From the Academic Year 2025-2026

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

ACCREDITED BY NAAC WITH A++ GRADE

DEPARTMENT OF CHEMISTRY

ENGINEERING CHEMISTRY

(For ECE & EEE branches)

SYLLABUS FOR B`E I SEMESTER

Instruction : 2 Hrs / Week	Semester End Exam Marks : 60	Subject Reference Code : U25BS120CH
Credits : 2	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. Introduce the fundamental concepts and applications of nanomaterials and electrochemical sensors 4. Get acquainted with engineering materials such as polymers and liquid crystals.	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. Explain the synthesis and properties of nanomaterials along with working principle of electrochemical sensors. 4. Outline the properties associated with different types of engineering polymers and liquid crystals.

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	1	-	-	-	-	2	-	-	-	-	2
3	3	1	-	-	-	-	1	-	-	-	-	2
4	3	1	-	-	-	-	2	-	-	-	-	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, week acid *vs* strong base and mixture of acids *vs* strong base.

Cells – electrolytic and electrochemical cells. concept of electrode potential, electromotive force (EMF). 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 titrations.

UNIT-II: ENERGY STORAGE DEVICES (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 – numerical. Memory effect, flat discharge rate.

Primary batteries: Types-acidic, alkaline and reserve batteries. Construction and electrochemistry of Ag_2O-Zn 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. B.Manohar Prof. G. Satyanarayana Dr. Krishnan Rangan Dr. P. Venugopal

UNIT-III: NANO MATERIALS AND SENSORS (10)

a) Nanomaterials:

Introduction – concept of nanomaterials – quantum confinement and surface volume ratio. Applications of Nanomaterials. 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 method, Microscopic Characterization: Limitations of optical microscopy, Principle and block diagram of Scanning Electron Microscope (SEM).

b) Sensors:

Introduction – characteristics of sensors, elements of sensors- receptor, transducer, Classification of sensors- working principle with an example of potentiometric sensors and amperometric sensors- Applications of Electrochemical sensors.

UNIT-IV: POLYMERS AND LIQUID CRYSTALS (10)

Introduction, degree of polymerization, functionality of monomers and its effect on the structure of polymers. Classification of polymers – i) homo and co-polymers, ii) homo chain and hetero chain polymers. iii) plastics- elastomers, fibers and resins. Molecular weight – number average and weight average molecular weight, numericals. Glass transition temperature (T_g) and factors affecting T_g.

Plastics: Thermo plastics and Thermo sets. Preparation, properties and engineering applications of PVC, Bakelite and Nylon 6,6.

Elastomers: Preparation, properties and engineering applications of Buna-S.

Biodegradable polymers: Concept, preparation and uses of polylactic acid and polyvinyl alcohol.

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

Text Books:

1. P. C. Jain, M Jain Engineering Chemistry, Dhanapathi Rai publishing company (17th edition), New Delhi.
2. O. G. PALANNA, Engineering Chemistry, TMH Edition.

Learning Resources:

1. B. H. Mahan, University Chemistry.
2. B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTEL Web-book).
3. P. W. Atkins, Physical Chemistry.
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. D. Dhara, IIT Kharagpur, NPTEL Polymer Chemistry Course.
7. Gowarikar V R, Polymer chemistry, V Edition.
8. S M Lindsay, Introduction to Nanoscience, Oxford University press.
9. Sashi Chawla, Text book of Engineering Chemistry, Dhanapathi Rai & Co, New Delhi.
10. J.C. Kuriacose and Rajaram, Chemistry in Engineering and Technology
11. Wiley Engineering Chemistry, Wiley India pvt Ltd, II edition.
12. Peter Grundler, Chemical sensors, An introduction for scientists and engineers, Springers
13. Chemistry of Nanomaterials by CNN Rao.

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