KUMARAGURU
college of technology
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B.TECH DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Fifth Semester

BIOTECHNOLOGY

U18BTI5203: Heat and Mass Transport in Bioprocess

COURSE OUTCOMES

CO1: Outline the modes of heat of transfer.

CO2: Design the heat transfer equipment in bioprocess industries.

CO3: Illustrate the principles of diffusion and apply the concepts of interphase mass transfer in bioreactor.

CO4: Apply the concept of distillation and drying in bioprocess.

CO5: Comprehend the extraction separation in bioprocess.

CO6: Interpret the membrane separation in bioprocess.

Time: Three Hours | **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Define the Fourier's law of conduction	CO1	[K$_1$]
2.	Delineate Nusselt number	CO1	[K$_1$]
3.	State the merits of compact heat exchanger	CO2	[K$_2$]
4.	Differentiate counter current flow from cross flow	CO2	[K$_2$]
5.	Classify the methods used for the K$_L$a determination in bioreactors	CO3	[K$_2$]
6.	Compare molecular diffusion and convective diffusion	CO3	[K$_2$]
7.	What is molecular distillation	CO4	[K$_1$]
8.	Illustrate the extraction isotherm	CO5	[K$_1$]
9.	What is the principle of reverse osmosis	CO6	[K$_1$]
10.	Recall the demerits of membrane filtration	CO6	[K$_1$]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	Derive the relation for overall heat transfer coefficient in terms of individual heat transfer coefficients	12	CO1	[K$_2$]
	b)	Outline the concept of correction factors of overall heat transfer coefficient	4	CO1	[K$_1$]

| 12. | a) | Discuss the thermal conductivity and its application in biological materials | 12 | CO1 | [K$_2$] |
| | b) | Compare thermal diffusivity with thermal conductivity | 4 | CO1 | [K$_2$] |

| 13. | a) | Extend the boiling heat transfer phenomenon and the process of boiling with a neat sketch in an evaporator | 12 | CO2 | [K$_2$] |
| | b) | Interpret the principles of Recuperator and Regenerator | 4 | CO2 | [K$_1$] |

14. A continuous distillation column is used to separate a feed mixture at its boiling point, containing 24% acetone and 76% Jasmine oil into a distillate product containing 77% acetone and a residue product containing 5% acetone. Areflux ratio of twice the minimum is to be used. The overall plate efficiency is 60%. Determine the number of actual plates required for separation. Rmin = 3.053. The VLE data is given below: 16   CO3   [K$_3$]

| x | 0 | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| y | 0 | 0.10 | 0.19 | 0.32 | 0.43 | 0.51 | 0.59 | 0.66 | 0.72 | 0.82 | 0.9 | 1.0 |

15. Organize the working of any two-leaching industrial equipments used in bioprocess industries   16   CO5   [K$_2$]

16. Rephrase the principle and working of electro-dialysis of blood with neat sketch   16   CO6   [K$_2$]

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