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14CHE12/22

First/Second Semester B.E. Degree Examination, Dec.2018/Jan.2019
Engineering Chemistry

Time: 3 hrs.

Max. Marks:100

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

Module - 1

- 1 a. Derive Nernst equation for electrode potential. (05 Marks)
- b. What are reference electrodes? Describe the construction and working of calomel electrode. (05 Marks)
- c. Explain the construction, working and applications of Ni-MH battery. (05 Marks)
- d. What are fuel cells? Explain the construction and working of Methanol-Oxygen fuel cell. (05 Marks)
- 2 a. What are concentration cells? Derive an expression for emf of a concentration cell. (05 Marks)
- b. Explain an experimental method of determination of pH using glass electrode. (05 Marks)
- c. Describe the construction, working and applications of Zn-Air battery. (05 Marks)
- d. What are fuel cells? How they differ from a battery? (05 Marks)

Module - 2

- 3 a. Define the term corrosion. Explain electrochemical theory of corrosion with respect to iron. (06 Marks)
- b. Explain the effect of the following factors on the rate of corrosion:
 - i) Relative area of anode and cathode
 - ii) Nature of corrosion product. (04 Marks)
- c. What is electroless plating? Explain electroless plating of copper on PCB. (06 Marks)
- d. Explain the process of galvanizing. (04 Marks)
- 4 a. Explain the following types of corrosion:
 - i) Pitting corrosion
 - ii) Water line corrosion. (04 Marks)
- b. What is cathodic protection? Explain the following methods of control of corrosion:
 - i) Sacrificial anode
 - ii) Impressed current. (06 Marks)
- c. Explain the following terms:
 - i) Polarization
 - ii) Decomposition voltage. (06 Marks)
- d. Explain the process of electroplating of decorative chromium. (04 Marks)

Module - 3

- 5 a. What are chemical fuels? Give the classification of fuels with an example. (05 Marks)
- b. What is cracking process? Explain fluidized bed catalytic cracking with neat diagram. (05 Marks)
- c. What are photovoltaic cells? Explain construction and working of photovoltaic cell. (05 Marks)
- d. Discuss the production of solar grade silicon by union carbide process. (05 Marks)

- 6 a. What is gasoline knocking? Explain its mechanism with chemical reactions. (05 Marks)
 b. Calculate GCV and NCV using the following data. Mass of coke = 0.8×10^{-3} kg, mass of water = 2.5kg, water equivalent of calorimeter = 0.5kg, specific heat of water = 4.187 kJ/kg/K, increase in temperature = 2.8K, latent heat = 2457 kJ/kg, H = 2.5%. (05 Marks)
 c. Explain doping of silicon by diffusion technique. (04 Marks)
 d. Discuss the physical and chemical properties of silicon relevant to photovoltaics. (06 Marks)

Module – 4

- 7 a. Explain addition and condensation polymerization with example. (04 Marks)
 b. What is glass transition temperature? Explain any two factors effecting it. (06 Marks)
 c. What are polymer composites? Explain the synthesis and applications of Kevlar fibres. (05 Marks)
 d. Explain synthesis and applications of the following polymers: i) PMMA ii) Teflon. (05 Marks)
- 8 a. Explain free radical mechanism of polymerization of vinylchloride as an example. (05 Marks)
 b. What are elastomers? Give the synthesis and applications of silicone rubber. (05 Marks)
 c. What is conducting polymer? Explain the mechanism of conduction in polyaniline. (05 Marks)
 d. A polymer has the following composition:
 100 molecules of molecular mass 1000 g/mol, 200 molecules of molecular mass 2000 g/mol and 500 molecules of molecular mass 5000 g/mol. Calculate the number and weight average molecular weights of a polymer. (05 Marks)

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Module – 5

- 9 a. What is boiler feed water? Explain the scale and sludge formation in boiler. (05 Marks)
 b. What is desalination? Explain the process of desalination of water by electro dialysis. (05 Marks)
 c. What are nano materials? Explain the synthesis of nano materials by precipitation and gas condensation processes. (06 Marks)
 d. Write a note on nano composites. (04 Marks)
- 10 a. Define BOD and COD. 25cm^3 of an industrial effluent requires 12.5cm^3 of 0.5N $\text{K}_2\text{Cr}_2\text{O}_7$ solution for complete oxidation. Calculate the COD of the effluent. (06 Marks)
 b. Explain activated sludge process of sewage treatment with neat diagram. (04 Marks)
 c. Explain synthesis of nano materials by chemical vapour condensation and sol-gel processes. (06 Marks)
 d. Write a note on carbon nano tubes. (04 Marks)

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