CORROSIONS:**

Electrochemical Cells: Galvanic and electrolytic cells; Redox reactions; Electrode potential; Electrochemical series, EMF of an electrochemical cell; Nernst equation - applications and significances; Reference electrodes – Standard hydrogen electrode.

Corrosion: Introduction, dry & wet corrosion; Galvanic series; Corrosion prevention by cathodic protection.

SKILLS:

- ✓ Synthesize various polymers.
- ✓ Synthesize nanomaterials.
- ✓ Identify the properties of different industrially relevant engineering materials.
- ✓ Understand the different components of an electrochemical cell.
- ✓ Design electrochemical cell such as battery.
- ✓ Identify the types of energy conversion/storage systems.

UNIT-2**8L+0T+8P=16 Hours****BATTERIES & FUEL CELLS:**

Batteries: Introduction and importance; Classification of batteries - Lead-acid storage cell and Lithium-ion batteries.

Fuel Cells: Classification of Fuel Cells; Construction, working principle and applications of Hydrogen-Oxygen fuel cell, Biofuel cells - Microbial fuel cells.

PRACTICES:

- Determination of EMF and ΔG of an electrochemical cell.
- Determination of rate of corrosion by weight loss method.
- Construction of Batteries.
- Determination of Molecular weight by viscometer.
- Determination of Fe (II) by dichrometry method.
- Determination of available chlorine in bleaching powder.
- Determination of strength of Weak acid by pH-method.
- Determination of concentration of mixture of acids by conductometry.
- Electroplating of Copper and Zinc on metallic objects.
- Determination of rate of corrosion by weight loss method.
- Construction of galvanic cell and measure the EMF.

COURSEOUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply various synthetic methods for preparing polymers for engineering applications.	Apply	1	1, 2, 4, 9, 10, 11, 12
2	Analyze characteristics in different engineering nanomaterials for the applications of electronic engineering.	Analyze	1	1, 2, 3, 5, 9, 10, 11, 12
3	Distinguish different types of electrochemical cells and corrosions for the real time analysis.	Analyze	2	1, 2, 3, 5, 6, 7, 9, 10, 11, 12
4	Analyze possible corrosion types and their different protection methods.	Analyze	2	1, 2, 3, 5, 6, 7, 9, 10, 11, 12
5	Recommend the principle of electrochemistry for designing various batteries and fuel cells.	Evaluate	2	1, 2, 3, 5, 6, 7, 9, 10, 11, 12

TEXT BOOKS:

1. S. Chawala, "A Textbook of Engineering Chemistry Engineering Materials and Applications", Dhanpat Rai Publications, 3rd Edition, 2015.
2. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publications, 17th Edition, 2015.

REFERENCE BOOKS:

1. K. S. Maheswaramma and M. Chugh, "Engineering Chemistry", Pearson, 1st Edition, 2015.
2. B. S. Bahl, Arun Bahl and B. D. Tuli, "Essentials of Physical Chemistry", S. Chand and Co. Ltd., 2007.
3. G. Raj and C. Anand, "Instrumental Methods of Analysis", Himalaya Publications, 5th edition, 2007.
4. T. Pradeep, "Nano: The Essentials; Understanding of Nano Science and Technology" Tata McGraw-Hill, New Delhi, 2012.
5. J. Mendham, R. C. Denney, J. D. Bares, M. Thomas and B. Siva Sankar, "Vogel's Textbook of Qualitative Chemical Analysis" (vol. 1), Pearson Publications, 2009.