SEM 1 – 3 (RC 16-17)

F.E. (Semester – I/II) (Revised in 2016-2017) Examination, May/June 2017
APPLIED SCIENCE (CHEMISTRY)

Duration : 3 Hours   Total Marks :100

Instructions : 1) *Answer* **any two** *questions each from Part – A and Part – B .*
                 Answer **any one** *question from Part – C.*
                 2) **Draw** *diagrams* **wherever** *necessary.*
                 3) **Assume** *additional data, if required.*

PART – A

Answer **any two** questions :

1. a) Sketch the electrochemical cell, write the cell reactions and representation if Mg and Zn electrodes are used along with their salt solutions of 0.01 M and 0.001 M respectively. Also calculate the cell potential.
(Data : $E° Zn = -0.76$ v; $E°Mg = 2.37$ v).   6

   b) Discuss the effect of the following factors on the rate of corrosion :   6

      i) Position of the metal in the EMF series.

      ii) Nature of corrosion product.

   c) Define the terms :   4

      i) Gross calorific value

      ii) Net calorific value

      iii) Octane number

      iv) Cetane number.

   d) Explain the term Atom Economy by taking a suitable example.   4

2. a) A galvanic cell to be operated at 25°C is set up using elements Mg and Cu. Write the cell representation and chemical reactions involved, also find the EMF of the cell assuming that $MgSO_4$ (0.01 M) and $CuSO_4$(0.1 M) were used as electrolytes. (Data : $E°Cu = 0.34$ v; $E°Mg = -2.37$ v)   6

   b) Discuss the wet electrochemical theory of corrosion with a suitable example.   6

   c) What are the different stages involved in purification of crude oil.   4

   d) Discuss any two applications of Green Chemistry for achieving sustainable development.   4

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3. a) Calculate the EMF and write the cell representation of the cell consisting of silver electrodes immersed in silver salt solutions of strength 0.01 M and 0.1 M. Explain the working principle of the cell.   **6**

   b) State and explain measures for corrosion control by modification of environment.   **6**

   c) Explain the construction and working of photovoltaic cell.   **4**

   d) Describe the use of Dimethyl Carbonate (DMC) as an alternate reagent to achieve the goals of Green Chemistry.   **4**

PART – B

Answer **any two** questions :

4. a) Explain the process of degradation of polymers due to oxidation and exposure to high temperature.   **6**

   b) A water sample was analyzed for :   **6**
      i) DO
      ii) Hardness.

      The test analysis as per standard protocols gave the following data :

      i) 10 ml of the water sample upon titration with 0.01 M $Na_2S_2O_3$ required 1.0 ml of the titrant.

      ii) The sample showed the presence of $CaCO_3$ (10 ppm) and $MgCl_2$ (20 ppm). Find the DO (in ppm) and Hardness (in ppm $CaCO_3$ eq.) (data given At. Wt. Ca = 40; C = 12; O =16; Mg = 24; S = 32; Cl = 35.5)

   c) State the basic principle involved in working of UV-visible spectroscopy and Gas Chromatography.   **4**

   d) Briefly describe the layered and particulate type of composite materials.   **4**

5. a) Outline the structure properties relationship in polymers with regard to mechanical and chemical properties.   **6**

   b) Define the term BOD of water. A 100 ml of the sample tested using the standard procedures gave the following observations: **6**

      i) 2.0 ml of 0.01 M $Na_2S_2O_3$ required to achieve the end point on Day 1 and 1.5 ml of 0.01 M $Na_2S_2O_3$ required to achieve the end point on Day 5. Calculate the BOD of the sample in ppm.

   c) Draw the block diagram for UV-Vis spectrophotometer and differential scanning calorimeter.   **4**

   d) Discuss briefly fibre reinforced composites.   **4**

6. a) Compare the bulk and suspension methods of polymerization.   6

   b) Explain the experimental procedures for determining dissolved solids, Hardness and alkalinity in water: 6

   c) With the help of a neat labeled diagram explain the flash evaporation method for desalination of water.   4

   d) Discuss the role of particulates as dispersed phase in composites.   4

PART – C

Answer **any one** question :

7. a) Write the Nernst equation for the following electrode system Cu^{2+} (0.01M)/Cu and determine its electrode potential at 25°C. ($E°Cu = 0.34$ v).   5

   b) Describe 'Pitting Corrosion' with the help of a suitable example.   5

   c) Explain the process of achieving electrical conductivity in polyacetylene.   5

   d) Draw a flow diagram illustrating the various stages involved in the municipal treatment of water for producing potable water.   5

8. a) Outline the construction and working of hydrogen-oxygen fuel cell.   5

   b) State and explain the role of different ingredients involved in compounding of polymers to yield plastic material.   5

   c) What is differential aeration corrosion ? Illustrate with an example.   5

   d) Explain the electro dialysis process for desalination of water.   5

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