

First/Second Semester B.E. Degree Examination, June/July 2019
Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What is single electrode potential? Derive Nernst's equation for single electrode potential. (06 Marks)
- b. What are batteries? Demonstrate the construction and working of Ni-MH battery, mention its applications. (07 Marks)
- c. What voltage will be generated by a cell that consists of an iron electrode immersed in 0.5M FeSO₄ solution and a copper electrode immersed in 1M CuSO₄ solution at 298 K. Given $E^{\circ}_{Fe} = -0.44$ V and $E^{\circ}_{Cu} = 0.34$ V. Write the cell representation and cell reactions. (07 Marks)

OR

- 2 a. What is Battery? Explain primary and secondary with examples. (06 Marks)
- b. Describe the construction and working of Li-ion battery. Mention its applications. (07 Marks)
- c. What are concentration cells? Emf of the cell Cd | CdSO₄ (XM) || CdSO₄ (0.025M) | Cd at 28°C is 0.035 V. Find the concentration of CdSO₄ at anode. Given $R = 8.314$ J/K/mol, $F = 96500$ C. (07 Marks)

Module-2

- 3 a. Discuss the following types of corrosion:
 - i) Differential metallic corrosion
 - ii) Water line corrosion
 (06 Marks)
- b. What is corrosion? Illustrate electrochemical theory of corrosion taking iron as an example. (07 Marks)
- c. What is electroless plating? Outline the electroless plating of copper. (07 Marks)

OR

- 4 a. Explain the factors affecting the rate of corrosion:
 - i) Nature of corrosion product
 - ii) Ratio of anodic to cathodic areas
 (06 Marks)
- b. What is meant by metal finishing? Highlight any five technological importance of metal finishing. (07 Marks)
- c. What is electroplating? Discuss the electroplating of chromium. (07 Marks)

Module-3

- 5 a. What are fuel cells? Describe the construction and working of Methanol-Oxygen fuel cell. (06 Marks)
- b. Describe the experimental determination of calorific value of solid fuel using Bomb Calorimeter. (07 Marks)
- c. 0.95 g of coal sample (C = 93%; H₂ = 6% and ash 1%) was subjected to combustion in Bomb calorimeter. Mass of water taken in the calorimeter was 2.6 kg and the water equivalent of calorimeter was 0.75 kg. The rise in temperature was found to be 3.2°C. Calculate the gross and net calorific values of the sample. Latent heat of steam = 2457 kJ/kg/°C and S = 4.187 kJ/kg/°C. (07 Marks)

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OR

- 6 a. Explain the preparation of solar grade silicon by union-carbide process. (06 Marks)
 b. What are pv-cells? Illustrate the construction and working of a typical pv-cell. (07 Marks)
 c. What is knocking? Explain the mechanisms of knocking. Mention its ill effects. (07 Marks)

Module-4

- 7 a. Outline the softening of water by ion-exchange method. (06 Marks)
 b. What are the sources, effects and control of lead pollution? (07 Marks)
 c. Define COD. In a COD test, 30.6 cm³ and 15.5 cm³ of 0.05N FAS solution are required for blank and sample titration respectively. The volume of the test sample used was 25 cm³. Solve the COD of the water sample solution. (07 Marks)

OR

- 8 a. What is Desalination? Describe the process of reverse osmosis of water. (06 Marks)
 b. What is boiler corrosion? Explain the boiler corrosion with CO₂, O₂ and Mg. (07 Marks)
 c. Define COD. Illustrate the determination of COD of waste water sample. (07 Marks)

Module 5

- 9 a. Describe the synthesis of nano-material by sol-gel technique. (06 Marks)
 b. Discuss the theory and instrumentation of conductometry. (07 Marks)
 c. Outline the theory, instrumentation and applications of colorimetry. (07 Marks)

OR

- 10 a. Explain size dependent properties of nano material:
 i) Surface area
 ii) Electrical
 iii) Optical properties (06 Marks)
 b. Write a note on fullerenes. Mention its properties and applications. (07 Marks)
 c. What are nanomaterials? Explain the synthesis of nanomaterial by chemical vapour deposition method. (07 Marks)

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