

**VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)**  
**DEPARTMENT OF CHEMISTRY**  
**ENGINEERING CHEMISTRY**  
**(For ECE & EEE branches)**

Instruction : 3 +0 Hrs / week	Semester End Exam Marks : 60	Subject Reference Code : U21BS110CH
Credits : 3	Continuous Internal Exam Marks : 40	Duration of semester End Exam : 3H

<b>LEARNING OBJECTIVES:</b>	<b>LEARNING OUTCOMES</b>
<b>The course will enable the students to:</b>	<b>At the end of the course, students should be able to:</b>
<ol style="list-style-type: none"> <li>1. Study types of conductance, variation of electrode potential and EMF and to acquaint with applications of Galvanic Cell.</li> <li>2. Classify and compare various types of batteries and fuel cells.</li> <li>3. Get acquainted with different types of polymers and their applications.</li> <li>4. Explain the concepts of engineering materials like nano materials and liquid crystals.</li> <li>5. Know the principles of few analytical techniques.</li> </ol>	<ol style="list-style-type: none"> <li>1. Construct a galvanic cell and calculate its EMF and pH wherever applicable.</li> <li>2. Describe the construction, functioning and applications of the selected primary, secondary batteries and fuel cells.</li> <li>3. Categorise the polymers and discuss the synthesis of few polymers along with their applications.</li> <li>4. Get expose to the classification, properties and applications of nano materials and liquid crystals.</li> <li>5. Familiarize with the working principle of IR, UV and Thermal analytical techniques.</li> </ol>

<b>CO-PO MAPPING FOR ENGINEERING CHEMISTRY</b>												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	-	-	-	-	-	-	-	-	-	1
2	3	2	-	-	-	-	2	-	-	-	-	2
3	3	2	-	-	-	-	2	-	-	-	-	2
4	3	1	-	-	-	-	1	-	-	-	-	2
5	3	1	-	-	-	-	-	-	-	-	-	1

**UNIT-I: ELECTROCHEMISTRY (10)**

Introduction, conductance, types of conductance- specific, equivalent, molar conductance and their interrelationship-numericals. Principle and applications of conductometric titrations- strong acid vs strong base, weak acid vs strong base and mixture of acids vs strong base.

Cells- electrolytic and electrochemical cells. IUPAC convention of cell notation, cell reaction, concept of electrode potential, electro motive force (EMF). Electrochemical series – applications, Nernst equation-derivation, applications and numericals. Types of electrodes- construction and working of calomel electrode (CE), quinhydrone electrode and glass electrode (GE). Determination of pH using glass electrode and quinhydrone electrode. Principle and Applications of potentiometry- acid base and redox reaction (Fe(II) Vs  $\text{KMnO}_4$ ).

**UNIT-II: BATTERY TECHNOLOGY (9)**

Introduction- definition of cell and battery – Types of cells (reversible and irreversible cells). Battery characteristics: free energy change, electromotive force of battery, power density, energy density- numericals, Memory effect, flat discharge rate.

Primary batteries: Construction and electrochemistry of Zn-C battery, Zn- $\text{Ag}_2\text{O}$  battery and lithium- $\text{V}_2\text{O}_5$  battery.

Secondary batteries: Construction and working of lead-acid, Ni-Cd and lithium ion battery – advantages, limitations and applications.

Fuel cells: Concept, types of fuel cells and merits. Construction, working and applications of methanol-oxygen fuel cell, phosphoric acid fuel cell and Molten carbonate fuel cell.

G. Salyan

Prasad

Chh

A. Srinivas



### UNIT-III: POLYMER CHEMISTRY (11)

Introduction, degree of polymerization, functionality of monomers and its effect on the structure of polymers. Classification of polymers-a) homo and co-polymers, b) homo chain and hetero chain polymers. c) plastics, elastomers, fibers and resins.

Types of Polymerization - Addition and condensation polymerization.

Glass transition temperature (T<sub>g</sub>), factors affecting T<sub>g</sub>.

Molecular weight- number average and weight average molecular weight, numericals.

**Plastics:** Thermo plastics and thermosets - preparation, properties and applications of a) Aramid (Kevlar) b) Poly methyl methacrylate(PMMA)

**Biodegradable polymers:** Concept, preparation and uses of poly lactic acid.

**Conducting polymers:** Definition- classification, mechanism of conduction in (p doped and n- doped) polyacetylene and applications.

**Polymer composites:** Introduction, advantages of composites over conventional materials, fibre reinforced composites Kevlar, Carbon and Glass FRCs and their applications.

### UNIT-IV: ENGINEERING MATERIALS (9)

#### Nano Materials

Introduction - concept of nanomaterials - quantum confinement and surface volume ratio - catalytic and electrical properties.

Types of Nano materials: carbon nano tubes, quantum dots, nanowires, nano crystals.

Synthesis of nano materials: Top down and bottom up approaches- mechanical grinding by ball milling, sol gel method.

Carbon Nano tubes: Single walled carbon nanotubes (SWCNTs). Multi walled carbon nanotubes (MWCNTs), synthesis of CNTs- arc discharge and laser ablation methods, applications.

#### Liquid Crystals

Introduction, classification of liquid crystals-Thermotropic and Lyotropic liquid crystals - Chemical constitution & liquid crystalline behavior. Molecular ordering in liquid crystals- Nematic, Smectic and Cholestric liquid crystals - Applications.

### UNIT-V: INSTRUMENTAL METHODS OF ANALYSIS (8)

**Spectroscopy:** Principle, block diagram, applications of Atomic absorption spectroscopy.

**Microscopic techniques:** Introduction, Limitations of optical microscopy. Significance of de Broglie's equation, Principle and block diagram of Scanning Electron Microscope (SEM), Atomic Force Microscope (AFM).

**Thermal Analysis:** Principle, block diagram of Thermo Gravimetric Analysis (TGA) and analysis of calcium oxalate. Principle, block diagram of Differential Scanning Calorimetry (DSC) and analysis of TG of a polymer.

#### Learning Resources:

##### Text Books:

1. PC Jain, M Jain Engineering Chemistry, Dhanapathi Rai and sons (16<sup>th</sup> edition), New Delhi.
2. O.G. PALANNA, Engineering Chemistry, TMH Edition.

##### Reference books:

1. Sashi Chawla, Text book of Engineering Chemistry, Dhanapathi Rai &sons, New Delhi.
2. Wiley Engineering chemistry, Wiley India pvt Ltd, II edition.
3. Chemistry in engineering and technology by J.C. Kuriacose and Rajaram.
4. University chemistry, by B. H. Mahan
5. Physical Chemistry, by P. W. Atkins
6. S. S. Dara, S Chand and sons, Engineering Chemistry, New Delhi.
7. Puri, Sharma and Pathania Principles of physical chemistry, Vishal Publishing Co.
8. Polymer chemistry by Gowariker
9. Introduction to Nanoscience, by S m Lindsay, Oxford University press.

##### Online Resources:

1. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
2. NPTEL Polymer Chemistry Course, D. Dhara, IIT Kharagpur.

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