

**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

**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.

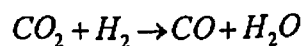
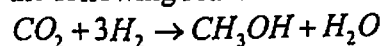
**Q.1** What is 'catalyst wetting'? Where does it occur? What are the causes? Elaborate (10)  
the majors to overcome this problem.

**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<sub>2</sub>, 5mol H<sub>2</sub> and 1mol water is undergoing (05)  
the following reactions :



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)  
 $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_3\text{OH}(\text{g})$

given that the Gibbs free energy function  $\phi_{298}^0 = \frac{G_r^0 - H_{298}^0}{T}$  for CO, H<sub>2</sub> 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<sub>3</sub>OH (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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