

**VASAVI COLLEGE OF ENGINEERING (A)**  
**DEPARTMENT OF CHEMISTRY**  
**SEMESTER-I**  
**ENGINEERING CHEMISTRY**  
**(Common to all branches)**

|                                  |                                     |   |
|----------------------------------|-------------------------------------|---|
| Instruction : 2+1 hours per week | Semester End Exam Marks : 60        | Subject Reference Code : BS130CH        |
| Credits : 2                      | Continuous Internal Exam Marks : 40 | Duration of semester End Exam : 3 Hours |

| OBJECTIVES   | OUTCOMES   |
|--|--|
| <b>The course will enable the students to:</b>   | <b>At the end of the course students should be able to:</b>  |
| 1. Study types of conductance, variation of electrode potential and electromotive force and to acquaint with applications of Galvanic Cell.<br><br>2. Describe the requirements of water for domestic and industrial uses.<br><br>3. Study the phase behaviour and composition of heterogeneous equilibrium systems.<br><br>4. Study various types of nano materials, their preparation methods and applications.<br><br>5. Get acquainted with engineering materials like membranes and refractories. | 1. Apply concepts of electrode potentials and Nernst equation to calculate electromotive force of a given cell.<br>2. Explain the principles and applications of conductometric and potentiometric titrations and determination of pH of a solution using Glass and Quinhydrone electrodes.<br>3. Determine hardness and alkalinity of a given water sample and suggest suitable methods for removal of hardness of the given water sample.<br>4. Apply Phase rule to explain phase diagrams of one component and two component systems.<br>5. Explain properties, synthetic methods, and applications of nanomaterials in general and carbon nanotubes in particular<br>6. Discuss the principle, casting methods, and applications of membranes with special reference to poly phenylene oxide and poly ether sulphone.<br>7. Apply the knowledge of properties of refractory materials and suggest a suitable refractory material for a given industrial application. |

### UNIT-I-Electro Chemistry

Introduction, types of conductors-electronic and electrolytic, description of conductivity cell, principle and applications of conductometric titrations- electrolytic and galvanic cells. IUPAC convention of cell notation, cell reaction, concept of electrode potential, electro motive force (emf), electro chemical series – applications, Nernst equation-derivation and Numericals. Types of electrodes- Calomel electrode (CE), Quinhydrone and Glass electrode (GE). Determination of  $p^H$  using quinhydrone and glass electrodes. Principle and applications of potentiometric titrations.

### UNIT-II- Water Technology

Hardness of water- types and its units, Degree of hardness-Numericals on calculation of hardness of water. Determination of hardness of water by complexometric titration method - Numericals. Alkalinity of water and its determination-Numericals. Effect of hard water in boilers- scales, sludges, causes and their prevention by calgon & blow down processes. Softening of water by de mineralization. Specifications of potable water ( WHO & BIS ). Water treatment for drinking purpose- Chlorination- Break Point Chlorination and Reverse Osmosis.

### UNIT-III-Phase rule

Phase rule- explanation of terms involved, One component system: Water system, Condensed phase rule, Two component systems: Lead- Silver (Pb-Ag) system, Pattinson's process, Copper -Nickel (Cu-Ni) system, Lead – Tin system (Pb-Sn), Eutectics and their applications in safety fuses and solders.

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## UNIT-IV- Nano Materials

Introduction - concept of Nanomaterials, electrical, optical, magnetic, 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 and Chemical vapor deposition methods.

Carbon Nanotubes: Single walled carbon nanotubes (SWCNTs), structure of SWCNTs - arm chair, chiral and zig zag. Multi walled carbon nanotubes (MWCNTs), synthesis of CNTs- arc discharge and laser ablation methods, applications.

## UNIT-V- Membrane technology and Refractories

### Membrane technology

Introduction, classification, working principle of membrane, casting methods: Phase Inversion and Solvent Evaporation methods, Synthesis of poly phenylene oxide, poly ether sulphone and membrane casting. Industrial applications of membranes.

### Refractories:


Introduction, requirements of a good refractory, classification, properties: Refractoriness-determination and significance, Refractoriness under load (RUL)-determination and significance, Thermal spalling and Porosity- Applications of refractories.

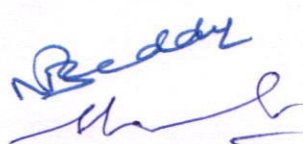
### Books:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub, Co., New Delhi (2002)
2. Shasi Chawla, "Text Book of Engineering Chemistry", Dhanpat Rai Publishing Company, NewDelhi (2008).
3. S.S. Dara "A text book of engineering chemistry" S.Chand&Co.Ltd., New Delhi (2006).
4. Puri B. R., Sharma L. R. and Pathania M. S., "Principles of Physical Chemistry", Vishal Publishing Company, Delhi, 2010.
5. Palanna O. G., "Engineering Chemistry", Tata Mc.Graw Hill Education Pvt. Ltd., New Delhi, 2009.
6. Mary Jane Shultz, "Engineering Chemistry", Cengage Learning, USA, 2009

### Suggested Reading:

1. B.K.Sharma, "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001)
2. Water Treatment : F. I. Bilane, Mir publisher
3. Chemistry of Advanced Materials: CNR Rao, RSC Publication.
4. Materials Science and Engineering an Introduction, William D. Callister, (Jr. Wiley publisher).
5. Introduction to nano materials by T.Pradeep.
6. Derek Pletcher and Frank C. Walsh, "Industrial Electrochemistry", Chapman and Hall, New York, 1993
7. Vijayamohanan K. Pillai and MeeraParthasarathy. "Functional Materials - A Chemist's Perspective" Universities Press, India, 2012.
8. Nanostructures and Nanomaterials: Synthesis, Properties and applications, Cao G, ICP, London,2004

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