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18CHE12/22

First/Second Semester B.E. Degree Examination, July/August 2022
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. Define single electrode potential. Derive Nernst equation for single electrode potential. (07 Marks)
- b. What are batteries? Explain the construction and working of Nickel – Metal hydride battery. Mention its applications. (07 Marks)
- c. A galvanic cell consists of a rod of copper immersed in 10.0M solution of CuSO_4 and a rod of iron immersed in 0.1M solution of FeSO_4 . Write the cell representation, cell reaction and calculate the emf of the cell. Given, $E_{\text{Fe}^{2+}/\text{Fe}}^0 = -0.44\text{V}$ and $E_{\text{Cu}^{2+}/\text{Cu}}^0 = 0.34\text{V}$. (06 Marks)

OR

- 2 a. What are reference electrodes? Describe the construction and working of calomel electrode. Mention its advantages. (07 Marks)
- b. Explain primary, secondary and reserve batteries with an example. (07 Marks)
- c. Define electrolyte concentration cell. Give an example. The emf of the cell $\text{Ag(s)}|\text{Ag}^+(0.01\text{M})||\text{Ag}^+(\text{xM})|\text{Ag(s)}$ is 0.0591V at 298K. Find the value of x. (06 Marks)

Module-2

- 3 a. Define metallic corrosion. Discuss the electrochemical theory of corrosion taking iron as an example. (07 Marks)
- b. What is galvanizing? Explain the galvanizing of iron. (07 Marks)
- c. What is electroplating? Explain the electroplating of hard chromium with reactions. (06 Marks)

OR

- 4 a. What is cathodic protection? Explain the impressed current and sacrificial anode methods of corrosion control. (07 Marks)
- b. Define electroless plating. Discuss the electroless plating of copper with relevant reactions. (07 Marks)
- c. What is metal finishing? Mention any FIVE technological importance of metal finishing. (06 Marks)

Module-3

- 5 a. Explain the experimental determination of calorific value of a solid fuel using Bomb calorimeter. (07 Marks)
- b. What is biodiesel? How is it produced? Mention its advantages. (07 Marks)
- c. What is knocking in IC engines? Explain the mechanism of knocking in petrol engine. (06 Marks)

OR

- 6 a. What are PV cells? Explain the construction and working of PV cell with neat diagram. (07 Marks)
- b. Describe the construction and working of MeOH – O₂ fuel cell. Mention its applications. (07 Marks)
- c. On burning 0.78g of a fuel in a bomb calorimeter, the temperature of 2600g of water was increased by 2.8K water equivalent of calorimeter is 400g. If the fuel contains 5% hydrogen, calculate its GCV and NCV. Given, specific heat of water = 4.187kJkg⁻¹ K⁻¹ and Latent heat of steam = 2454 kJ/kg. (06 Marks)

Module-4

- 7 a. Mention the sources, effects and discuss the control of oxides of sulphur pollution. (07 Marks)
- b. What is boiler feed water? Explain the scale and sludge formation in boilers. Mention their ill effects. (07 Marks)
- c. Define BOD and COD. In a COD test, 28.2cm³ and 12.5cm³ of 0.05N FAS solution is consumed for blank titration and sample titration respectively. The volume of waste water used is 25cm³. Calculate the COD of the sample. (06 Marks)

OR

- 8 a. Mention the sources of solid wastes. Explain the scientific land filling method and composting method of solid waste disposal. (07 Marks)
- b. What are the sources, ill effects and control of lead pollution? (07 Marks)
- c. What is desalination of sea water? Describe the desalination of water by reverse osmosis process. (06 Marks)

Module-5

- 9 a. Write the principle and explain the instrumentation and any one application of conductometry. (07 Marks)
- b. What are nano – materials? Explain the synthesis of nano-materials by chemical vapour deposition. (07 Marks)
- c. Explain the theory and instrumentation of potentiometry. (06 Marks)

OR

- 10 a. Write a note on fullerenes and carbon nanotubes. (07 Marks)
- b. Discuss the synthesis of nanomaterials by sol-gel process. (07 Marks)
- c. Discuss the theory and application of colorimetry in the estimation of concentration of copper in the given solution. (06 Marks)

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