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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- Oct 2017

B.Tech 5th Semester

COURSE CODE: 15B11BT511 **MAX. MARKS:** 25

COURSE NAME: Bioprocess Engineering

COURSE CREDITS: 04 **MAX. TIME:** 1:30 Hrs.

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

1. Define Mass flux. [1]

2. What is surface renewal theory? [1]

3. What are the different factors affecting the cellular oxygen demand? [2]

4. What do you understand by Kolmogorov scale? What is its significance? [2]

5. How do you explain the difference between the amount of electrical power consumed by the motor and the power dissipated by the stirrer? [2]

6. How a fed-batch culture is different from batch culture? [2]

7. How the solubility of oxygen get affected by the following factors: [3]

   a) Solutes **b)** Temperature **c)** Partial pressure of oxygen

8. A fermentation broth with viscosity 10^{-2} Pa s and density 1000 kg m^{-3} is agitated in a 2.7 m^3 baffled tank using a Rushton turbine with diameter 0.5 m and stirrer speed 1 s^{-1}. Estimate the mixing time. [3]

9. How will you determine the volumetric mass transfer coefficient using oxygen balance method? Elaborate the method in flow chart format. [4]

10. A genetically-engineered strain of yeast is cultured in a bioreactor at 30 °C for production of heterologous protein. The oxygen requirement is 80 mmol $l^{-1}h^{-1}$; the critical oxygen concentration is 0.004 mM. The solubility of oxygen in the fermentation broth is estimated to be 10% lower than in water due to solute effects.

    a) What is the minimum mass-transfer coefficient necessary to sustain this culture if the reactor is sparged with air at approximately 1 atm pressure? [3]

    b) What mass-transfer coefficient is required if pure oxygen is used instead of air? [2]