



VIT
Vellore Institute of Technology
(Approved to the University under section 3 of UGC Act, 1956)

School of Bio Sciences and Technology

Fall Semester 2023-24

Continuous Assessment Test – II

SLOT E1+ TE1+E2+TE2

Programme Name & Branch: B.Tech, Biotechnology

Course Name & code: Principles of Bioprocess Engineering, BBIT301L

Class Number (s): VL2023240100122, VL2023240100124, VL2023240100125,
VL2023240100126, VL2023240100128

Faculty Name (s): Dr. Aanchal Mittal, Dr. Rohit, Dr. Sreeja S.

Exam Duration: 90 Min.

Maximum Marks: 50

General instruction(s):

Answer all the questions.

Q.No.	Question	Max Marks
1.	How can the mass balance equation be formulated for a limiting substrate in an enzyme-based batch reactor?	10
2.	a) A fermenter produces 80 Kg of lysine per day. If the volumetric productivity is 0.8 g/l/h, what is the volume of fermenter? The cell concentration is 10 g/l dry weight. Calculate the specific productivity also. (5 marks) b) How the substrate consumption rate can be expressed in terms of yield in a bioprocess? Specify the importance of each term in the expression. (5 marks)	10
3.	Consider a fermenter (5 m^3) running as chemostat with feed substrate concentration 10 Kg/m^3 . The microorganisms cultivated have following characteristics $\mu_m = 0.22 \text{ h}^{-1}$, $K_s = 0.4 \text{ Kg/m}^3$ $Y_{X/S} = 0.27 \text{ Kg Kg}^{-1}$. Calculate feed flow rate required for 90% substrate conversion. Calculate D_{opt} (D-Optimum) which can lead to maximum biomass productivity.	10
4.	Steady state biomass concentration in a chemostat is given by the equation $x = Y_{X/S} (S_0 - S)$. Prove that the biomass concentration increases by a factor of $1/(1+\alpha(1-C))$ when operated with cell recycle?	10
5.	<i>Pseudomonas</i> sp. is used for waste water treatment in a chemostat with volume 10 L. What is the steady state substrate and biomass concentration when the chemostat is operated at a flow rate of 3 L/h? The initial substrate concentration is 30 g/L, $\mu_m = 0.5 \text{ h}^{-1}$, $K_s = 1 \text{ g/L}$, $Y_{X/S} = 0.6 \text{ g/g}$.	10

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