VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

ACCREDITED BY NAAC WITH A++ GRADE

DEPARTMENT OF CHEMISTRY

ENGINEERING CHEMISTRY

(For ECE & EEE branches)

Instruction : 3 +0 Hrs / week	Semester End Exam Marks : 60	Subject Reference Code : U23BS110CH
Credits : 3	Continuous Internal Exam Marks : 40	Duration of semester End Exam : 3H

COURSE OBJECTIVES:	**COURSE OUTCOMES**
The course will enable the students to:	**At the end of the course, students should be able to:**
1. Study types of conductance, variation of electrode potential and EMF and to acquaint with applications of Galvanic Cell. 2. Classify and compare various types of batteries and fuel cells. 3. Get acquainted with different types of polymers and their applications. 4. Explain the concepts of engineering materials like nano materials and liquid crystals. 5. Know the principles of few analytical techniques.	1. Construct a galvanic cell and calculate its EMF and pH wherever applicable. 2. Describe the construction, functioning and applications of the selected primary, secondary batteries and fuel cells. 3. Classify the polymers and discuss the synthesis and applications of few polymers. 4. Get expose to the classification, properties and applications of nanomaterials and liquid crystals. 5. Familiarize with the basic concepts of few analytical techniques.

CO-PO MAPPING FOR ENGINEERING CHEMISTRY

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 (11)

Introduction, conductance, types of conductance – specific, equivalent, molar conductance and their interrelationship – numericals. Principle and applications of conductometric titrations- strong acid *vs* strong base, week 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, electromotive 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.

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 – acidic and alkaline battery and lithium-V_2O_5 battery.

Secondary batteries: Construction and working of lead-acid 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 and phosphoric acid fuel cell.

Prof. P. Leelavathi | Prof. G. Satyanarayana | Prof. K. Laxma Reddy | Dr. D. Satyanarayana | Dr. P. Venugopal

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 Polymerizations – Addition and condensation polymerization.

Glass transition temperature and factors affecting glass transition temperature.

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

Plastics: thermo plastics and thermosets,

Biodegradable polymers: Concept, preparation and uses of ploy 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, Classification of composites. Manufacturing methods- Hand lay up and RTM method.

UNIT-IV: ENGINEERING MATERIALS (10)

Nanomaterials

Introduction – concept of nanomaterials – quantum confinement and surface volume ratio – surface Plasmon resonance. Applications of Nanomaterials.

Types of Nanomaterials**:** carbon nanotubes, quantum dots, nanowires, nanocrystals.

Synthesis of nanomaterials: Top down and bottom-up approaches – Mechanical grinding by ball milling, sol gel method.

Carbon Nanotubes**:** Single walled carbon nanotubes (SWCNTs). Multi walled carbon nanotubes (MWCNTs), synthesis of CNTs – arc discharge and laser ablation methods.

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 (9)

Spectroscopy: Principle of Beer- Lamberts law, numericals. Principle, block diagram and Applications of Atomic Absorption Spectroscopy (AAS).

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).

Thermo Gravimetric Analysis: Principle, block diagram of Thermogravimetric Analysis (TGA) and analysis of calcium oxalate and copper sulphate.

Text Books:

1. P. C. Jain, M Jain Engineering Chemistry, Dhanapathi Rai and sons (16th edition), New Delhi.
2. Sashi Chawla, Text book of Engineering Chemistry, Dhanapathi Rai &sons, New Delhi.
3. O. G. PALANNA, Engineering Chemistry, TMH Edition.
4. Wiley Engineering chemistry, Wiley India pvt Ltd, II edition.
5. Chemistry in engineering and technology by J.C. Kuriacose and Rajaram.

Learning Resources:

1. University chemistry, by B. H. Mahan
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
3. Physical Chemistry, by P. W. Atkins
4. S. S. Dara, S Chand and sons, Engineering Chemistry, New Delhi.
5. Puri, Sharma and Pathania Principles of physical chemistry, Vishal Publishing Co.
6. NPTEL Polymer Chemistry Course, D. Dhara, IIT Kharagpur.
7. Polymer chemistry by Gowariker
8. Introduction to Nanoscience, by S m Lindsay, Oxford University press

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