BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: BE **SEMESTER: VII**
BRANCH: BIOTECH **SESSION : MO/2019**

SUBJECT : BT7023 BIOREACTOR AND BIOPROCESS DESIGN

TIME: 1.5 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

Q1 (a) Define Reactor and Bioreactor with suitable example. [2]
(b) List the different components of a typical batch bioreactor. [3]

Q2 (a) Derive the performance equation of a MFR. [2]
(b) A fed batch culture was operated with intermittent addition of glucose solution at a flow rate of 200 ml/h. The values of Ks, μm and D, are 0.3 g/L, 0.4 h^{-1} and 0.1 h^{-1}, respectively. Determine the concentration of growth limiting substrate (g/L) in the reactor at quasi-steady state. [3]

Q3 (a) Name at least 2 bioreactors that you can use for animal cell culture. [2]
(b) Prove that in a chemostat, at steady state and for sterile feed, $\mu = D$. [3]

Q4 Consider the scale up of fermentation from a 10 L to 10,000 L vessel. The small fermenter has a height to diameter ratio of 3. The impeller diameter is 30% of the tank diameter. Agitator speed is 500 rpm and three impellers are used. Determine the dimensions of the large fermenter and agitator speed for constant P/V and constant impeller tip speed. [5]

Q5 (a) Write the mathematical expression of Monod chemostat model. [2]
(b) A chemostat is operated at a dilution rate of 0.6 h^{-1}. At steady state, the biomass concentration in the exit stream was found to be 30 g/L. Calculate the biomass productivity (g/L. h) after 3 h of steady state operation. [3]

Q6 (a) Write the importance of determining K_La. [2]
(b) Describe the dynamic method of determination of K_La for aerobic fermentation. [3]

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