Exam.Code:1032
Sub. Code: 7564

2123

M. E. (Bio-Technology)

First Semester

ME-BIO-104: Bio-Separation and Bio-Process Technology

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: ***Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section. State clearly your assumptions.***

x-x-x

1) Write briefly: *(2×5=10)*
   a) Fermentation media.
   b) Sterilization.
   c) Precipitation.
   d) Yield coefficients.
   e) Upstream and downstream.

SECTION – A

2) Briefly discuss:
   I. Centrifugation and design of centrifuge.
   II. Filtration and different types of filters. *(5, 5)*

3) Discuss the various methods of cell disruption with suitable examples. *(10)*

4.A) In a fermentation process producing baker's yeast, the biomass is separated using a continuous centrifuge, operating at 5000 rpm with a feed rate of 90 L/min. The solid particles may be assumed to have an average diameter of 0.05 mm. The density of the biomass is 1010 kg/m^3. The fluid may be assumed to have properties of water. Find the sigma factor for the centrifuge.

B) Briefly discuss about electrophoresis? *(6, 4)*

SECTION - B

5) Write a critical review on "Energy production or green chemical from biomass". *(10)*

6) Suppose you have a microorganism that obeys the Monod equation:

$$\frac{dC_x}{dt} = \frac{\mu_{max} C_s C_x}{K_s + C_s}$$

where $\mu_{max} = 0.7\ hr^{-1}$ and $K_s = 5 g/L$ .The Cell yield ($Y_{x/s}$) is 0.65. You want to cultivate this microorganism in either one reactor or two in series. The flow rate and Substrate concentration of the inlet stream should be 500 L/hr and 85 g/L, respectively. The substrate concentration of the outlet stream must be 5 g/L.

   a) If you use one CSTR, what should be the size of the Reactor? What is the cell concentration of the outlet stream?

   b) If you use two CSTR in series, what size of the two Reactors will be most productive? *(10)*

7.A) Discuss the bioreactor modeling of batch, fed batch and CSTR with cell mass, substrate and product balance. Explain merit and demerit of Batch, CSTR and fed batch reactor. *(6)*

B) The specific growth rate for inhibited growth in chemostat is given by the following equation:

$$\mu = \frac{\mu_{max} S}{K_s + S + \frac{I.K_s}{K_I}}$$

Where $\mu_{max} = 0.5\ hr^{-1}$ and $K_s = 1.0$ g/L, $I = 0.05$g/L, $Y_{x/s} = 0.1$ (g cells/g substrate), $K_I = 0.01$ g/L, S0=10 g/L, X_0=0

a) Determine Cell mass (X) and substrate concentration as a function of D when I=0

b) With inhibitor added to a chemostat determine Cell mass (X) and substrate concentration as a function of D.

c) Determine Cell Productivity (DX) as a function of D. *(4)*

x-x-x