



UNIT-I

1. a. Assess the role of water impurities in causing boiler troubles and their implications for industrial energy systems [7M]
b. What are the key stages in municipal water treatment process? Apply the concept of breakpoint chlorination to municipal water treatment. [2 + 5M]

OR

2. a. Analyze how differences in operating principles between lime-soda and ion-exchange processes influence cost, maintenance, and environmental impact. [7M]

b. Analyze the advantages and limitations of reverse osmosis vs electrodialysis. [7M]

UNIT-II

3. a. Apply electrochemical principles to explain why zinc–air batteries exhibit higher energy density compared to zinc–carbon batteries. [7M]
b. Analyze the limitations of nickel–cadmium batteries that led to the development of nickel–metal hydride batteries, with reference to electrochemical performance and environmental impact. [7M]

OR

4. a. Describe how zinc–alkaline batteries differ in operation from zinc–carbon batteries. [7M]
b. Compare primary and secondary batteries with respect to rechargeability, energy density, and applications. [7M]

UNIT-III

5. a. Analyse the reasons for carbon monoxide poisoning in fuel cell catalysts and its impact on cell performance. [7M]
b. Describe the basic principle of solid oxide fuel cells and mention two practical limitations. [7M]

OR

6. a. Summarize the significance of anodic and cathodic reactions in fuel cell performance. List few anodic and cathodic materials that help improve the efficiency of high temperature fuel cells. [2+5M]

b. Explain the working principle of optical fiber sensors and demonstrate their use in at least two sensing applications. [7M]

UNIT-IV

7. a. Describe the role of moisture and oxygen in initiating electrochemical corrosion. Give significance of the galvanic series in corrosion. [4+3M]
b. What is electroplating process. Demonstrate how surface preparation influences the effectiveness of electroplating processes. [2+5M]

OR

8. a. Analyze the factors responsible for pitting corrosion and explain why it is considered more dangerous than uniform corrosion. [7M]
b. Describe in detail the functions of protective coatings in corrosion prevention. Explain how it can reduce corrosion kinetics. [4+3M]

UNIT-V

9. a. Explain how green chemistry differs from conventional pollution control approaches. Highlight the major goals of green chemistry in promoting sustainable chemical processes. [3+4M]
b. Describe how green synthesis of paracetamol improves, reduces environmental impact and minimizes energy consumption when compared with the conventional synthesis route. [7M]

OR

10. a. Analyse how solvent choice influences reaction rate, safety, and waste generation in green synthesis. [7M]
b. Critically evaluate how green chemistry contributes to sustainable development in engineering and societal applications. [7M]