MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

II SEMESTER B. TECH. END SEMESTER MAKE UP EXAMINATIONS, JUNE 2019

ENGINEERING CHEMISTRY (CHM 1051)

Date:11.06.2019 **Time: 3 Hours** **Max. Marks: 50**

Note: Answer all the questions.

1A. **(i)** Write the principle and calculation steps involved in the estimation of nitrogen and sulfur content in a coal sample.

(ii) Write the Nernst equation and calculate the EMF of the following cell at 298 K. Write the reactions involved. Given $E^{\circ}_{Cu^{2+}/Cu} = 0.34V$; $E^{\circ}_{Mg^{2+}/Mg} = -2.37V$

$$Mg\ (s) / Mg^{2+}\ (0.001\ M)\ //\ Cu^{2+}\ (0.0001\ M) / Cu\ (s)$$

1B. **(i)** Give reason – The electrode potential of calomel electrode is dependent on the concentration of KCl used.

(ii) Explain any four methods of cleaning the metal surface before electroplating.

1C. Discuss the structural features of polycatenar and bent liquid crystals.

[5+3+2]

2A. **(i)** Explain the construction and working of (a) nickel-cadmium battery (b) H_2-O_2 fuel cell.

(ii) Why lead acid battery should not be kept idle in partially discharged condition?

2B. **(i)** Describe liquid junction potential with an illustrative example.

(ii) For a Weston cadmium cell, EMF is 1.018 V at 293 K. Its temperature coefficient $(\delta E / \delta T)_p = -4.00 \times 10^{-5}\ VK^{-1}$. Calculate ΔG and ΔS for the cell reaction.

2C. **(i)** Draw the labelled diagram of the fixed dome type biogas plant.

(ii) The gross calorific value of a fuel containing 8% hydrogen was to be 9225.9 Kcal/kg. Find out its net calorific value if the latent heat of steam is 587 Kcal/kg.

[5+3+2]

3A. **(i)** Discuss the role of cathodic inhibitors in combating corrosion.

(ii) Given below are the standard reduction potentials of Fe, Zn, Sn, Cu

Fe (E^{o}= -0.44V) ; Zn (E^{o} = -0.76V) ; Sn (E^{o} = -0.14V) ; Cu (E^{o} =+ 0.36V).

Which bimetallic couple undergoes maximum corrosion among these? Why?

3B. List any two differences between the following:

(i) Large particle and dispersion strengthened composites
(ii) Nematic and smectic liquid crystalline phases
(iii) Two dimensional and three dimensional nanomaterials

3C. **(i)** Write any two requirements that need to be satisfied by materials in order to use them as biomaterials.

(ii) Give an example each for ion-dipole and dipole-dipole interactions.

[5+3+2]

4A. **(i)** Give reason for the following:
(a) Anodic inhibitors should be added in sufficient quantity to the medium to prevent corrosion.
(b) Calomel electrodes gives erroneous results above 50 °C.

(ii) With a labelled diagram explain the CVD technique used for the formation of thin films.

4B. Explain how the following factors affect the rate of corrosion.

(i) Hydrogen overvoltage **(ii)** Temperature **(iii)** pH

4C. Consider a polymer sample comprising of 5 moles of polymer molecules having molecular weight of 4000 g/mol and 15 moles of polymer molecules having molecular weight of 3000 g/mol. Calculate number average and weight average mass.

[5+3+2]

5A. **(i)** Justify the following statements;

a) Ethylene undergoes polymerization while ethane doesn't.
b) Porosity must be controlled in refractories.

(ii) Explain how the following factors affect the glass transition temperature.

(a) Cross linking **(b)** Plasticizer **(c)** Molecular weight

5B. Mention any four predictable causes of nonlinearity of the Beer-Lambert law.

5C. Explain structural composites with suitable examples.

[5+3+2]