BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - VII CHEMICAL : WINTER- 2022
SUBJECT : MULTIPHASE REACTION ENGINEERING

Day : Monday

Time : 02:30 PM-05:30 PM

Date : 19-12-2022

W-13596-2022

Max. Marks : 60

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N.B.

1) All questions are **COMPULSORY**.
2) Figures to the **RIGHT** indicate **FULL** marks.
3) Use of non-programmable calculator is **allowed**.
4) Assume suitable data **WHEREVER** necessary.

Q.1 What is 'catalyst wetting'? Where does it occur? What are the causes? Elaborate **(10)** the majors to overcome this problem.

OR

Q.1 With neat schematic elaborate the working of Bubble Columns and also write its **(10)** industrial applications.

Q.2 **a)** Derive the relationship between the mole fraction of the components taking **(05)** part in the reaction and the extent of the reaction.

b) A gas mixture containing 3mol CO_2, 5mol H_2 and 1mol water is undergoing **(05)** the following reactions :

$$CO_2 + 3H_2 \rightarrow CH_3OH + H_2O$$

$$CO_2 + H_2 \rightarrow CO + H_2O$$
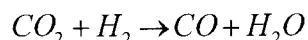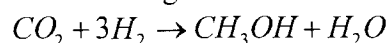
Develop expressions for the mole fraction of the species in terms of the extent of reaction

OR

Q.2 Evaluate the equilibrium constant at 600 K for the reaction **(10)**
$$CO(g) + 2H_2(g) \rightarrow CH_3OH(g)$$

given that the Gibbs free energy function $\phi_{298} = \dfrac{G_T^0 - H_{298}^0}{T}$ for CO, H_2 and

methanol at 600 K are respectively –203.81. –136.39 and –249.83 J/mol K. The heats of formation at 298 K of CO (g) and CH_3OH (g) at 298 K are –110,500 J/mol and –200,700 J/mol.

Q.3 The design and scale-up of bubble column reactors generally depend on which **(10)** factors? Elaborate your answer with relevant examples.

OR

Q.3 Explain hydrodynamics of mechanically agitated contactors with flow patterns and **(10)** power consumption in presence of gas.

Q.4 Differentiate between mechanically agitated contactor (MAC) and bubble column **(10)** (BC) with an industrial example.

OR

Q.4 According to principles of fluid mixing elaborate the mixer technologies and name **(10)** various types of mixers.

Q.5 **a)** With neat schematic representation, explain commonly used industrial **(05)** impellers.

b) What are the different forces acting on the particles in case of solid-liquid **(05)** mixing process? Elaborate your answer with suitable example.

OR

Q.5 With neat schematic, explain effect of impeller spacing on power consumption. **(10)**

Q.6 Derive an expression to estimate pressure drop in fluidized bed. **(10)**

OR

Q.6 Enumerate solid liquid fluidized bed with following parameters : **(10)**
i) Effect of superficial liquid velocity ii) Effect of particle diameter
iii) Effect of distributor design.

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