Exam.Code:0910
Sub. Code: 6716

(25)

1059

B.E. (Biotechnology) Sixth Semester

BIO-613: Bioreactor Design and Operation

e allowed: 3 Hours

Max. Marks: 50

E: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section.

x-x-x

) **Write briefly:** *(1×10 = 10)*

a) ---------- is pressure measuring sensor in bioreactor.
b) Define 'quasi steady state' for a batch cultivation of microbial cells.
c) How light absorption is related to reactor depth in photobioreactor?
d) How oxygen transfer rate is related to mass transfer coefficient?
e) What is the use of baffles in a stirred tank reactor?
f) What do you mean by aspect ratio?
g) Gas hold up in internal loop air lift reactor is similar to ----------bioreactor.
h) Give example of materials used for making membranes in membrane bioreactors.
i) What is peclet number?
j) Give example of microorganisms those are suggested for use as model cells for bioreactor research.

SECTION-A

2. a) Justify the importance of microbial characteristics on bioreactor selection.
b) How bubble column and air lift reactors are different? *(5, 5)*

3. a) Give a brief account on the salient features of photo bioreactors and membrane bioreactors.
b) Saccharomyces cerevisiae is used to convert glucose to ethanol in batch fermenter under anaerobic conditions. The yield of biomass from substrate is 0.06 gg^{-1}; Ypx is 7.7 gg^{-1}. The maintenance coefficient is 2.2 $gg^{-1}h^{-1}$; the specific rate of product formation due to maintenance is 1:1 h^{-1}. The maximum specific growth rate of S. cerevisiae is approaximately 0.3h^{-1}. 5 g bacteria are inoculated into 50 liters of medium containing 12 gl^{-1}. Determine batch culture time required to:
   a) produce 10 g biomass;
   b) achieve 90% substrate conversion
   c) produce 100 g ethanol. *(6, 4)*

4. a) Derive batch bioreaction time when product formation is not directly coupled with energy metabolism.
b) Explain working principle of biosensors with specific example. *(5, 5)*

P.T.O.

SECTION-B

5. a) What will be the effect of cell recycle on the biomass concentration and biomass productivity in a chemostat?

b) Explain about various flow models of a reactor.

(5, 5)

6. a) Explain the application to design continuous sterilizer.

b) Explain about fermenter dynamics and indicate conditions for stability

(5, 5)

7. a) Phosphoglucomutase converts glucose 1-phosphate to glucose 6 phosphate during glycogen breakdown. In a 1 litre solution at 25^0C, the reaction is started with 0.04 gmol glucose 1-phosphate. The reaction proceed to equilibrium at which the concentration of glucose 1 phosphate is 0.002 M and the concentration of glucose 6 phosphate is 0.038 M.

i) Calculate the equilibrium constant

ii) What is the theoretical yield?

iii) What is the yield based on the reactant supplied?

b) How can we measure RTD of a non ideal reactor?

(5, 5)

x-x-x