Course Code: CYT100

Course Name: ENGINEERING CHEMISTRY

(2019-Scheme)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 What will be the standard electrode potential of Ni^{2+} / Ni electrode if the cell potential of the cell Ni / Ni^{2+}(1M) // Cu^{2}(0.1M) / Cu is 0.59 V at 25 °C? (3)

$E^{0}_{Cu2+/Cu}$= 0.34 V

2 Briefly explain the principle of electroless plating. (3)

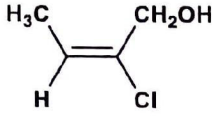
3 Give the mechanism of interaction of electromagnetic radiation with oscillating dipole. (3)

4 State Beer-Lambert's law and write the differential form. (3)

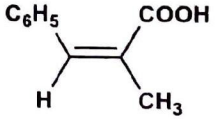
5 Write any three differences of TGA and DTA. (3)

6 Explain sol-gel method for the synthesis of nano particles (3)

7 Determine the configuration of the following alkenes as ***E*** or ***Z***: (3)



A



B

8 Mention any three advantages of OLEDs over LED and LCD. (3)

9 Explain disinfection by chlorination. (3)

10 Compare BOD and COD. (3)

PART B

Answer one full question from each module, each question carries 14 marks

Module-I

11 a) Explain the mechanism of electrochemical corrosion in different environmental conditions. (10)

b) How is the cell constant of a conductivity cell measured? (4)

12 a) Describe the construction and working of Li-ion battery. What are the major advantages of it? (10)

b) Calculate the EMF of the cell at 25°C: (4)

$Al / Al^{3+}(0.1M) // Sn^{4+}(0.1M) / Sn^{2+}(0.01M)$

$E^0_{Al^{3+}/Al} = -1.66$ V, $E^0_{Sn^{4+}/Sn^{2+}} = 0.15$ V

Module-II

13 a) Define chemical shift in NMR and explain the factors affecting chemical shift with examples. (8)

b) Calculate the force constant of H-F molecule that is showing IR absorption signal at 4000 cm^{-1}. By what factor do you expect this frequency to shift if Deuterium is substituted for Hydrogen in this molecule? Given that atomic masses of H and F are 1u and 19 u, respectively. (6)

14 a) How many vibrational modes are possible for the molecules CO, NO, CO_2 and H_2O? Draw the vibrational modes of CO_2 and H_2O and explain their IR active modes. (8)

b) Each compound gives only one signal in its 1H-NMR spectrum. Propose a structural formula for each. a) C_8H_{18} and b) $C_8H_{18}O$ (6)

Module-III

15 a) Describe the instrumentation, principle and working of SEM with the help of a labelled diagram. Give any two applications. (10)

b) Explain the visualization techniques used in thin layer chromatography. (4)

16 a) Describe the principle, instrumentation, procedure and applications of HPLC. (10)

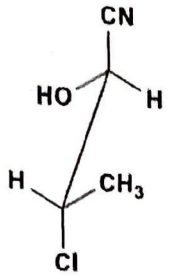
b) How TGA is used to analyze thermal stability of polymers? (4)

Module-IV

17 a) Discuss the conformations in butane by depicting the Newman formula about C2-C3 bond of all the conformers. Also draw the energy level diagram with dihedral angle. (10)

b) How is ABS synthesized? Mention some applications. (4)

18 a) Explain the rules for assigning ***R-S*** configuration and determine the ***R-S*** configuration of all the asymmetric carbon atoms in the molecule after writing its Fischer projection formula. (8)



b) What is meant by doping of polymers? Describe the different types of doping. (6)

Module-V

19 a) Describe the steps involved in municipal water treatment. (10)

b) The following data are obtained for a hard water sample from an EDTA experiment (4)

i) 20 mL standard hard water (5 g/L $CaCO_3$) = 25 mL EDTA solution

ii) 100 mL of hard water sample = 24 mL EDTA solution

iii) 100 mL of boiled hard water sample = 18 mL EDTA solution

Calculate the temporary and permanent hardness.

20 a) With the help of a flow diagram explain the steps involved in sewage treatment. (10)

b) Calculate the temporary and permanent hardness of water sample containing the following dissolved salts. (4)

$Ca(HCO_3)_2$ = 28 mg/L; $CaSO_4$ = 18 mg/L; $Mg(HCO_3)_2$ = 32 mg/L;

$MgCl_2$ = 30 mg/L; NaCl =58 mg/L.

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