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SE-7323

B. E. - IV (Sem. VII) (Chemical) Examination

May / June – 2011

Chemical Reaction Engg. - II

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 4 (Sem. 7) (Chem.)**

Name of the Subject :

☛ **Chemical Reaction Engg. - 2**

☛ Subject Code No. : **7 3 2 3** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Attempt **all** the questions.

(3) Assume suitable data if necessary.

(4) Figures to the right indicate full marks.

(5) Draw neat and clean figures wherever required.

SECTION - I

1 (a) Answer the following : **5×2=10**

(1) For the homogeneous phase reaction $A+B \rightarrow R$ and $R+B \rightarrow S$, if the reaction rate is very high, what should be done to achieve homogenecity in A and R throughout the reaction mixture before reaction has reached to any significant extent ?

(2) State reasons for non-ideality in a reactor.

(3) Draw the concentration profile for fast reaction, 2^{nd} order rate with $A_{(g)} + B_{(l)} \rightarrow$ Prod. .

(4) If film conversion parameter $m >> 1$ all the reaction occures in the _____, if $m << 1$, then the reaction occurs in _____.

(5) State the difference between progressive conversion model and unreacted area model in brief.

(b) Discuss the models for partial segregation in detail. **10**

2 Attempt any **two** : **16**

(1) An ore of uniform size particles is to be reacted in a fluidised bed reactor. The time required for complete conversion of solid particles is 20 min and the mean residence time of particles in the bed is 48 min. The solids remain unchanged in size during reaction. Calculate the fraction of the original are remaining unconverted assuming.

(i) Chemical reaction step as rate controlling

(ii) Ash diffusion step as rate controlling

(2) Calculate the time required from complete burning of particles of graphite of size CRO = 5 mm, density. $\rho_\beta = 2.29/cm^3$ in an 8% oxygen stream at 900°C and 1 atm. For the high gas velocity used assume that film diffusion does not offer any resistance to transfer and reaction. Rate constant = k" = 20 cm/s.

(3) Discuss unreacted cone model for spherical particles of unchanging size when diffusion through gas film control.

3 Attempt any **two** : **14**

(1) Explain the kinetics of a slurry reactor with diagram.

(2) Discuss in brief kinetic regimes for mass transfer and reaction for a fluid-fluid reaction $A_{(g)} + B_{(l)} \rightarrow$ Prod.

(3) Discuss limitations of the shrinking core model.

SECTION - II

4 (a) Answer the following : **2×5=10**

(i) What is the relationship between the F and E curves.

(ii) Enlist the factors affecting the behaviours of the nonideal flow reactor.

(iii) Explain the behaviour, of E_θ curve for the dispersion no. less than 0.01.

(iv) Explain closed circulation system for the tanks in series model.

(v) What is langmuir isotherm ?

(b) Derive the expression for the reaction rate and dispersion, when the reaction is governed by the dispersion model. **1×8=8**

5 Answer any **two** : **2×8=16**

(a) From a pulse input into a vessel, we obtain the following output signal. Determine the no. of tanks to be used to represent the flow through a vessel.

Time (min)	1	3	5	7	9	11	13	15
Conc.	0	0	10	10	10	10	0	0

(b) Explain void volume and solid density of the catalyst.

(c) Explain catalyst deactivation in detail.

6 Answer any **four** : **4×4=16**

(a) Write a short note on Mercury penetration method.

(b) Discuss about the catalyst classification.

(c) Write the reaction mechanism for the following kinetics :

(i) $A+B \rightleftharpoons R+S$ single site

(ii) $A+B \rightleftharpoons R+S$ dual site

(d) Explain production distribution for the series reaction.

(e) Explain effectiveness factor for the reaction with respect to their modules.

(f) Write a short note on mixed flow and recycle reactor.