Ref. No. : Ex/FTBE/T/324/2018

B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING THIRD YEAR SECOND SEMESTER – 2018

BIOCHEMICAL ENGINEERING-I

Part-I

(60 Marks for Part-I)

Use a separate answer script for each part

Time: 3hrs Full Marks: 100

Group-A

Answer any two questions **20×2 = 40**

1. (a) Streptomycine is extracted from the fermentation broth using an organic solvent in a counter current staged extraction unit. The distribution coefficient of streptomycine at pH = 4 is KD = 40 and the flow rate of aqueous phase is H = 150l/min. if only five extraction units are available to reduce the streptomycine concentration from 10g/l in the aqueous phase to 0.2 g/l, determine the required flow rate of the organic phase (L) in the extraction unit.

   (b) What is centrifugal coefficient? Find the relation between centrifugal coefficient and liquid flow rate through a centrifuge. 12+8=20

2. (a) In a cross-flow ultra filtration system used for filtration of proteins from a fermentation broth, gel resistance increases with protein concentration according to the following equation: $R_c=0.5+0.01(C)$ where C is in mg/l.

   Pressure at the entrance of the system is $P_i = 6$ atm and at the exit is $P_0 = 2$atm. The shell side of the filter is open to the atmosphere, resulting in $P_f = 1$ atm. The membrane resistance is RM = 0.5 atm/m^2.h), and protein concentration in the broth is C = 100 mg/l, Determine:

   (iv) The pressure drop across the membrane

   (v) Filtration flux

   (vi) Rejection coefficient of the membrane for effluent protein concentration of Ci = 5mg/l.

   (b) How purification of proteins are controlled by ionic strength, presence of organic solvent, salt, ionic polyelectrolyte and nonionic polymers? 12+8=20

[Turn over

3. (a) Gentamycin crystals are filtered through a small test filter medium with a negligible resistance. The following data were obtained:

t(sec)	10	20	30	40
V(l)	0.6	0.78	0.95	1.1

The pressure drop in this test tube was 1.8 times that when water was used with a filter area of 100cm^2. The concentration of gentamycin in solution is 5g/l. how long would it take to filter 5000 l of gentamycin solution through a filter of 1.5 m^2, assuming the pressure drop is constant and viscosity of the broth is 1.2 centipoise?

(b) What are the different types of continuous elution type chromatographic methods? Write their basic working principle. 12+8=20

Group-B

Answer any two questions **10×2 = 20**

4. (a) What are the advantages and disadvantages of enzyme immobilization?

(b) What are the selection criteria of matrix for enzyme immobilization? 6+4 = 10

5. (a) What are different enzyme immobilization techniques?

(b) Briefly describe the entrapment method for enzyme immobilization. 5+5 = 10

6. (a) What is Damkohler number (D_a)? Explain its significance.

(b) How mass transfer resistances may be minimized in case of immobilized enzyme bead? 5+5 = 10

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B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING

THIRD YEAR SECOND SEMESTER EXAM 2018

Biochemical Engineering I

Time: 3 hrs. Full Marks : 100

Part – II

1. Answer any one from the following (a) and (b)

(a) Draw the general bacterial growth curve on suitable axes and label properly. What is the difference between batch and fed-batch and continuous fermentation?

If one starts with 10,000 (10^4) cells in a culture that has a generation time of 2 h, how many cells will be in the culture after 4, 24, and 48 h? 3 + 3 + 4

(b) The following data were collected using a culture of *Pseudomonas* during growth in a minimal medium containing salicylate as a sole source of carbon and energy. Using these data, calculate the specific growth rate for the exponential phase. 10

Time (h)	0	4	6	8	10	12	16	20	24	28
Culturable cell count (CFU/ml)	$1.2x10^4$	$1.5x10^4$	$1.0x10^5$	$6.2x10^6$	$8.8x10^8$	$3.7x10^9$	$3.9x10^9$	$6.1x10^9$	$3.4x10^9$	$9.2x10^8$

2. Answer any two from the following (a) , (b) and (c)

(a) Define bioreactor. What is the difference between a shake flask , a pilot plant scale and an industrial scale bioreactor. Name different types of bioreactors and mention the factors which guide you during selection of reactor for a particular fermentation process. Name two types of pneumatically agitated bioreactors and write their difference? 1+2+(2+2)+3

(b) With a neat sketch explain the mechanism of action in an air lift reactor. What are the advantages of an air lift bioreactor? What are the challenges against membrane reactor? Give one example of use of photobioreactor. 5 + 2 +2 +1

(c) Write the advantages and disadvantages of immobilized cell bioreactor. On which factors choice of design depend for Immobilized bioreactor? What do you mean by trickle bed bioreactor ? What is the difference between a packed bed and a fluidized bed bioreactor? 3+2+3+2

3. Answer any one from the following (a) and (b)

(a) Write the objectives of using agitator and baffles in a fermenter ? What are the advantage and disadvantage of using bottom entry agitator? What volume of air/ hr to be supplied for an aerobic fermentation with 2lit medium, if the rotameter reading is controlled at 2vvm. With the proper sketch show the resistances for oxygen transfer from the air bubble to the microbial cell during fermentation. 3+2+2+3

(b) Write the difference between axial flow and radial flow impeller and give example of each type. Mention the factors which control foaming during fermentation. With neat sketch explain the mechanism of (i) pH control and (ii) foam control during a fermentation process. 2+2+ (3+3)