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15CHE12/22

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

Time: 3 hrs.

Max. Marks: 80

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

**Module-1**

- What is single electrode potential? Derive the Nernst equation for single electrode potential. (06 Marks)
  - Define Electrolyte Concentration Cell. Two copper electrodes placed in CuSO<sub>4</sub> solutions of equal concentration are connected to form a concentration cell :
    - What is the Cell Voltage?
    - If one of the solutions is diluted until the concentration of Cu<sup>2+</sup> ions is 1/15<sup>th</sup> of its original value, what will be the cell voltage after dilution? (05 Marks)
  - Describe the construction, reactions and applications of Nickel metalhydride battery. (05 Marks)

**OR**

- Describe the following battery characteristics :
    - Voltage
    - Capacity
    - Cycle life. (06 Marks)
  - Explain the construction and working of Calomel electrode. (05 Marks)
  - Describe the construction, electrode reactions and applications of Methanol — oxygen fuel cell. (05 Marks)

**Module-2**

- Explain the effects of following variables on the nature of electro deposit :
    - Current density
    - Metal ion concentration
    - Complexing agents. (06 Marks)
  - Explain the Electrochemical theory of corrosion with iron as an example. (05 Marks)
  - Describe the Cathodic protection by Sacrificial Anode Method. (05 Marks)

**OR**

- Describe the effects of following factors on the rate of corrosion :
    - Nature of metal
    - Nature of corrosion products
    - Difference in potential between anodic and cathodic regions. (06 Marks)
  - Define Electroless plating. Explain the Electroless plating of copper. (05 Marks)
  - Describe Electro deposition of Hard Chromium. (05 Marks)

**Module-3**

- Explain how calorific value of a solid fuel is determined using Bomb Calorimeter. (06 Marks)
  - Explain the purification of silicon by zone refining process. (05 Marks)
  - A 0.85g of coal sample (carbon 90%, H<sub>2</sub> 5% and ash 5%) was subjected to combustion in a bomb calorimeter. Mass of water taken in the calorimeter was 2000g and the water equivalent of calorimeter was 600g. The rise in temperature was 3.5 °C. Calculate the gross and net calorific value of the sample. Given, specific heat of water = 4.187 kJ/kg/ °C and latent heat of steam 2454 kJ/kg. (05 Marks)

**15CHE12/22**

- 6 a. What is Photovoltaic cell? Explain the construction and working of PV cell. (06 Marks)  
 b. Describe Fluidized bed catalytic cracking. (05 Marks)  
 c. Explain the process of doping of silicon by diffusion technique. (05 Marks)

**Module-4**

- 7 a. Mention the preparation and applications of Poly methyl Methacrylate (PMMA) and poly carbonate. (06 Marks)  
 b. Define Glass transition temperature. Explain the following factors influencing the  $T_g$  value.  
     i) Flexibility      ii) intermolecular forces. (05 Marks)  
 c. Explain the free radical mechanism of addition polymerization by taking vinyl chloride as an example. (05 Marks)

**OR**

- 8 a. What is Conducting polymer? Explain the synthesis of conducting polyaniline. (06 Marks)  
 b. Define Adhesive. Explain the preparation and applications of Epoxy resin. (05 Marks)  
 c. A polymer has following composition, 100 molecules of molecular mass 1000g/mol, 200 molecules of molecular mass 2000g/mol and 500 molecules of molecular mass 5000g/mol. Calculate the number and weight average molecular weight. (05 Marks)

**Module-5**

- 9 a. Explain Winkler's method of determining dissolved oxygen. Give the reactions involved. (06 Marks)  
 b. Define COD. 25cm<sup>3</sup> of an industrial effluent requires 12.5cm<sup>3</sup> 0.5N K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> for the complete oxidation. Calculate COD of the sample. Assuming that the effluent contains only oxalic acid. Calculate the amount of oxalic acid present in 1 dm<sup>3</sup> (Eq.wt of oxalic acid = 45). (05 Marks)  
 c. Write a note on Dendrimer. (05 Marks)

**OR**

- 10 a. Explain the Synthesis of nano materials by Chemical vapour condensation and precipitate methods. (06 Marks)  
 b. Write a note on Carbon nanotubes. (05 Marks)  
 c. Explain the desalination of water by electro — dialysis. (05 Marks)

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