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M.E. / M.TECH. DEGREE EXAMINATIONS, MAY 2019

Second Semester

CL18202 – ADVANCED CHEMICAL REACTION ENGINEERING*(Chemical Engineering)***(Regulation 2018)****Time: Three Hours****Maximum : 100 Marks**Answer **ALL** questions**PART A - (10 X 2 = 20 Marks)**

1. State the application of semi-batch reactor.
2. Compare the design equation of batch and semi-batch reactor.
3. Compare the design equation of PFR with packed bed reactor.
4. What do you mean by autothermal plug flow reactor?
5. What is Eley-Rideal mechanism?
6. Write down the different steps involved in gas-solid catalytic reaction.
7. State effects of channelling and flooding in fixed bed reactor.
8. Define minimum fluidization velocity.
9. What do you mean by moments of distribution?
10. Write the application of population balance modeling?

PART B - (5 X16 = 80 Marks)

11. (a) Experiment shows that the homogeneous decomposition of ozone proceeds with **(16)**
a rate $-r_{O_3} = k [O_3]^2 [O_2]^{-1}$
(a) What would be the overall order of reaction?
(b) Suggest a two step mechanism to explain the rate and state how you would further test this mechanism.
- (OR)**
- (b) Explain about the effect of flow on conversion in different reactors. **(16)**
12. (a) Derive the energy balance equation for a unsteady state CSTRs and Semi-batch **(16)**
reactors.

(OR)

- (b) The formation of acetic anhydride is first order with acetone and the specific rate (16) is given by $\ln k = 34.34 - (34.22/T)$. It is desired to feed 8000 kg of acetone per hour to a tubular reactor. The reactor consists of a bank of 1000 1-inch schedule 40 tubes. We will consider two cases.

1) The reactor is operated adiabatically.

2) The reactor is surrounded by a heat exchanger where the heat transfer coefficient is $110 \text{ J/m}^2 \cdot \text{s} \cdot \text{K}$ and the ambient temperature is 1150 K .

The inlet temperature and pressure data are the same for both the cases at 1053 K and 162 kPa (1.6 atm), respectively. Plot the conversion and temperature along the length of the reactor.

13. (a) Spherical solid particles containing B are roasted at constant temperature in an (16) oven by gas of constant composition. Solids are converted to give a firm non-flaking product according to the shrinking core model (SCM). From the following conversion data determine the rate controlling mechanism for the transformation of solid.

Data”

d_p (mm)	X_B	t, s
2	0.875	1
1	1	1

(OR)

- (b) Find a mechanism for the hydro demethylation of toluene and make suitable (16) assumptions if required.
14. (a) Discuss the various modeling aspects and factors involved in the design of fixed (16) bed reactor.

(OR)

- (b) Discuss the various modeling aspects and factors involved in the design of (16) fluidized bed reactor.
15. (a) Explain the significance of reaction Engineering in mitigation of global warming. (16)

(OR)

- (b) Explain the application of reaction Engineering in automotive monolith catalytic (16) converter.