ENGINEERING CHEMISTRY

(Common to CSE, ECE, EEE, IT, CSE (AI&ML), CSE (Data Science))

Course Code: 22BC1101

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Course Outcomes: At the end of the Course the student shall be able to
CO1: construct electrochemical cells and measure electrode potentials (L3)
CO2: classify different types of cells and explain the merits of fuel cells. (L3)
CO3: illustrate various sources of renewable energy and applications of solar energy (L3)
CO4: apply different polymers to specific applications. (L3)
CO5: describe the importance of nano materials and molecular machines. (L2)

UNIT- I **10 Lectures**

ELECTROCHEMICAL CELLS: Introduction-Electrode potential, origin and measurement, Nernst Equation for a single electrode; Types of Reference Electrodes -Hydrogen and Calomel electrode; Electrochemical Cell, Sign conventions, Galvanic Cell vs Electrolytic Cell, , EMF of a cell; Concentration Cells; Ion Selective Electrodes - glass membrane electrode-pH measurement.

Learning outcomes:
At the end of the module the student will be able to

1. illustrate the construction of electrochemical cells. (L3)
2. explain the significance of electrode potentials.(L2)
3. use ion selective electrodes. (L3)

UNIT-II **10 Lectures**

ELECTROCHEMICAL ENERGY SYSTEMS: Batteries- primary cells- Dry/Leclanche cell, Alkaline cells (Zn-HgO cell, Zn-Ag_2O cell), Weston Cadmium Cell; Secondary cells– Lead acid battery, Ni-Cd battery, Lithium-ion battery, metal air battery; Fuel cells- Introduction, merits of fuel cells, hydrogen - oxygen fuel cell- Alkaline fuel cell, phosphoric acid fuel cell, propane and oxygen fuel cell .

Learning outcomes:
At the end of the module the student will be able to

1. classify different types of batteries. (L2)
2. compare the merits of different cells. (L2)
3. apply redox principles for construction of batteries and fuel cells. (L3)

UNIT- III **10 Lectures**

ENERGY SOURCES AND APPLICATIONS: Introduction- fossil and renewable energy; Sources of renewable energy, Solar energy- Physical and chemical properties of silicon, Production of solar grade silicon from quartz, Doping of Silicon- p and n type semiconductors; p-n junction. Silicon Photovoltaic cells - manufacture by chemical vapour deposition method and applications.

Learning outcomes:

At the end of the module the student will be able to

1. discuss different renewable sources of energy. (L2)
2. illustrate the construction of a p-n junction diode. (L3)
3. explain how photovoltaic cells convert light into energy. (L2)

UNIT-IV **10 Lectures**

POLYMER CHEMISTRY: Introduction to polymers - functionality of monomers, Types of polymerization- chain growth and step growth polymerization, coordination polymerization, copolymerization.

Plastics – Introduction, Thermoplastic and Thermosetting plastics, preparation, properties and applications of – Bakelite, urea-formaldehyde polymer, Nylon-66.

Elastomers-Natural rubber- Drawbacks, Vulcanization, Synthetic rubber- preparation, properties and applications of Buna-S, Buna-N.

Conducting polymers – Preparation, properties and applications of polyacetylene, polyaniline, polypyrroles.

Learning Outcomes:

At the end of the module the student will be able to

1. use different types of polymers for various applications (L3)
2. explain the preparation, properties and applications of Bakelite and Nylon-6,6. (L2)
3. describe the role of vulcanisation process in improving the mechanical properties of polymers. (L2)

UNIT – V **10 Lectures**

NANOMATERIALS AND MOLECULAR MACHINES:

Nanomaterials: Introduction to nanomaterials - nanoclusters, fullerenes, carbon nanotubes (CNT) and nanowires; Variation of colour of gold nanoparticles – quantum confinement – qualitative picture based on band diagram; Synthesis of nanomaterials - Sol-gel method, Reverse micellar method; Applications of nanomaterials in wastewater treatment, lubricants and engines.

Molecular machines -Introduction- Rotaxane and Catenanes as artificial molecular machines.

Molecular Switches- Introduction, Cyclodextrin based switches.

Learning outcomes:

At the end of the module the student will be able to

1. explain the synthesis and characterization methods of nano materials. (L2)
2. discuss role of nanomaterials in wastewater treatment and other applications (L2)
3. discuss the concepts of artificial molecular machines. (L2)

Text Books:

1. P.C. Jain and M. Jain, *Engineering Chemistry*, 15th edition, Dhanpat Rai & Sons, Delhi, 2014.
2. B.S Murthy and P. Shankar, *A Text Book of NanoScience and NanoTechnology,* University Press, 2013.

Reference Books:

1. O.G.Palanna, *Engineering Chemistry*, Tata McGraw Hill Education Pvt Ltd, 2009.
2. Sashi Chawla, *A Textbook of Engineering Chemistry* , Dhanapath Rai and sons, 2003.
3. S.S. Dara, *A Textbook of Engineering Chemistry*, S.Chand & Co, 2010.
4. Jonathan. W.Steed, Jerry L.Atwood, *Supramolecular Chemistry*, Second Edn, Wiley Publications, 2009.