CBCS Scheme

USN | | | | | | | | | | 15BT51

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Bio-Kinetics & Bio-reaction Engineering

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Define the following with example:
(i) Order and molecularity.
(ii) Rate and mechanism.
(iii) Elementary and Non-elementary reaction. **(06 Marks)**

b. Explain temperature dependency of rate expression given by collision theory. **(06 Marks)**

c. The pyrolysis of ethane proceeds with an activated energy of about 75000 cal. How much fast is the decomposition at 650°C than at 500°C. **(04 Marks)**

OR

2 a. Explain integral and differential method of analyzing kinetic data. **(06 Marks)**

b. A recompression of dimethylether was studied in a constant volume batch reactor at constant temperature. The reaction is

$(CH_3)_2O \rightarrow CH_4 + CO + H_2$

The following data is obtained:

Time, sec	0	210	717	1195	3155
PmmHg	312	408	488	562	779

Find the rate expression to represent this reaction. **(10 Marks)**

Module-2

3 a. Derive the performance equation for batch reactor. **(06 Marks)**

b. A homogeneous liquid phase reaction A→R, $-\gamma_A = KC_A^2$ taking place with 50% conversion in mixed flow reactor.
(i) What will be the conversion if this reactor will be replaced by 6 times as large all else remain unchanged.
(ii) What will be the conversion if original reactor is replaced by PFR all else remain unchanged? **(10 Marks)**

OR

4 a. Show that the performance of mixed flow reactor connected in series, as N→ ∞ the overall effect equivalent to plug flow reactor. **(10 Marks)**

b. A kinetics of aqueous phase decomposition of 'A' is investigated in two mixed reactors in series. The second having twice the volume of first reactor, at steady state with feed concentration of 1 mol/lit, and mean residence time of 96 sec in first reactor, the concentration of first reactor is 0.5 mole A/lit and in the second is 0.25 mole A/lit. Find the kinetic equation to represent this reaction. **(06 Marks)**

Module-3

5 a. Explain the experimental method to determine residence time distribution (stimulus response technique) and list out the properties of tracer. **(06 Marks)**

b. The concentration reading in the table represent continuous delta function input to the closed vessel which is used as chemical reactor.

(i) Tabulate and plot E and F curve.

(ii) Calculate mean and variance. **(10 Marks)**

Data:

t,min	0	5	10	15	20	25	30	35
C gm/lit	0	3	5	5	4	2	1	0

OR

6 a. Explain the relation between E, F and C curve. **(06 Marks)**

b. The data in the following table are shown the result of reactor for liquid decomposition, $-\gamma_A = KC_A$, $K = 0.307\ min^{-1}$

t: min	0	5	10	15	20	25	30	35
C, gm/lit	0	3	5	5	4	2	1	0

Find the material unconverted in real reactor and compare the conversion with ideal PFR and CSTR. **(10 Marks)**

Module-4

7 a. What are enzymes? explain the classification based on nomenclature and application. **(06 Marks)**

b. Derive Michaelis-Menten equation, starting with all assumptions. **(10 Marks)**

OR

8 a. Explain lineweaver-Burk plot and Hanes-Wolf plot of estimating Km and Vmax. **(08 Marks)**

b. Determine M-M parameter Vm and Km for,

$$\text{Urea} + \text{Urease} \underset{K_2}{\overset{K_1}{\rightleftarrows}} ES \xrightarrow[H_2O]{K_3} NH_3 + CO_2 + \text{Enzyme}$$

The rate equation is given as function of urea concentration. **(08 Marks)**

Urea concentration Kmol/m^3	0.2	0.02	0.01	0.005	0.002
Rate, Kmol/m^3-sec	1.082	0.55	0.38	0.20	0.09

Module-5

9 a. Derive Monod growth kinetics with ideal reactor kinetics. **(08 Marks)**

b. How do you classify microbial products? Explain. **(08 Marks)**

OR

10 a. What is simple and complex media? Explain in detail. **(08 Marks)**

b. With neat sketch, explain principle and working of filter sterilization. **(08 Marks)**

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