RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

SECOND YEAR

B.A./B.SC. FOURTH SEMESTER (January – June), 2012

Mid-Semester Examination, March 2012

Date : 19/03/2012 **INDUSTRIAL CHEMISTRY (Honours)**

Time : 2 pm – 4 pm Paper : IV Full Marks : 50

[Use separate Answer Books for each group]

Group – A

Unit - I

1. a) Explain the following terms with examples. (**any two**) [4]
   i) Unit Operations and Unit Process with examples
   ii) Differential and Integral balances
   iii) Degrees of Freedom and process variables
   b) Check the dimensional homogeneity of the following equations [3]
   $Q = Cd.a\sqrt{2gh}$ and $V = C\sqrt{mi}$

2. The Ethanol dehydrogenation reaction is carried out with the feed entering at 300°C. The feed contains 90% (mole %) ethanol and balance acetaldehyde. To keep the temperature from dropping too early and hence quenching the reaction at a low conversion heat is added to the reactor. It is observed that when the heat addition rate is 5300KJ per 100 moles of the feed gas, the outlet temperature is 265°C.
   Calculate :
   a) the heat balance of the feed and product
   b) fractional conversion of ethanol achieved
   Data : The reaction is $C_2H_5OH(g) \rightarrow CH_3CHO(g) + H_2O(g)$; $\Delta Hg^\circ = 68{\cdot}95$ KJ/mol
   $C_2H_5OH(g)$: $C_P = 26{\cdot}3$ cal/mole °C
   $CH_3CHO(g)$: $C_P = 19{\cdot}1$ cal/mole °C
   H_2 (g) : $C_P = 6{\cdot}93$ Cal/mole °C
   Assume the values of C_P to be constant with temperature. [7]

   Or,

   The spent acid from a nitrating process contains 33% H_2SO_4, 36% HNO_3 and 31% water by weight. This acid is to be strengthened by the addition of concentrated sulphuric acid (95%) and concentrated nitric acid (78%). The strengthened mixed acid is to contain 40% sulphuric acid and 43% nitric acid. Calculate the quantities of spent and concentrated acids that should be mixed together to yield 1500 kg of the desired mixed acid. [7]

3. State phase rule. What is triple point and what is the triple point of water. What is an eutectic mixture? [6]

Unit - II

4. Derive Hagen Poiseuille law for laminar flow in Pipes. [5]

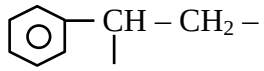
5. a) Define Newton's Law of Viscosity. [2]
   b) The space between two parallel plates each of side 0·8m is filled with an oil of specific gravity 0·8. If the space between the plate is 12·5mm and the upper plate which moves with a velocity of 1·25m/sec requires a force of 51·2N. Determine—
   i) Dynamic Viscosity of the oil in poises and
   ii) Kinematic Viscosity of oil in stokes [3]

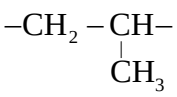
6. What is Reynolds's number? Show that Reynolds's number is dimensionless.
An oil having a Kinematic Viscosity of 21·4 stokes is flowing through a pipe of 300mm diameter. Determine the type of flow, if the discharge through the pipe is 15 liters/s. [2+3]

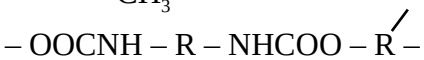
Group – B

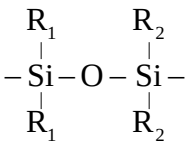
(Answer **any three** questions)

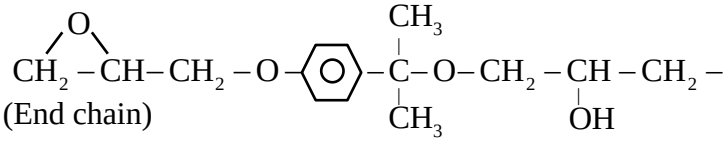
7. Write the correct nomenclature of the polymers from following repeat units. Mention one important commercial application of each. [1×5]

a) 

b) 

c) 

d) 

e) 
(End chain)

8. Write a short note on M-F resin covering synthesis of Malamine, Polymerization Process, and Commercial uses.
Why m-F resin is not used in Plywood Laminaion like U-F resin. [1+2+1+1]

9. Compare between addition (chain growth) polymers and condensation (step growth) polymers illustrating at least five salient features. [1×5]

10. What are copolymers? What benefit is derived from copolymers?
Write down the constitution of Maleic Anhydride Vinyl Benzene copolymer when he two monomers are alternately spaced in Network.
Distinguish between Block and Graft polymers. How do you predict nature of copolymers based on rate constants of reactions involving $\dot{M}_1$ and $\dot{M}_2$? [1+1+1+2]

11. What are polyurethanes? Show how Perlon U Fibre is obtained.
How PU Rubber is synthesised? Mention two important commercial applications of PU. [1+2+1+1]