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B.Tech. IV Sem.

TU-125

B.Tech. Examination, May 2014

C.E.

Chemical Engg. Thermodynamics

[BT-417(N)]

Time : Three Hours] *[Maximum Marks : 100*

Note: Attempt any **five** questions. **All** questions carry equal marks.

1. Explain the following : 20

   (a) Zeroth Law

   (b) Reversibility & Irreversibility

2. Write short notes on : 20

   (a) Maxwell Equations

   (b) Second Law of thermodynamics

P.T.O.

(c) Free Expansion

(d) Heat Pump

3. Prove that 20

$$S^g = \sum_i Y_i S_i^{\bar{g}} - R \sum_i Y_i \ln y_i$$

OR

Explain the following-

(a) Fundamental Property Relation

(b) Partial Properties.

4. Prove that : 20

$$-\Delta G^{\circ} = RT \ln k$$

OR

Prove that :

$$(dG^t)_{T,P} \leq 0$$

OR

5. Prove that : 20

$$S_2 - S_1 = C_p \ln \frac{V_2}{V_1} + C_v \ln \frac{P_2}{P_1}$$

6. The need is arises in laboratory for 2000 cm^3 of an antifreeze solution consisting of 30 Mol% Methanol in water. What volumes of pure Methanol and of pure water at 298.15K must be mixed to form the 2000 cm^3 of antifreeze, also at 298.15K? Partial Molar Volumes for methanol and water in a 30 Mol% methanol solution and their pure species Molar volumes both at 298.15K are : 20

Methanol (1) : $\overline{V}_1 = 38.632\ cm^3/mol$,

$V_1 = 40.727\ cm^3/mol$

Water (2) : $\overline{V}_2 = 17.765\ cm^3/mol$,

$V_2 = 18.068\ cm^3/mol$

7. Prove that : 20

(a) $\overline{M}_1 = M + x_2 \frac{dM}{dx_1}$

(b) Work-done is zero in free expansion.

8. Write short notes on : 20

(a) Ideal Solution

(b) Raoult'p Law

(c) Carnot theorem

(d) Fugacity

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Roll No. .....

B.Tech.-IV Sem.

TU-127

B.Tech. Examination, May 2014

C.E.

Chemical Reaction Engg.-I

[BT-419(N)]

Time : Three Hours] *[Maximum Marks : 100*

Note: (i) Attempt any **five** questions.

(ii) Marks allotted to each part / question have been indicated.

(iii) Assume suitable data if missing and indicate.

(iv) The use of calculator is permitted.

1. (a) (i) What do you mean by half life period used for analyzing kinetic data? 5

(ii) What is order of reaction? Explain with the help of an example? 5

P.T.O.

(b) Show that the following Scheme

$$N_2O_5 \underset{K_2}{\overset{K_1}{\rightleftharpoons}} NO_2 + NO_3^*$$

$$NO_3^* \xrightarrow[K_3]{} NO + O_2$$

$$NO^* + NO_3^* \xrightarrow{K_4} 2NO_2$$

is consistent and can explain the first order decomposition of N_2O_5. 10

2. (a) Experiment shows that the primary reaction in the homogeneous decomposition of nitrous oxide proceeds with stoichiometry: 10

$$N_2O \rightarrow N_2 + \frac{1}{2} O_2$$

$$-r_{N_2O} = \frac{K_1 [N_2O]^2}{1 + K_2 [N_2O]}$$

$$K_1 = 10^{13.33} e^{-61800/RT}$$

$$K_2 = 10^{8.59} e^{-28400/RT}$$

What is the activation energy of this reaction.

(b) A reaction is represented as:

$$2A \rightarrow 2B$$

What are the molecularity and order of this reaction? 10

3. (a) Describe the differential method of analysis of data. Compare integral and differential method of analysis of data. 10

(b) Give the reaction $2NO_2 + \frac{1}{2}O_2 \rightarrow N_2O_5$; What is the relation between the rates of formation and disappearance of the 3 components. 10

4. A homogeneous gas reaction $A \rightarrow 3R$ has a reported rate at 215°c

$$-r_A = 10^{-2} C_A^{1/2} \text{ (mol/liter sec)}$$

Find the space time needed for 80% conversion of a 50% A – 50% inert feed to a plug flow reactor operating at 215°c and 5 atm (C_{A0} = 0.0625 mol/litre) 20

5. For the series reaction of the type

$$A \xrightarrow{k_1} R \xrightarrow{k_2} S \quad k_1 = k_2$$

Find the maximum concentration of R and the time at which it is reached. 20

6. (a) Reactants A and B are placed in a reaction vessel at zero time, where $(C_A)_0 = (C_B)_0$. The following reaction occur at constant volume.

(i) $A + B \xrightarrow{k_1} C$

(ii) $A + C \xrightarrow{k_2} D$

Where C is desired product. If both reactions are second order, derive an expression for the selectivity of C with respect to D in terms of total conversion of A. Also determine the total conversion at which the selectivity will be maximum if $k_2/k_1 = 1$ 10

(b) What do you understand by variable volume reaction system? Explain. 10

7. (a) What is the difference between space time and holding time? Explain with the help of examples. 10

(b) A first order reaction is to be carried out in a series of two mixed reactors. Show that the total volume of the two reactors is minimum when the reactors are of equal size. 10

8. A first order liquid phase reaction is planned to carry out in two equal volume CSTRs. The reactors are connected in series and in parallel in two different cases. Compare the final conversion for two arrangement of the reactors. 20

[Data :

F_{A0} = 10 k / mol / s, k = 1 second^{-1},

C_{A0} = 1k mol / m^3 V_{CSTR} = 1 m^3]

9. (a) What do you understand by ' residence time distribution of flowing fluiding in vessel's? Explain. 10

(b) What do you understand by optimal temperature progression? Explain. 10

10. (a) Write short note on thermal stability of a CSTR. 10

(b) Explain C and E curves and their physical significance. 10

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B.Tech.-IV Sem.

TU-128

B.Tech. Examination, May 2014

C.E.

Chemical Technology I (Organic)

BT-420(N)

Time : Two Hours] *[Maximum Marks : 50*

Note: Attempt any **five** questions. **All** questions carry equal marks.

1. (a) Describe the refining of sugar in detail with neat sketch.

   (b) What are various antibiotics available? Explain.

2. (a) What are various Fermentation Products? Explain the manufacturing of any one with neat diagram.

P.T.O.

(b) Describe the major engineering Problems during the manufacturing of Pulp.

3. (a) What are the various uses of citric acid and acetic acid in day to day life? Discuss.

(b) What is Present Scenario of Chemical Industries in India?

4. (a) What are Common Pollution Control Techniques used in chemical industries? Explain the working of 'ETP'.

(b) Explain the various steps required to obtain tanned Leather from hides. Also write the operating conditions with the reactions, if involved.

5. (a) Differentiate between hard wood and soft wood.

(b) Describe the various chemicals obtained from wood distillation.

6. (a) How are Petroleum Products classified? Explain the visbreaking with neat diagram. Also write its operating conditions.

   (b) What is the difference between natural fibre and synthetic fibre?

7. Compare the rubbers with polymers and discuss its merits and demerits in detail.

8. Describe the manufacturing of Nylon-66 with neat flow diagram. Name the five major industries in India which produce Nylon-66.

9. What do you understand by pesticides? Explain the manufacturing of DDT with neat flow diagram.

10. Explain the manufacturing of formaldehyde with neat flow sheet from methanol as raw material.

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B.Tech. - IV Sem.

TU-133(B)

B.Tech. Examination, May 2014

C.E.

POLYMER SCIENCE

[BT-421(N)]

Time: Three Hours] *[Maximum Marks : 100*

Note: Attempt any Five Questions. All questions carry equal marks.

1. What do you know about the crystallinity of Polymers ? Discuss the effect of crystallinity on the properties of polymers.

2. Describe briefly the preparation, properties, structure and applications of the following polymers:

   (i) Nylon-6, 6 (ii) PVC

   (iii) PET (iv) PF resins

3. What are fibre-reinforced-plastics? Give a method for the preparation of such a plastic. Describe its properties and applications.

4. Distinguish between the following pairs of terms :

(i) Random and alternate copolymers

(ii) Thermoplastics and thermosetting polymers.

(iii) Phenol-formaldehyde and Melamine-formal dehyde resins.

(iv) Homo and Hetero polymers.

5. What is a coordination polymerisation? Discuss the mono metallic mechanism of coordination polymerisation.

6. How the size and the shape of a polymer can be determined? Explain in detail.

7. Describe the three basic steps involved in the mechanism of free radical chain growth polymerisation. What is a average chain length of a free radical chain growth polymer.

8. What do you mean by the molecular weight of the polymer? How many ways it is expressed, explain it clearly?

A polymer sample is composed of molecules of three sizes. Out of which ten moles of first size have molecular weight 10,000; eighty moles of second size have molecular weight 50,000 and ten moles of the third size have molecular weight 1,00,000. Calculate its number average weight average and viscosity average molecular weights.

9. Write the applications of polymers in the following fields :

(i) Agriculture

(ii) Building constructions

(iii) Medicine

(iv) Space

10. (a) What is nitrile rubber? Give the structure of GR-N rubber

(b) Write down the structure of silicone and dimethyl silicone.

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B.Tech.IV Sem.

TU-126

B.Tech. Examination, May 2014

C.E.

Heat Transfer Operation

[BT-418(N)]

Time : Three Hours] *[Maximum Marks : 100*

Note : (i) Attempt any **five** questions.

(ii) **All** questions carry equal marks.

(iii) Assume suitable data if missing. Calculator will be allowed.

1. Define Fourier law of heat conduction and derive the equation for the flow of heat conduction through a spherical shell. 10

2. Derive the equation of steady state heat con-

P.T.O.

duction through a cylindrical wall made up of two layers. 10

3. Explain the critical thickness of insulation for cylinder and sphere. 10

4. Differentiate between the hydrodynamic boundary layer and thermal boundary layer. 10

5. Explain the following term : 10

   (i) Lambert Cosine law

   (ii) Plank Distribution law

6. A shell and tube heat exchanger is being used to cool a hot fluid. The fluid enter at 80^0C and leaves 50^0C. The cold water is available at 20^0C which leaves at 35^0C. Determine the LMTD if the steam contact in a : 10

(i) Counter Current manner

(ii) Co Current Manner.

7. Using dimensional analysis, show that for convective heat transfer. 10

$$NU = f(Re, Pr, Gr)$$

8. What do you understand by film wise and drop wise condensation? 10

9. Give the significance of : 10

(i) Nusselt No.

(ii) Paclet No.

(iii) Renold's No.

(iv) Prandtl No.

(v) Grashofl No.

10. What is the Purpose of Providing fins? Define effectiveness of the fin. 10