Code No: R05312301 **R05** **Set No. 2**

III B.Tech I Semester Examinations,November 2010
BIOCHEMICAL REACTION ENGINEERING
Bio-Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) What are the advantages and disadvantages of fed batch reactors over continuous reactors?
   (b) Explain in detail what are the feeding mechanisms for fed batch reactor. [16]

2. A batch fermenter was operated for the production of alcohol from glucose using yeast. The following data were obtained in the fermenter.

Time (h)	0	2	4	6	8	10	12	14
Concentration of glucose	70	68	66	63	58	52	44	36
Yeast count ($\times 10^6$ cenn/ml	–	6	10	20	38	180	117	140
Alcohol prodyction (kg mol/m^3	0	1	5	11	20	30	41	55

Find out whether the above rate data could be interpreted by a simple kinetic equation of the type.

$-r_{\mathrm{A}} = k_n C_A^n$

where C_A stands for substrate concentration. If so, find k_n and n. if not, indicate the reasons thereof. [16]

3. Compute K_y at 10 atm if K_p at this pressure is 0.00381 atm^{-1} for ammonia synthesis reaction from hydrogen and nitrogen at 500 ^0C. (assume ideal gas holds good). [16]

4. A "closed" vessel has flow for which D/u L = 0.2. We wish to represent this vessel by the tanks in series model. What value of N should we select? [16]

5. (a) Why do airlift bioreactors often produce higher productivities than gas stirred tank bioreactors? Explain in detail.
   (b) State what are the measuring devices used for the parameters of ongoing large-scale fermentation. [16]

6. Using colour indicator which shows when concentration of A falls below 0.1 mol/l, the following scheme is devised to explore the kinetics of decomposition of A. The feed containing 0.6 mol A/l is introduced into the first of the two CSTRs in series, each having a volume of 400 cm^3. The colour change occurs in the first reactor (single reactor) for a steady state feed rate of 10 cm^3 / min, and in second reactor in series (two reactors setup) for a steady state feed rate of 50 cm^3/ min. Find the rate expression that represents the decomposition of A from the information provided. [16]

7. Write about the stability of the Chemostat with substrate inhibition using various stability methods? [16]

8. Consider the liquid phase reaction

   $A + B \xrightarrow{k_1} R(\text{desired}), {}^{dC_R}/_{dt} = 1.0C_A^{1.5}C_B^{0.30}, \text{mol}/(\iota.\text{min})$

   $A + B \xrightarrow{k_2} R(\text{undesired}), {}^{dC_S}/_{dt} = 1.0C_A^{0.5}C_B^{1.8}, \text{mol}/(\iota.\text{min})$

   equal volumetric flow rates of A and B streams with each stream of concentration of 20 mol/l of reactant are fed to the reactor.

   For 90% conversion of A, find the concentration of R in the product stream if flow in the reactor follows:

   (a) plug flow,
   (b) mixed flow,
   (c) plug flow with side streams of B and C_{Bf}= 1 mol /l every where in a reactor. [16]

*****

Code No: R05312301 **R05** **Set No. 4**

III B.Tech I Semester Examinations,November 2010
BIOCHEMICAL REACTION ENGINEERING
Bio-Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Why do airlift bioreactors often produce higher productivities than gas stirred tank bioreactors? Explain in detail.
   (b) State what are the measuring devices used for the parameters of ongoing large-scale fermentation. [16]

2. Write about the stability of the Chemostat with substrate inhibition using various stability methods? [16]

3. A batch fermenter was operated for the production of alcohol from glucose using yeast. The following data were obtained in the fermenter.

Time (h)	0	2	4	6	8	10	12	14
Concentration of glucose	70	68	66	63	58	52	44	36
Yeast count ($\times 10^6$ cenn/ml	–	6	10	20	38	180	117	140
Alcohol prodyction (kg mol/m^3	0	1	5	11	20	30	41	55

   Find out whether the above rate data could be interpreted by a simple kinetic equation of the type.

   $-r_{\mathrm{A}} = k_n C_A^n$

   where C_A stands for substrate concentration. If so, find k_n and n. if not, indicate the reasons thereof. [16]

4. Compute K_y at 10 atm if K_p at this pressure is 0.00381 atm^{-1} for ammonia synthesis reaction from hydrogen and nitrogen at 500 ^0C. (assume ideal gas holds good). [16]

5. Using colour indicator which shows when concentration of A falls below 0.1 mol/l, the following scheme is devised to explore the kinetics of decomposition of A. The feed containing 0.6 mol A/l is introduced into the first of the two CSTRs in series, each having a volume of 400 cm^3. The colour change occurs in the first reactor (single reactor) for a steady state feed rate of 10 cm^3 / min, and in second reactor in series (two reactors setup) for a steady state feed rate of 50 cm^3/ min. Find the rate expression that represents the decomposition of A from the information provided. [16]

6. A "closed" vessel has flow for which D/u L = 0.2. We wish to represent this vessel by the tanks in series model. What value of N should we select? [16]

7. (a) What are the advantages and disadvantages of fed batch reactors over continuous reactors?

(b) Explain in detail what are the feeding mechanisms for fed batch reactor. [16]

8. Consider the liquid phase reaction

$A + B \xrightarrow{k_1} R(\text{desired}), {}^{dC_R}/_{dt} = 1.0 C_A^{1.5} C_B^{0.30}, \text{mol}/(\iota.\text{min})$

$A + B \xrightarrow{k_2} R(\text{undesired}), {}^{dC_S}/_{dt} = 1.0 C_A^{0.5} C_B^{1.8}, \text{mol}/(\iota.\text{min})$

equal volumetric flow rates of A and B streams with each stream of concentration of 20 mol/l of reactant are fed to the reactor.

For 90% conversion of A, find the concentration of R in the product stream if flow in the reactor follows:

(a) plug flow,

(b) mixed flow,

(c) plug flow with side streams of B and C_{Bf}= 1 mol /l every where in a reactor. [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: R05312301 **R05** **Set No. 1**

III B.Tech I Semester Examinations,November 2010
BIOCHEMICAL REACTION ENGINEERING
Bio-Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. A batch fermenter was operated for the production of alcohol from glucose using yeast. The following data were obtained in the fermenter.

Time (h)	0	2	4	6	8	10	12	14
Concentration of glucose	70	68	66	63	58	52	44	36
Yeast count ($\times 10^6$ cenn/ml	–	6	10	20	38	180	117	140
Alcohol prodyction (kg mol/m^3	0	1	5	11	20	30	41	55

Find out whether the above rate data could be interpreted by a simple kinetic equation of the type.

$-r_{\mathrm{A}} = k_n C_A^n$

where C_A stands for substrate concentration. If so, find k_n and n. if not, indicate the reasons thereof. [16]

2. (a) What are the advantages and disadvantages of fed batch reactors over continuous reactors?
   (b) Explain in detail what are the feeding mechanisms for fed batch reactor. [16]

3. Write about the stability of the Chemostat with substrate inhibition using various stability methods? [16]

4. Compute K_y at 10 atm if K_p at this pressure is 0.00381 atm^{-1} for ammonia synthesis reaction from hydrogen and nitrogen at 500 ^0C. (assume ideal gas holds good). [16]

5. Using colour indicator which shows when concentration of A falls below 0.1 mol/l, the following scheme is devised to explore the kinetics of decomposition of A. The feed containing 0.6 mol A/l is introduced into the first of the two CSTRs in series, each having a volume of 400 cm^3. The colour change occurs in the first reactor (single reactor) for a steady state feed rate of 10 cm^3 / min, and in second reactor in series (two reactors setup) for a steady state feed rate of 50 cm^3/ min. Find the rate expression that represents the decomposition of A from the information provided. [16]

6. (a) Why do airlift bioreactors often produce higher productivities than gas stirred tank bioreactors? Explain in detail.
   (b) State what are the measuring devices used for the parameters of ongoing large-scale fermentation. [16]

7. Consider the liquid phase reaction

   $A + B \xrightarrow{k_1} R(\text{desired}), {}^{dC_R}/_{dt} = 1.0C_A^{1.5}C_B^{0.30}, \text{mol}/(\iota.\text{min})$

   $A + B \xrightarrow{k_2} R(\text{undesired}), {}^{dC_S}/_{dt} = 1.0C_A^{0.5}C_B^{1.8}, \text{mol}/(\iota.\text{min})$

   equal volumetric flow rates of A and B streams with each stream of concentration of 20 mol/l of reactant are fed to the reactor.

   For 90% conversion of A, find the concentration of R in the product stream if flow in the reactor follows:

   (a) plug flow,
   (b) mixed flow,
   (c) plug flow with side streams of B and C_{Bf}= 1 mol /l every where in a reactor. [16]

8. A "closed" vessel has flow for which D/u L = 0.2. We wish to represent this vessel by the tanks in series model. What value of N should we select? [16]

⋆⋆⋆⋆⋆

Code No: R05312301 **R05** **Set No. 3**

III B.Tech I Semester Examinations,November 2010
BIOCHEMICAL REACTION ENGINEERING
Bio-Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) What are the advantages and disadvantages of fed batch reactors over continuous reactors?
   (b) Explain in detail what are the feeding mechanisms for fed batch reactor. [16]

2. A "closed" vessel has flow for which D/u L = 0.2. We wish to represent this vessel by the tanks in series model. What value of N should we select? [16]

3. A batch fermenter was operated for the production of alcohol from glucose using yeast. The following data were obtained in the fermenter.

Time (h)	0	2	4	6	8	10	12	14
Concentration of glucose	70	68	66	63	58	52	44	36
Yeast count ($\times 10^6$ cenn/ml	–	6	10	20	38	180	117	140
Alcohol prodyction (kg mol/m^3	0	1	5	11	20	30	41	55

   Find out whether the above rate data could be interpreted by a simple kinetic equation of the type.

   $-r_{\mathrm{A}} = k_n C_A^n$

   where C_A stands for substrate concentration. If so, find k_n and n. if not, indicate the reasons thereof. [16]

4. Write about the stability of the Chemostat with substrate inhibition using various stability methods? [16]

5. Compute K_y at 10 atm if K_p at this pressure is 0.00381 atm^{-1} for ammonia synthesis reaction from hydrogen and nitrogen at 500 ^0C. (assume ideal gas holds good). [16]

6. (a) Why do airlift bioreactors often produce higher productivities than gas stirred tank bioreactors? Explain in detail.
   (b) State what are the measuring devices used for the parameters of ongoing large-scale fermentation. [16]

7. Using colour indicator which shows when concentration of A falls below 0.1 mol/l, the following scheme is devised to explore the kinetics of decomposition of A. The feed containing 0.6 mol A/l is introduced into the first of the two CSTRs in series, each having a volume of 400 cm^3. The colour change occurs in the first reactor (single reactor) for a steady state feed rate of 10 cm^3 / min, and in second reactor in series (two reactors setup) for a steady state feed rate of 50 cm^3/ min. Find the rate expression that represents the decomposition of A from the information provided. [16]

8. Consider the liquid phase reaction

   $A + B \xrightarrow{k_1} R(\text{desired}), {}^{dC_R}/_{dt} = 1.0C_A^{1.5}C_B^{0.30}, \text{mol}/(\iota.\text{min})$

   $A + B \xrightarrow{k_2} R(\text{undesired}), {}^{dC_S}/_{dt} = 1.0C_A^{0.5}C_B^{1.8}, \text{mol}/(\iota.\text{min})$

   equal volumetric flow rates of A and B streams with each stream of concentration of 20 mol/l of reactant are fed to the reactor.

   For 90% conversion of A, find the concentration of R in the product stream if flow in the reactor follows:

   (a) plug flow,
   (b) mixed flow,
   (c) plug flow with side streams of B and C_{Bf}= 1 mol /l every where in a reactor. [16]

⋆ ⋆ ⋆ ⋆ ⋆