JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION-2022

B.Tech-V Semester (BT/BI)

COURSE CODE (CREDITS): 18B11BT511(4)　　　　　　MAX. MARKS: 35

COURSE NAME: Bioprocess Engineering

COURSE INSTRUCTORS: Dr. Saurabh Bansal　　　　　　MAX. TIME: 2 Hours

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

[CO I]

Q1. a) What do you understand by growth-associated and non-growth-associated products? How are they different from each other in terms of their production?　　[2]

b) If you grow a culture on three different carbon sources, X, Y & Z, you obtain the yields after fermentation as 0.3 g/g, 0.8 g/g and 0.5 g/g. Which carbon source will you choose for setting up the fermentation and why?　　[2]

[COII]

Q2. How can you improve the mass transfer by dealing with the following factors:　　[3]

　　a) Volumetric mass transfer coefficient (K_La)

　　b) Using pure oxygen

Q3. How will you deal with foam-related issues while running a fermenter?　　[2]

[COIII, IV]

Q4. a) The insect cells in the active growth phase were seeded at a density of 1×10^5 cells/ml. After 72 hours, 1×10^6 cells/ml were obtained. Determine the population doubling time of the cells in hours.　　[2]

b) If the moist sterilization of the sample was carried out. If the k_d value of the spores is 1.0 min^{-1}, determine the time (in minutes) required to reduce the number of viable spores from an initial value of 10^{10} to a final value of 1.　　[2]

[COV]

Q5. Which bioreactor is better than the following: Justify your answer with the appropriate reasons.　　[6]

　　a) Airlift bioreactor (ALB) with an internal loop or ALB with an external loop

　　b) Airlift bioreactor with air-riser inside the draft tube or ALB with air-riser outside the draft tube

　　c) Fixed bed bioreactor or Fluidized bed bioreactor

Q6. What are the functions of following in a fermenter? [3]

   a) Load Cells   **b)** Headspace Volume   **c)** Baffles

Q7. a) What are the advantages of using immobilized cell bioreactors over free cell bioreactors? [2]

   b) Draw a self-explanatory schematic diagram of a continuous stirred tank bioreactor representing all its important components. [2]

[COVI]

Q8. a) What do you understand by bioprocess scale down? What is the importance of scale down? [2]

   b) The dimensions and operating condition of a lab-scale fermentor are as follows: Volume = 1 L Diameter = 20 cm Agitator speed = 600 rpm Ratio of impeller diameter to fermentor dia = 0.3. This fermentor needs to be scaled upto 8,000 L for a large-scale industrial application. If the scale-up is based on constant impeller tip speed, determine the agitator speed (rpm) in the larger reactor. Assume that the scale-up factor is the cube root of the ratio of fermentor volumes. [2]

Q9. A stirred-tank reactor is to be scaled down from 10 m^3 to 0.1 m^3. The dimensions of the large tank are: Dt = 2 m; Di = 0.5 m; N = 100 rpm. [3+2]

   a) Determine the dimensions of the small tank (Dt, Di, H) by using geometric similarity.

   b) What would be the required rotational speed of the impeller in the small tank if the constant impeller Reynolds number (N_{Re}) was used as scale up criteria?