B.Tech 2nd Semester Exam., 2016

ENGINEERING CHEMISTRY

Time: 3 hours

Full Marks: 70

Instructions:

(i) The marks are indicated in the right-hand margin.

(ii) There are NINE questions in this paper.

(iii) Attempt FIVE questions in all.

(iv) Question No. 1 is compulsory.

1. Fill in the blanks/Answer the following (any seven):

   \[ 2 \times 7 = 14 \]

   (a) If 50 ml hard water required 1.5 ml of 0.1 M EDTA, the hardness of water is __ ___ p.p.m.

   (b) The general formula of zeolite is __ ___.

   (c) What is an azotropic mixture?

   (d) Colligative properties depend on __ ___.

   (e) Why does iron corrode faster than Al?

   (f) Why are liquid fuels better than solid fuels (3 characters)?

2. (a) What is hardness of water? How is it expressed?

   (b) Write the principal and chemical reactions involving lime-soda method of softening of water.

   (c) A water sample contains the following in mg/lit:

   \[ \text{Ca(HCO}_3\text{)}_2 = 8.1, \quad \text{Mg(HCO}_3\text{)}_2 = 2.92, \]
   \[ \text{MgCl}_2 = 9.5, \quad \text{MgSO}_4 = 1.2, \quad \text{CaCl}_2 = 1.11, \]
   \[ \text{NaHCO}_3 = 4.2, \quad \text{CO}_2 = 2.2, \quad \text{HCl} = 3.65 \]

   Calculate the amount of lime and soda required for softening 50000 lit of water.

   \[ \text{Turn Over} \]
3. (a) Describe Fisher-Tropsch method of manufacture of gasoline.

(b) Define octane number and cetane number. What are the structural features of fuel that increases octane cetane numbers?

(c) A coal sample contain 76% carbon, 10% hydrogen, 8% oxygen and 6% nitrogen. Find the minimum amount of $O_2$ and air by weight for complete combustion of 1 kg of coal. Also calculate the weight of air if 20% excess air is supplied. (Air contains 23% $O_2$ by weight.)

4. (a) Write the charging and discharging reactions of lead-acid storage battery.

(b) Explain the construction and working of $H_2$-$O_2$ fuel cell.

(c) What is the pH of the solution of the given cell if its cell potential is 1.04 volt?

\[ E^\circ_{\text{Ag}^+ / \text{Ag}} = -0.8 \text{ volt} \]

\[ \text{Pt} : \text{H}_2 [\text{1 atm}] | \text{H}^+ (\text{pH} = 7) | \text{Ag}^+ (0.01 \text{ M}) | \text{Ag} \]

Write the cell reaction also.

5. (a) Differentiate between the following: $2 \times 2 = 4$

(i) Thermosetting and Thermoplastic resins

(ii) Graft copolymer and Block copolymer

(b) Give the method of preparation and uses (three) of the following:

(i) Nylon-6 from cyclohexanol

(ii) Neoprene from acetylene

(iii) ABS polymer

(iv) Plexiglass

6. (a) Explain with examples Pilling-Bedworth law.

(b) What are causes for the formation of cathodes and anodes regions on the metal surface?

(c) What are the factors that control the rate of corrosion?

7. (a) State Raoult's law of lowering of vapour pressure. Give its limitations.

(b) What is ideal solution? Explain positive and negative deviations from ideal behaviour of liquid pairs.
(c) At 100 °C, the vapour pressure of solution of 6.2 gm of solute in 126 gm water is 745 mm. What is the boiling point of solution ($K_b = 0.52$)?

8. Write the method of prevention of the following:

(a) Scale formation
(b) Caustic embrittlement
(c) Priming and foaming
(d) Boiler corrosion

9. Write short notes on the following:

(a) Galvanic series
(b) Waterline corrosion
(c) Pitting corrosion
(d) Glass transition temperature