



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY : KAKINADA
KAKINADA-533003, Andhra Pradesh, India

R-19 Syllabus for CE - JNTUK

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| I Year - II Semester | | L | T | P | C |
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| ENGINEERING CHEMISTRY(BS1210) | | | | | |

Pre-requisite Course: Students should have basic understanding of Chemistry.

Course Description and Objectives: 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.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes.

| CO | Course Outcomes | POs |
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| 1 | Outline the properties of polymers and various additives added and different methods of forming plastic materials. Interpret the mechanism of conduction in conducting polymers | 4 |
| 2 | Explain the theory of construction of battery and fuel cells. Categorize the reasons for corrosion and study some methods of corrosion control. | 5 |
| 3 | Outline the awareness of materials like nano-materials and fullerenes and their uses Explain the techniques that detect and measure changes of state of reaction. Illustrate the commonly used industrial materials. | 3 |
| 4 | Obtain the knowledge of computational chemistry and understand importance molecular machines | 3 |
| 5 | Explain the impurities present in raw water, problems associated with them and how to avoid them are understood | 4 |

SYLLABUS:

UNIT - I: POLYMER TECHNOLOGY

Objective: Importance of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries

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.

UNIT-II: ELECTROCHEMICAL CELLS AND CORROSION

Objective: Outline the basics for the construction of electrochemical cells, batteries and fuel cells.

Understand the mechanism of corrosion and how it can be prevented

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)

UNIT-III: CHEMISTRY OF MATERIALS

Objective: To express the increase in demand as wide variety of advanced materials are introduced; which have excellent engineering properties. Classify and discuss the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubrication is also summarized.

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

Thermal analysis techniques: Instrumentation and applications of thermogravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC).

Part-B:

Refractories: - Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

Lubricants: - Definition, mechanism of lubricants and properties (definition and importance).

Cement: - Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR), chemistry of setting and hardening, deterioration of cement.



UNIT-IV: FUELS

Objective: Relate the need of fuels as a source of energy to any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence introduced.

Introduction-calorific value-HCV and LCV-problems using Dulong's formula- proximate and ultimate analysis of coal sample-significance of these analyses-problems-Petroleum (refining-cracking)-Synthetic petrol (Fischer Tropsch and Bergius)-petrol knocking-diesel knocking-octane and cetane ratings-anti-knock agents-Introduction to alternative fuels (Bio-diesel, ethanol, methanol, Natural gas, LPG, CNG)-Flue gas analysis by Orsat apparatus-Rocket fuels

UNIT-V:

Objective: Explain the importance and usage of water as basic material in almost all the industries; interpret drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

Hardness of water-determination of hardness by complexometric method-boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement)-internal treatments-softening of hard water (zeolite process and related sums, ion exchange process)-treatment of industrial waste water

Portable water and its specifications-steps involved in purification of water-chlorination, break point chlorination-reverse osmosis and electro dialysis.

TEXT 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.
2. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
3. Engineering Chemistry by Shashi Chawla; Dhanpat Rai Publishing Co. Latest edition