

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2023

B.Tech-V Semester (BT/BI)

COURSE CODE (CREDITS): 18B11BT511 (04)

MAX. MARKS: 35

COURSE NAME: Bioprocess Engineering

COURSE INSTRUCTORS: Dr. Saurabh Bansal

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

[CO I]

1. a) What do you understand by steady state? Which mode of operation usually runs at steady state? [2]
- b) What is scale up? [1]
- c) Write the expression of impeller Reynolds' Number. [1]

[CO II]

2. In a bioprocess, a lot of foam is generated due to its medium composition, how will you deal with this issue of foam generation? [2]
3. How can you improve the K_{La} for better mass transfer in a fermentation? [2]

[CO III]

4. a) Calculate the doubling time of *E. coli* showing a specific growth rate 0.8 hr^{-1} . [1]
- b) How a chemostat is different from a fed-batch culture? [2]

[CO IV]

5. Differentiate between Dynamic & Static Gassing Out method. [2]
6. For a bioprocess require higher oxygen demand, which bioreactor from the following should be used and why: Bioreactor A with $K_{La} 0.3 \text{ sec}^{-1}$ or Bioreactor B with $K_{La} 0.8 \text{ sec}^{-1}$. Assume all other components in bioreactors are the same. [2]

[CO V]

7. Draw schematic diagram of a stirred tank bioreactor representing all its important parts. [2]

8. Which of following bioreactor is better and why? [4]
a) Fluidized Bed and Fixed Bed Bioreactor
b) Airlift Bioreactor and Bubble Column Bioreactor
9. Write down the main function of following in a bioreactor. [4]
a) Baffles b) Condenser c) Sparger d) Load Cell

[CO VI]

10. If the height-to-diameter ratio remains constant, how it will impact the surface-to-volume ratio during scale up? [2]
11. After a batch fermentation, the system is dismantled and approximately 75% of the cell mass is suspended in the liquid phase (2 L), while 25% is attached to the reactor walls and internals in a thick film. Work with radioactive tracers shows that 50% of the target product (intracellular) is associated with each cell fraction. The productivity of this reactor is 2 g product/L at the 2 L scale. What would be the productivity at 20,000 L scale if both reactors had a height-to-diameter ratio of 2 to 1? [4]
12. Consider the scale up of fermentation from a 10 L to 10,000 L vessel. The small fermenter has a height-to-diameter ration of 3. The impeller diameter is 30% of the tank diameter. Agitator speed is 600 RPM and three Rushton impellers are used.
a) Determine the dimensions of the large fermenter. [2]
b) Determine the agitator speed for constant impeller tip speed. [2]