Ref. No.: Ex/FTBE/PC/B/T/311/2024

B.E. FOOD TECHNOLOGY AND BIOCHEMICAL ENGINEERING THIRD YEAR FIRST SEMESTER EXAM 2024

BIOCHEMICAL ENGINEERING-I

Full Marks: 100 Time: 3hrs

Part-I (50 Marks)

Group-A

Answer any one question $5\times1 = 5$

1. What is centrifugal factor? How it is related to rotational speed? How flow rate of the centrifuge is related to centrifugation coefficient? $2+3 = 5$
2. Draw a flow chart of the enzyme purification method considering the major steps involved.

Group-B

Answer any three questions $15\times3 = 45$

3. Derive material balance equation in multistage counter current extractor. Briefly describe enzyme precipitation method. What are the different types of nuclease? Write their functions. $7+5+3 = 15$
4. (a) Derive the equation of filtration rate under constant operating pressure and incompressible filter cake.
   (b) Yeasts cells are recovered from a fermentation broth by using a tubular centrifuge. Sixty percent of the cells are recovered at a flow rate of 12 l/min with a rotational speed of 4000 rpm. Recovery is inversely proportional to flow rate.
   (i) To increase the recovery of cells to 95% at the same flow rate, what should be the rpm of the centrifuge?
   (ii) At a constant rpm of 4000, what should be the flow rate to result in 95% cell recovery? $7+8 = 15$
5. (a) Biomass present in a fermentation broth is to be separated by vaccum filtration. Filter and broth characteristics are given below.
   $A = 50m^2$; $\Delta P = 0.01N/m^2$; $C = 15\ kg/m^3$; $\mu = 0.003$ kg/m.s; $\alpha = 2m/kg$.
   (i) If the rate of filtration has a constant value of $dV/dt = 50$ l/min, determine the cake and filter resistances at $t = 30$ min.
   (ii) Determine the filter surface area required to filter 5000 l broth within 60 min with the same pressure drop across the filter.

   (b) Write short note on reverse osmosis. $10+5 = 15$

[Turn over

6. Write the advantages and disadvantages of genetically modified foods. What are the different types of chromatographic methods? 8+7 = 15
7. Write short note on any three 5×3 = 15
   (i) Cloning process
   (ii) Dialysis of enzyme
   (iii) Aqueous two-phase extraction
   (iv) Cell disruption method
   (v) Electrophoresis

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B.E (FTBE) 3RD YEAR-1ST SEMESTER EXAMINATION 2024

Biochemical Engineering- I

Part-II (Full marks 50)

[Answer any five of the following questions (5 x 10 = 50)]

1. What do you mean by 'specific growth rate' ? If the 'generation time' of a bacteria is 20 mins. then find out what will be the no of that bacteria on a growth medium after 3 hrs ,assuming that the initial count was 100. Draw bacterial growth curve and explain the significance of lag phase. What is the dimension of 'k_d'? (2+3+(2+2)+1)

2. How do you define 'submerged fermentation'? Mention some applications of submerged fermentation. Mention some names of substrates and also names of some microorganisms involved in solid state fermentation. Compare solid state and submerged fermentation w.r.t oxygen source, product yield, energy consumption and raw material cost. (2+2+(1+3)+2)

3. What do you mean by 'fed-batch' fermentation? Mention advantages and disadvantages of continuous fermentation process. Write six differences between batch and continuous fermentation. What do you mean by 'yield coefficient'? (2+4+3+1)

4. Citing proper example define 'simple' and 'enriched' culture media. Write the conditions for sterilization using autoclave. Name the reference organism for media sterilization process. Draw a neat sketch of an 'indirect heat exchange type continuous sterilizer. (1.5x2)+2+1+4)

5. What is 'Del factor'? For a medium sterilization process specific death rate of the index organism is 2.5 $mins^{-1}$ at 121^0C and the time of sterilization is set to 5 mins, find the 'Del Factor' value. Write the relationship equation involving time and temperature of sterilization. Explain the effect of the time of heat treatment on the survival of a population of bacterial endospores. (2+3+2+3)

6. Write the full form of 'HEPA'. Differentiate between surface filtration and depth filtration. Mention the names of the mechanism by which microbes get arrested by fibrous filtration system . Name one ionizing and one non-ionizing radiation used for sterilization purposes. Name one liquid and one gaseous chemical sterilizing agent. In a sterilization process , $D_{121.1}$ value of the target organism is 0.22 minutes. What Time will be required for 99.999% inactivation of the target organism at 121.1 ^0C. (1+2+2+1+1+3)