

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2023

B.Tech.- V Semester (BT/BI)

**COURSE CODE (CREDITS):** 18B11BT511 (04)

**MAX. MARKS:** 25

**COURSE NAME:** Bioprocess Engineering

**COURSE INSTRUCTORS:** Dr. Saurabh Bansal

**MAX. TIME:** 1 Hour 30 Minutes

*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 II, III]

1. a) Why continuous sterilization is considered better over the batch sterilization for large scale fermentation processes? [1]
- b) Why sterilization is important in any bioprocess? [2]
- c) An industrial fermenter containing 10,000 L of medium needs to be sterilized. The initial spore concentration in the medium is  $10^7$  spores  $\text{mL}^{-1}$ . The desired probability of contamination after sterilization is  $10^{-3}$ . The death rate of spores at  $121^\circ\text{C}$  is  $5 \text{ min}^{-1}$ . Assume that there is no cell death during heating and cooling phases. Calculate the holding time of the sterilization process. [2]

[CO I]

2. Differentiate between
  - a) Sterilization and Disinfection [1]
  - b) Radial Flow and Axial Flow Impellers [2]

[CO IV, V]

3. a) What will happen if the baffle is not installed in a fermenter carrying low viscous fluid agitated at a higher speed? [1]
- b) List the equipments that help in mixing the fluid in a fermenter. [1]
- c) For animal cell culture which kind of impeller will you use and why? [2]
- d) For which kind of fluid, close clearance impellers (CCI) are used? Give two examples of CCI. [3]

[CO IV]

4. At the end of a batch culture, glucose solution is added at a flow rate of 400 ml/h. If the culture volume after 4 h of glucose addition is 3000 ml, then what would be the initial culture volume (in ml) in the fermenter? [2]
5. What do you understand by mass flux? [1]
6. Cells become metabolically disturbed if DO level drops below  $C_{crit}$ . In some cases, metabolic disturbance due to this may be advantageous. Whether this statement is correct? Justify your answer with suitable at least two examples. [3]
7. What is the significance of Kolmogorov scale? [1]
8. A fermentation broth with viscosity  $10^{-3}$  Pa s and density  $1000 \text{ kg m}^{-3}$  is agitated in a  $4 \text{ m}^3$  baffled tank using a Rushton turbine with diameter 0.5 m and stirrer speed  $1 \text{ s}^{-1}$ . Estimate the mixing time. [3]