MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

I SEMESTER B.TECH. END SEMESTER EXAMINATIONS, NOV/DEC 2016
SUBJECT: ENGINEERING CHEMISTRY [CHM 1001]
REVISED CREDIT SYSTEM
(29/11/2016)

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

❖ Answer **ANY FIVE FULL** questions.
❖ Write diagrams or equations or examples wherever necessary.

1A. Give reason for the following.
  i. Rock salt is a non-volatile solid whereas camphor is volatile solid at room temperature.
  ii. The substrate is placed near the cooler in physical vapour deposition.

1B. The free energy change for the cell, $Ag \mid AgCl(s) \parallel KCl(aq) \mid Hg_2Cl_2(s) \mid Hg$ is -8782 J mol^{-1}. Calculate the enthalpy and entropy changes for the cell reaction at 298 K. Temperature coefficient for the cell is 3.38×10^{-4} V K^{-1}.

1C. Identify and explain with suitable reactions, type of corrosion taking place when zinc rod is kept in contact with magnesium rod. Discuss sacrificial anode method and cathodic inhibitors in corrosion control.

[2 + 3 + 5]

2A. Justify the following.
  i. Ball milling method is not suitable for the preparation of polymeric nanomaterials.
  ii. Polymeric biomaterials are superior to metallic or ceramic biomaterials.

2B. Explain, which is more crystalline: nylon-6,6 or polystyrene?
Calculate the number average and weight average molecular weights of polystyrene from the following data. Atomic weights of C and H are 12 and 1 amu respectively.

Degree of polymerization	150	200	350	400
Number of molecules	25	20	40	15

2C. Explain the construction and working of direct methanol fuel cell. List any two of its advantages and disadvantages. Discuss the working principle of lithium copper sulphide cell and lithium ion cell.

[2 + 3 + 5]

3A. The electrolysis of 1M aqueous solution of H_2SO_4 begins at an applied EMF of ≈ 0.75 V. However, the electrolysis continues for some time with decreasing rate and eventually stops. Explain the reason for this observation. How to make the above electrolysis to proceed continuously?

3B. Define Throwing power, Concentration polarization and Electroless plating.

3C. Explain with calculation steps for the estimation of carbon and hydrogen in the ultimate analysis of coal. Calculate the percentage of hydrogen present in the fuel on burning 0.92 g of a solid fuel in a bomb calorimeter using the following data.
Amount of water 2.9 kg, temperature of water increased from 27.8 °C to 30.6 °C, Water equivalent of the calorimeter = 385 g, Latent heat of steam = 2454 kJ kg^{-1}, Specific heat of water = 4.184 kJ $kg^{-1}\,K^{-1}$, NCV = 40948 kJ.

[2 + 3 + 5]

4A. Give reason for the following.
   i. Welding of sheets is preferred in steel boilers.
  ii. Increase in temperature has negligible effect on the corrosion rate of stainless steel in nitric acid in the initial stages and then accelerates the corrosion.

4B. When SCE is connected with $Zn^{2+}_{(unknown)} \mid Zn$, it produced an EMF of 1.0495 V at 298 K, calculate the concentration of zinc ions. E^0 of $Zn^{2+} \mid Zn$ is -0.76 V. Write the anodic and cathodic reactions for the cell.

4C. Describe the pultrusion technique for the fabrication of composite materials and give any two advantages of this technique. Explain the lamellar and hexagonal phase formation by sodium stearate.

[2 + 3 + 5]

5A. Give any four differences between Fuel cell and Galvanic cell.

5B. Write the equation which relates the boundary potential to the hydrogen ion concentrations and explain the terms. A glass electrode dipped in a solution of pH = 3.2 offered an EMF of 0.4029 V with SCE at 298 K. When the same glass electrode was dipped in a solution of unknown pH at the same temperature, the recorded EMF was 0.2394 V. Calculate the pH of the unknown solution. E_{SCE} at 298 K = 0.2422 V.

5C. Explain the electrochemical mechanism for the rusting of iron. Give four differences between electrochemical and galvanic series.

[2 + 3 + 5]

****