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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E.
Branch: Biotechnology
Course Code: 19BT5DCBPT
Course: Bioprocess Technology

Semester: V
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Discuss on how the enrichment liquid culture could be used in isolation of an industrially important organism. **06**

b) The performance of the fermentation process is in turn dependent on the physiological status of the inoculum when transferred to next cultural stage. Discuss on the same. **08**

c) Selection of a superior producer organism follows some important criteria in industrial fermentation processes. Justify. **06**

UNIT - II

2 a) A genetically engineered harmless microorganism is being used for the large scale (more than 10 dm^3) production of sector-II Biotechnology product. Pertaining to this biotechnological operation; **10**
   i. Determine the most suitable containment level.
   ii. Summarize and justify the appropriate containment requirements which should be applied within the European federation of Biotechnology.

b) Design and draw a proportional sketch of a fermenter showing all the components with one multi-bladed impeller having the following geometrical details (use appropriate scale):
   i. Liquid height(L): 55cm
   ii. L/D (tank Diameter):0.72
   iii. Impeller Diameter:0.4(D)
   iv. Baffle width/D:0.10
   v. Impeller height:0.1(L) **10**

OR

3 a) Define Oxygen Mass transfer coefficient and describe the methods used in its determination. **10**

b) If unsterile broth was shown to contain 10^{11} viable organisms and acceptable risk of contamination is 1 in 1000.then **10**
   i. Calculate the Del factor
   ii. Calculate the holding Del factor if heating and cooling Del factor is 9.8 and 10.1 respectively.
   iii. Calculate the holding time, if specific death rate at 121^0C is 2.54min^{-1}, also calculate the same if contribution made by the

heating and cooling parts of the cycle were ignored.
    iv.   Comment on all the results.

UNIT - III

4 a) Describe on how the following properties of biological substances that are relevant in separation processes to select the suitable unit operation. **10**
        i.   Size and shape
        ii.   Electrostatic charge and polarity
        iii.   Solubility and Diffusivity
        iv.   Partition coefficient and volatility

  b) Compare and contrast how the process design criteria for the separation of product factor VIII vary from citric acid? **10**

OR

5 a) Describe on how Darcy's law is used in selection of the appropriate filtration equipment for separation of solids from slurry. **10**

  b) A biotechnologist is interested to isolate the following bio-products using the enzymatic methods: **10**
        i.   Invertase enzymes(EC 3.2.1.28) from *Saccharomyces cerevisiae*
        ii.   Penicillin G acylase enzyme(EC 3.5.1.11) from *E.coli*
        iii.   Protoplast isolation from a plant cell

Which enzyme would you suggest and justify your answer with relevant diagrams if any. Also comment on the limitations of enzymatic methods. How would you increase the efficiency of these methods in practice?

UNIT - IV

6 a) Compare the pressure driven membrane based bio-separation processes based on the size of the permeable species. **10**

  b) A protein solution (concentration = 4.4 g/1) is being ultrafiltered using a spiral wound membrane module, which totally retains the protein. At a certain transmembrane pressure the permeate flux is 1.3×10^{-5} m/s. The diffusivity of the protein is 9.5×10^{-11} m^2/s while the wall concentration at this operating condition is estimated to be 10 g/1. Predict the thickness of the boundary layer. If the permeate flux is increased to 2.6×10^{-5} m/s while maintaining the same hydrodynamic conditions within the membrane module, what is the new wall concentration? **10**

UNIT - V

7 a) Describe an equipment which is based on principle of sublimation. **06**
  b) With a schematic representation, discuss the design of circulating liquid evaporator-crystallizer. **06**
  c) With a schematic representation discuss the liquid-liquid extraction process. Identify the important criteria for extraction of compounds through this methods. **08**

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