

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
DEPARTMENT OF CHEMISTRY
ENGINEERING CHEMISTRY
(For CSE, ECE, EEE & IT branches)

Instruction : 3 +1 Hrs / week	Semester End Exam Marks : 60	Subject Reference Code : U19BS010CH
Credits : 4	Continuous Internal Exam Marks : 40	Duration of semester End Exam : 3H

LEARNING OUTCOMES

At the end of the course, students should be able to:

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. Categorise the polymers and discuss the synthesis of a few polymers and their applications.
4. Get expose to basic concepts of engineering materials such as Composites and membranes.
5. Know the classification, properties, applications and types of liquid crystals & nano materials along with their synthesis.

UNIT-I: ELECTROCHEMISTRY (11)

Introduction, conductance, types of conductance- specific, equivalent, molar conductance and their interrelationship- numericals. Ionic mobility and transport number- definition, determination by Hittorfs method (Non attackable electrodes) 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. Applications of potentiometry- acid base and redox titration (Fe(II) Vs 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.

Primary, secondary and fuel cells.

Primary batteries: Construction and electrochemistry of Ag_2O -Zn battery and lithium- V_2O_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 and phosphoric acid fuel cell.

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_g), factors affecting T_g .

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

Plastics: Thermo plastics and thermosets - preparation, properties and applications of a) Aramid (Kevlar) b) Phenol-formaldehyde (Bakelite) c) PVC

Elastomers: Natural rubber- structure – chemistry of vulcanization and advantages.

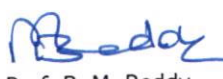
Artificial rubbers: Preparation, properties and uses of Buna-S and silicone rubbers.


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


Conducting polymers: Definition- classification, mechanism of conduction in polyacetylene and applications.


Prof. A. Panasa Reddy


Prof. Ch. V.R. Reddy


Prof. B. M. Reddy


Prof. K L Reddy


Dr. P. Venugopal

UNIT-IV: ENGINEERING MATERIALS (9)

a. Composite materials:

Introduction, constituents of composites, advantages over conventional materials. Applications of composites. Types of composites based on matrix and dispersed phases. Manufacturing techniques – Hand lay up method-RTM, pull trusion methods.

Fiber reinforced composites: glass, carbon and aramid reinforced composites. Layered composites-applications.

b. Membrane technology

Introduction, classification- symmetric, asymmetric, electrically charged and liquid membranes. Working principle of membrane, advantages of membrane separation over conventional separation. Casting methods: phase inversion and solvent evaporation methods, synthesis of polyphenyleneoxide, polyethersulphone and membrane casting. Industrial applications of membranes- gas separation, pervaporation, elecetrodialysis, reverse osmosis, micro, ultra and nano filtration.

UNIT-V: ADVANCED ENGINEERING MATERIALS (10)

a. Nano Materials

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

Types of Nanomaterials: 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 Nanotubes:single walled carbon nanotubes (SWCNTs). Multi walled carbon nanotubes (MWCNTs), synthesis of CNTs- arc discharge and laser ablation methods, applications.

b. 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.

Text Books:

1. PC 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 Nano science, by S m Lindsay, Oxford University press



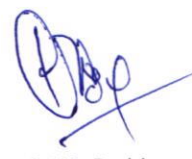
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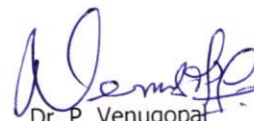
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