

2023

B.E. (Biotechnology) Sixth Semester
BIO-613: Bioreactor Design and Operation

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

1. Write briefly:

(1 × 10 = 10)

- a) Piezoelectric transducer is used for -----.
- b) What is downtime in a batch bioreaction?
- c) With decreasing pecllet number, the performance of sterilizer will -----.
- d) The riser and downcomer are separated by -----.
- e) What is the use of strain gauge in a bioreactor?
- f) Which one is best choice, stirred tank reactor or air-driven reactor for high viscosity culture?
- g) What is the expression of dilution rate in immobilized enzyme reaction?
- h) How light absorption is related to reactor depth in photobioreactor?
- i) Define total effectiveness factor for an enzymatic reaction.
- j) What is gas hold up?

SECTION-A

2. a) What will be batch bioreaction time of an enzymatic reaction considering the case of enzyme deactivation?
b) Compare between bubble column and air lift reactor.
(5, 5)
3. a) What are the important features of a membrane bioreactor?
b) How can we calculate light utilization in a photobioreactor?
(6, 4)
4. a) Determine the expression of reactor length in a continuous plug-flow tubular enzyme reactor where initial substrate concentration is S_i and outlet concentration of substrate is S_f . What will be the expression of residence time?
b) In a plug flow enzyme reactor the enzyme is immobilized in bed and packed into a 0.8 m^3 column. Total effectiveness factor is closed to unity; K_m for the enzyme is 1.42 Kg m^{-3} , V_{max} is $50 \text{ Kg m}^{-3}\text{h}^{-1}$. Substrate concentration in the feed stream is 10 Kg m^{-3} ; 98% substrate needs to be converted into product. The column is operated for 300 days in a year. Determine, i) Operating flow rate of the reactor, ii) If the molecular weight of the product is 220, how many tones of product is produced?
(5, 5)

(5, 5)

P.T.O.

(2)

SECTION-B

5. a) Explain various approaches for monitoring and control of pressure, flow rate and agitator shaft power.
b) What is the advantage of immobilized cell chemostat in comparison to suspended cells with respect to dilution rate?

(5, 5)

6. a) Design continuous sterilization equipments through flow diagram.
b) Mathematically express the importance of axial dispersion coefficient on the extent of cell destruction in a sterilizer.

(5, 5)

7. a) What are the automatic control systems available? Graphically explain the difference with brief discussion.
b) How RTD helps to understand kinetics of a non ideal reactor?

(5, 5)