Exam. Code: 0909
Sub. Code: 6309

2074

B.E. (Biotechnology) Fifth Semester

BIO-512: Bio-Process Engineering

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 Unit.

x-x-x

1. Attempt the following:-
   a) Define the dilution factor.
   b) What is X_{90}? Write an expression for it.
   c) How are biological reactions different from chemical reactions?
   d) What is meant by specific oxygen uptake rate?
   e) Define coefficient of viscosity.
   f) Define limiting substrate.
   g) Discuss the concept of repeated fed-batch culture.
   h) Define aseptic operation and containment.
   i) Justify the importance of HTST concept.
   j) Brief the washout conditions prevailing in a chemostat culture. (10x1)

UNIT - I

2. List main factors involved in scale-up. Discuss the suitability of constant P/V and constant k_La approaches for a scale-up of shear sensitive culture. Discuss how sterilization process is scale dependent and how it results in the nutrient degradation. (3,4,3)

3. a) Estimate the dilution rate which gives maximum biomass in a continuous bioreactor 10 tonnes/day of microbial cells. If S_0 = 100 kg m^{-3}; μ_{max} = 0.15 h^{-1}; k_s = 1 kg m^{-3} and $Y_{x/s}$ = 0.5 kg kg^{-1}. Also, estimate the reactor volume.
   b) Describe the growth-associated and non-growth associated product formation in fermentation process. (5,5)

4. Write the material balance equation for a CSTBR with a neat diagram. Describe how recycling in a chemostat improves the production. (10)

P.T.O.

UNIT - II

5. a) Which all reactions can be accommodated to account for the loss of nutrient quality that take place during sterilization?

   b) Explain how sterilization at high temperature for a short time is significant for any fermentation process. (10)

6. Briefly describe important components of a fermentation medium. What factors one need to consider while formulating fermentation medium for commodity chemicals/enzymes? (10)

7. a) Give reasons for foam formation during fermentations. Enlist desirable features for a substance to be used as ideal antifoam.

   b) Describe the process of oxygen transfer from the air bubble to the cell or cell cluster in fermentation broths. (6,4)

x-x-x