Printed Pages : 4

* 1 5 4 5 0 3 *

EBT-503

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 154503

Roll No.

B.Tech.

(SEM. V) (ODD SEM.) THEORY EXAMINATION, 2014-15

BIOPROCESS ENGINEERING - I

Time : **2** Hours]   [Total Marks : **50**

Note: (1)   Attempt all questions.

(2)   All questions carry equal marks.

1.   Attempt any four parts of the following   **2.5x4=10**

(a)   How the environmental conditions affect the microbial growth kinetics?

(b)   Describe the importance of sterilization in fermentation industry.

(c)   Explain the quantitative analysis of biomass concentration by using indirect methods.

(d)   Determine the volumetric oxygen transfer coefficient (k_{La}) in bioreactor by chemical method.

(e)   What is an autoclave and describe its application in biotechnology laboratories?

(f)   Discuss the various filtration mechanism used in filter sterilization process.

2. Attempt any four parts of the following   2.5x4=10

   (a) Compare the batch and continuous culture in industrial processes.

   (b) What are the criteria's for the selection of source of nutrients for media preparation?

   (c) What are foam sensors? Explain the working principle of any foam sensing device.

   (d) What is degree of reduction? Determine the theoretical oxygen demand and maximum possible yield in bioreactors.

   (e) What is volumetric oxygen transfer coefficient? In unsteady state condition in k_{La} determination why oxygen concentration remains above $C_{critical}$?

   (f) What is flocculation? Explain the working principle and industrial application of flocculation process in bioprocess industries.

3. Attempt any two parts of the following   5x2=10

   (a) Describe the working principle and assumptions of Plug Flow Bioreactor and derive the mathematical model equation of this reactor.

   (b) Discuss the Placket Barman Design method for medium optimization & its importance in the bioprocess industries.

   (c) $20 \ m^3$ fermenter with air at a rate of $10 \ m^3/$ min for a fermentation lasting 100 hrs. From an investigation of the filter material to be used, the optimum linear air velocity was shown to be 0.15 m/sec, at which the value of K was $1.535 \ cm^{-1}$. The dimensions of filter are to be calculated. The air in the fermentation plant contained approximately 200 microorganisms per m^3. The acceptable degree of contamination is one in a thousand.

4. Attempt any two parts of the following   5x2=10

   (a) What is pellet formation? Explain the growth kinetics and dynamics of pellet formation.

   (b) Discuss about the factors which can affecting the rate of oxygen transfer in bioreactors.

   (c) Zymomonas mobilis is used to convert glucose to ethanol in batch fermentation under anaerobic conditions. The yield of biomass from substrate is 0.06 g/g; Y_{PX} is 7.7 g/g. The maintenance coefficient is 2.2 g/gh^{-1}; the specific rate of product formation due to maintenance is 1.1 h^{-1}. The maximum specific growth rate of Z. mobilis is approximately 0.3 h^{-1}. 5 gm bacteria are inoculated into 50 litre of medium containing 12 g/l glucose. Determine batch culture times required to:

     (i) produce 10 g biomass

     (ii) achieve 90% substrate conversion

     (iii) produce 100 g ethanol.

5. Attempt any two parts of the following   5x2=10

   (a) Determine the volumetric oxygen transfer coefficient (k_{La}) in bioreactor by using dynamic method.

   (b) Explain the working mechanism of Fuzzy Logic & ANN based controllers used in Bioreactors.

(c)   Citric acid manufacturing using submerged culture of Aspergillus niger in a batch reactor operated at 30 ^{0}C. Over a period of two days, 2500 kg glucose and 860 kg oxygen are consumed to produce 1500 kg citric acid, 500 kg biomass and other products. Ammonia is used as nitrogen source. Power input to the system by mechanical agitation of the broth is about 15 Kw; approximately 100 kg water is evaporated over the culture period. Estimate the cooling requirements.

———————