



**KINGS**  
COLLEGE OF ENGINEERING



**Department of Science and Humanities**

**Sub. Code: HS1103**

**Sem/Year I / I**

**Sub. Name: Engg.Chemistry-I**

**UNIT – I – WATER TREATMENT PROCESS:**

**PART – A ( 2 Marks)**

1. Define hardness of water.
2. Distinguish between carbonate hardness and noncarbonate hardness.
3. Draw the structure of EDTA. What happens when EDTA is added to hard water?
4. Define alkalinity.
5. Why is water softened before using in boiler?
6. What is meant by priming and foaming? How can they be prevented?
7. What is meant by caustic embrittlement? How is it prevented?
8. Indicate the reasons for boiler corrosion.
9. What is the role of phosphates in the internal treatment of water?
10. What is calgon conditioning? How is it functioning in water treatment?
11. Mention requisites of potable water.
12. Write briefly on disinfection of water by UV treatment.
13. Write the principle involved in the desalination of water by reverse osmosis.
14. Define the term break-point chlorination.
15. Define desalination.
16. What is Sodium zeolite? What is its use?

### **PART – B ( 16 Marks)**

1. (i) What is the principle of EDTA method? Describe the estimation of Hardness of water by EDTA method. **(8)**  
(ii) Describe De-Mineralization process of water softening. Explain the Reactions involved with diagram. **(8)**
2. (i) Describe briefly the different steps in the purification of water for drinking Purposes. **(8)**  
(ii) What is desalination? Name the different methods of desalination. Explain any one in detail. **(8)**
3. (i) Discuss briefly about the problems caused due to the usage of hard water in boilers. **(8)**  
(ii) What are Zeolites? How do they function in removing the hardness? **(8)**
4. (i) How is internal treatment of boiler water carried out? **(8)**  
(ii) What is the various methods by which disinfection of domestic water is carried out? Explain. **(8)**

### **UNIT – II – SURFACE CHEMISTRY**

#### **PART – A ( 2 Marks)**

1. How does chemisorption differ from physisorption?
2. How will you increase the activity of adsorbent?
3. Define adsorption? What is an adsorption isotherm?
4. What is Freundlich's adsorption isotherm?
5. What are promoters?
6. What is catalytic poisoning?
7. What is the effect of temperature and pressure on the adsorption of hydrogen gas on charcoal?

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8. Define ion-exchange adsorption
9. what is langmuir adsorption isotherm? How it is mathematically represented?
10. What is the demerit of langmuir adsorption isotherm?

### **PART – B ( 16 Marks)**

1. (i) Distinguish between physical adsorption and chemisorption. [6]  
(ii) Derive an expression for Langmuir unimolecular adsorption isotherm.  
What are its limitations? [10]
- 2 (i) Explain adsorption theory (or) contact theory with examples. [6]  
(ii) Explain the classification & functions of ion-exchangers.[10]
- 3 (i) Define the term adsorption and list its application [4]  
(ii) Explain the role of adsorption in demineralization of water.[8]  
(iii) Give any three factors on which adsorption depends [4]
- 4 (i) Derive Freundlich's adsorption isotherm. Give the conditions in which  
It fails. [6]  
(ii) Explain the role of adsorption in catalytic reactions [10]
- 5 (i) Discuss the factors which influence adsorption of gas on a solid. [8]  
(ii) Define adsorption isotherm. Explain the various types of adsorption  
Isotherm. [8]
- 6 (i) Explain the role of adsorbents in pollution abatement. [12]  
(ii) Define the terms adsorbent and adsorbate giving suitable examples.[4]

### **UNIT – III – ELECTROCHEMISTRY**

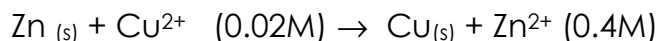
#### **PART – A ( 2 Marks)**

1. What is a cell? Mention its types.
2. Define the terms (i) single electrode potential (ii) Electrochemical cells.
3. Define Helmholtz electrical double layer.

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4. Write Nernst equation.
5. Define a reference electrode. Give one example.
6. What is electromotive series? What is its significance?
7. What is electrode concentration cell? Give one example.
8. Find the potential of the cell in which the following reactions takes place at 25° C.



9. What is electro chemical cell?
10. Why can glass electrode not be used for a solution of high alkalinity?
11. What are reversible & irreversible cells?
12. What are the advantages of conductometric titrations?

### **PART B [ 16 marks]**

1. (i) Derive Nernst equation. Give its significances. **(8)**  
(ii) What are reference electrodes? Describe any two reference electrodes with neat diagram and mention their uses. **(8)**
2. (i) Describe a glass electrode. How can it be used for determining the pH Of a solution? **(8)**  
(ii) How is Emf of a galvanic cell measured by poggendorff's compensation method? **(5)**  
(iii) Consider the cell reaction,  
$$\text{Zn}_{(s)} + \text{Fe}^{2+} (0.005 \text{ M}) \rightleftharpoons \text{Zn}^{2+} (0.01 \text{ M}) + \text{Fe}_{(s)}$$
Given that the standard emf of the cell at 298 K is 0.323 V. Construct the cell and  
Calculate the emf of the cell. **(3)**
3. (i) What are Reference Electrode? Explain the types with neat diagrams and mention their uses **(8)**

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(ii) What is the principle underlying conductometric titration? Explain acid-base titrations with neat graph. **(8)**

4(i) Describe a glass electrode. How can it be used for determining the pH of a solution? (8)

(ii) What is the principle underlying Potentiometric titration? Explain Redox titrations with neat graph. **(8)**

5. Describe the following electrodes giving the diagram, electrode notation and Electrode reaction. (i) Calomel electrode (ii) Glass Electrode (iii) Quin hydrone electrode (iv) Standard H<sub>2</sub> electrode [16]

### **UNIT – IV – ENERGY SOURCES AND ENERGY STORING DEVICES:**

#### **PART – A ( 2 Marks)**

1. Define nuclear fission.
2. What is nuclear chain reaction/
3. What is a nuclear reactor?
4. Mention any two differences of a nuclear reaction and a chemical reaction?
5. What is breeder reactor?
6. What is solar cell?
7. What are the applications of hydrogen-oxygen fuel cell?
8. What is wind energy? How is it obtained?
9. What is fissile and fertile nucleides?
10. What is super critical mass and sub critical mass?
11. What is nuclear energy?
12. What is a battery? How does it differ from a cell?
13. What are the advantages of alkaline battery over dry cell?
14. How is NICAD battery constructed?

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### **PART – B ( 16 Marks)**

1. (i) What is a nuclear reactor? Describe the components of a light water nuclear power Plant with a suitable block diagram. **(10)**  
(ii) Explain the mechanism and characteristics of a nuclear fission reaction with suitable Example. **(6)**
- 2.(i) What is reversible battery? Describe the construction and working of lead acid storage battery with reacting occurring during charging and discharging. **(8)**  
(ii). How is NICAD battery constructed? Explain with cell reactions. Give its uses. **(8)**
- 3(i). Write a brief note on Lithium battery. **(8)**  
(ii). Define Photo galvanic cell. Explain its working with diagram. Give its applications. **(8)**
4. What are Fuel cells? Explain the construction and working of  $H_2-O_2$  fuel cell . **(16)**

### **UNIT – V – ANALYTICAL TECHNIQUES AND CHEMOMETRICS:**

#### **PART – A ( 2 Marks)**

1. State Beer –Lambert's law. Give its limitations.
2. Name the components of colorimeter.
3. What is flame photometry?
4. How are alkali and alkaline –earth metals detected in flame photometry? Give examples.
5. What are the sources of UV light in UV-Visible spectrophotometer?
6. Define the term Batho chromic shift.
7. What is finger print region? Mention its important uses.
8. Write any two disadvantages of AAS.
9. Compare atomic absorption spectroscopy and flame emission spectroscopy

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10. How are IR spectral range subdivided?

11. What are the limitations of flame photometry?

### **PART – B ( 16 Marks)**

1. (i) Derive Beer-Lambert's law. Give its limitations. **(8)**

(ii) What is Colorimetry? With a block diagram explain how it is used to estimate iron in water. **(8)**

2. (i) Explain briefly the principle and instrumentation of flame photometry. How do you estimate sodium using flame photometry? **(8)**

(ii). Explain the various components and working of UV-Visible Spectrophotometer. **(8)**

3(i) What is IR spectroscopy?. Explain the various components and working of IR spectrophotometer. **(8)**

(ii). With energy level diagram explain various transitions involved in UV Spectra. **(8)**

4. Explain how different fundamental modes for different types of compounds are estimated in IR spectra. **(16)**