KUMARAGURU college of technology
character is life

Register Number: …….

B.TECH DEGREE EXAMINATIONS : APRIL/MAY 2016

(Regulation 2013)

Sixth Semester

BIOTECHNOLOGY

U13BTT604: Chemical Reaction Engineering

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. A first order reaction requires two equal sized CSTR. The conversion is
   a) less when they are connected in series
   b) more when they are connected in series
   c) more when they are connected in parallel
   d) same whether they are connected in series or in parallel
2. For every 10°C rise in temperature, the rate of chemical reaction doubles. When the temperature is increased from 30 to 70°C, the rate of reaction increases _____ times.
3. A reactor is generally termed as an autoclave, when it is a
   a) high pressure batch reactor
   b) atmospheric pressure tank reactor
   c) high pressure tubular reactor
   d) atmospheric pressure CSTR
4. 6 gm of carbon is burnt with an amount of air containing 18 gm oxygen. The product contains 16.5 gms CO_2 and 2.8 gms CO besides other constituents. The degree of conversion on the basis of disappearance of limiting reactant is _____.
5. Which of the following is the most suitable for very high pressure gas phase reaction?
   a) Batch reactor
   b) Tubular flow reactor
   c) Stirred tank reactor
   d) Fluidised bed reactor
6. '*N*' plug flow reactors in series with a total volume '*V*' gives the same conversion as a single plug flow reactor of volume '*V*' for _____ order reactions.
7. For a heterogeneous catalytic reaction
   a) free energy of activation is lowered in the presence of catalyst, which remains unchanged at the end of reaction
   b) a relatively small amount of catalyst can cause the conversion of large amount of reactants which does not mean that catalyst concentration is important
   c) the catalyst does not form an intermediate complex with the reactant
   d) the surface of the catalyst does not play an important role during reaction

8. A catalyst _____ the activation energy of reactants.
9. A reversible liquid phase endothermic reaction is to be carried out in a plug flow reactor. For minimum reactor volume, it should be operated such that the temperature along the length
   a) First increases and then decreases
   b) decreases
   c) Is at the highest allowable temperature throughout
   d) increases
10. The reaction between oxygen and organic material is a _____ reaction.

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

11. A reaction has the stoichiometric equation A + B = 2R. What is the order of reaction?
12. Define the terms molecularity & oOrder of an elementary reaction.
13. Classify chemical reactions and reactors on various basis.
14. What are autocatalytic Reactions?
15. What do you mean by a space velocity of 5 hr^{-1}?
16. Distinguish between holding time and space time for flow reactors.
17. Compare homogeneous and heterogeneous reaction system.
18. Write about the significance of Hatta Number.
19. What do you mean by RDS of a reaction?
20. Write the application of a trickle bed reactor.

PART C (5 x 14 = 70 Marks)
(Answer not more than 400 words)

Q.No. 21 is Compulsory

21. Discuss in detail about the methods of analyzing of batch reactor data.

22. (a) A homogeneous gas reaction A →3R has a reported rate at 215°C

$$-r_A = 10^{-2} C_A^{1/2} \frac{mol}{liter.sec}$$

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/liter).

(OR)

(b) At present 90% of reactant A is converted into product by a second-order reaction in a single mixed flow reactor. We plan to place a second reactor similar to the one being used in series with it.

i. For the same treatment rate as that used at present, how will this addition affect the conversion of reactant?
ii. For the same 90% conversion, by how much can the treatment rate be increased?

23. (a) A small diameter pipe 32 m long runs from the fermentation room of a winery to the bottle filling cellar. Sometimes red wine is pumped through the pipe, sometimes white, and whenever the switch is made from one to the other a small amount of 'house blend' rose is produced (8 bottles). Because of some construction in the winery the pipeline length will have to be increased to 50 m. For the same flow rate of wine, how many bottles of rose may we now expect to get each time we switch the flow?

(OR)

(b) (i) Explain the significance of RTD in a plug flow reactor. (7)

(ii) Explain the importance of RTD in a CSTR. (7)

24. (a) Elaborate in detail about the heterogeneous catalysis.

(OR)

(b) Summarize the progressive conversion model and shrinking core model.

25. (a) Examine with details on trickle bed reactor to carry out catalytic reactions along with the scheme involved with a neat diagram.

(OR)

(b) Discuss the working principle of a fluidized bed reactor with a neat diagram and mention its advantages and disadvantages.

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