

Code No: 54051

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B.Tech II Year II Semester Examinations, December - 2018****BIOPROCESS ENGINEERING****(Biotechnology)****Time: 3 hours****Max. Marks: 75****Answer any five questions****All questions carry equal marks**

- 1.a) Explain the various upstream and downstream unit operations involved in bioprocesses.
b) What are regulatory constraints? Explain about them with a special reference to bio processing. [7+8]
- 2.a) Discuss in detail the procedure for the calculations of material balance.
b) Distinguish extensive and intensive properties with suitable examples.
c) Explain the basic energy concepts. [8+3+4]
3. Estimate the theoretical growth and product yield coefficients for ethanol fermentation by *S.cerevisiae* as described by the following overall reaction
$$C_6H_{12}O_6 \rightarrow 2 C_2H_5OH + 2 CO_2$$

Where $y_{x/ATP} = 10.5$ gdw/mol ATP
Glycolysis yield = 2 mol ATP/ mol of glucose. [15]
- 4.a) What is enthalpy? Explain its calculation procedure for a system of your choice.
b) Explain in detail about energy changes due to reaction. [8+7]
5. Consider a 500 L CSTF in which biomass is being produced with glucose as the substrate. The microbial system follows a Monod relationship with $\mu_m = 0.45$ h⁻¹, $K_s = 2.0$ g/L and yield factor $y_{x/s} = 1.0$ g biomass / g substrate consumed. If normal operation is with a sterile feed containing 10g/L glucose at a rate of 50 L/h.
a) What is the specific biomass production rate g/L-h at steady state?
b) If recycle is used with a recycle stream of 10 L/h and a recycle biomass concentration is five times as large as that in the reactor exit, what would be the new specific biomass production rate? [7+8]
6. What is an engineered medium? Explain the factors to be considered for developing an engineered medium for cell growth and product formation. [15]
- 7.a) Explain the different phases of cell growth in a batch culture.
b) Write note on structured models for microbial growth. [8+7]
8. Derive the mathematical model for substrate and product inhibition on cell growth and product formation. [15]

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