



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA**  
**KAKINADA – 533 003, Andhra Pradesh, India**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

## COURSE STRUCTURE-R19

I Year - I Semester		L	T	P	C
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APPLIED CHEMISTRY (BS1106)					

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

### Learning Objectives:

- **Importance** of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- **Outline** the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
- **Express** the increase in demand as wide variety of advanced materials are introduced; which have excellent engineering properties.
- **Explain** the crystal structures, and the preparation of semiconductors. Magnetic properties are also studied.
- **Recall** the increase in demand for power and hence alternative sources of power are studied due to depleting sources of fossil fuels. Advanced instrumental techniques are introduced.

### UNIT I POLYMER TECHNOLOGY

**Polymerisation:-** Introduction-methods of polymerization (emulsion and suspension)-physical and mechanical properties.

**Plastics:** Compounding-fabrication (compression, injection, blown film, extrusion) - preparation, properties and applications of PVC, polycarbonates and Bakelite-mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

**Elastomers:-** Natural rubber-drawbacks-vulcanization-preparation, properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes).

**Composite materials:** Fiber reinforced plastics-conducting polymers-biodegradable polymers-biopolymers-biomedical polymers.

#### Learning Outcomes: *At the end of this unit, the students will be able to*

- **Outline** the properties of polymers and various additives added and different methods of forming plastic materials.
- **Explain** the preparation, properties and applications of some plastic materials.
- **Interpret** the mechanism of conduction in conducting polymers .
- **Discuss** natural and synthetic rubbers and their applications.

### UNIT II: ELECTROCHEMICAL CELLS AND CORROSION



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Single electrode potential-Electrochemical series and uses of series-standard hydrogen electrode, calomel electrode-concentration cell-construction of glass electrode-Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li ion battery, zinc air cells–Fuel cells:  $H_2$ - $O_2$ ,  $CH_3OH$ - $O_2$ , phosphoric acid, molten carbonate.

**Corrosion:-** Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, waterline corrosion-passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control (proper designing, cathodic protection)-Protective coatings: Surface preparation, cathodic and anodic coatings, electroplating, electroless plating (nickel). Paints (constituents, functions, special paints).

**Learning Outcomes:** *At the end of this unit, the students will be able to*

- *Explain* the theory of construction of battery and fuel cells.
- *Categorize* the reasons for corrosion and study some methods of corrosion control.

### UNIT III: MATERIAL CHEMISTRY

**Part I : Non-elemental semiconducting materials:-** Stoichiometric, controlled valency & chalcogen photo/semiconductors-preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling, epitaxy, diffusion, ion implantation) - Semiconductor devices (p-n junction diode as rectifier, junction transistor).

**Insulators & magnetic materials:** electrical insulators-ferro and ferri magnetism-Hall effect and its applications.

#### Part II:

**Nano materials:-** Introduction-sol-gel method- characterization by BET, SEM and TEM methods-applications of graphene-carbon nanotubes and fullerenes: Types, preparation and applications

**Liquid crystals:-** Introduction-types-applications.

**Super conductors:-** Type –I, Type II-characteristics and applications

**Learning Outcomes:** *At the end of this unit, the students will be able to*

- *Understand* the importance of materials like nanomaterials and fullerenes and their uses.
- *Understand* liquid crystals and superconductors.
- *Understand* the preparation of semiconductors.

### UNIT IV: ADVANCED CONCEPTS/TOPICS IN CHEMISTRY

**Computational chemistry:** Introduction, Ab Initio studies

**Molecular switches:** characteristics of molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light-powered molecular motor

**Learning Outcomes:** *At the end of this unit, the students will be able to*

- *Obtain* the knowledge of computational chemistry
- *Understand* importance molecular machines



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**COURSE STRUCTURE-R19**

**UNIT V: SPECTROSCOPIC TECHNIQUES & NON CONVENTIONAL ENERGY SOURCES**

**Part A: SPECTROSCOPIC TECHNIQUES**

Electromagnetic spectrum-UV (laws of absorption, instrumentation, theory of electronic spectroscopy, Frank-condon principle, chromophores and auxochromes, intensity shifts, applications), FT-IR (instrumentation and IR of some organic compounds, applications)-magnetic resonance imaging and CT scan (procedure & applications).

**Part B: NON CONVENTIONAL ENERGY SOURCES**

Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, hydropower, geothermal power, tidal and wave power, ocean thermal energy conversion.

**Learning Outcomes:** *At the end of this unit, the students will be able to*

- understand the principles of different analytical instruments.
- explain the different applications of analytical instruments.
- design sources of energy by different natural sources.

**Standard Books:**

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publishing Co.

**Reference Books:**

1. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 edition.