

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS: M. TECH
BRANCH: BIOENGINEERING & BIOTECHNOLOGY

SEMESTER: 1st
SESSION: MO/25

SUBJECT: BE501: ADVANCED BIOPROCESS ENGINEERING

TIME: 3 hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

		CO	BL
Q.1(a) With diagram, explain any one method of enzyme immobilization.	[5]	1	3
(b) An enzyme preparation contains 5 mg/mL protein. The specific activity of enzyme is 20 units/mg proteins. Calculate the initial velocity of the reaction in a standard 1 mL reaction mixture containing 25 μ L of preparation.	[5]	1	5
Q.2(a) Describe five important media components in any bioprocess.	[5]	2	3
(b) Write Monod chemostat model for bacterial growth. Prove that in a chemostat at steady state and for sterile feed, $D = \mu$;	[5]	2	4
Q.3(a) Explain the different component of a batch bioreactor with a neat diagram.	[5]	3	3
(b) Describe the $K_L a$ determination using dynamic gassing out method. Draw a continuous steam injection process for industrial media sterilization using HTST.	[5]	3	4
Q.4(a) Describe the use, instrumentation and control of pH and Temperature sensor used in the Bioreactor.	[5]	4	3
(b) A fed-batch culture operates with the intermittent addition of glucose solution. The values of the following parameters are given at $t = 2$ h. Considering the system is at a quasi-steady state, calculate V_0 , S and X .	[5]	4	5
Given, $V = 1000$ mL; $S_0 = 100$ g/L; $K_s = 0.1$ g/L; $X_0 = 30$ g; $F = 200$ mL/h; $\mu_{max} = 0.3$ h ⁻¹ ; $Y_{x/s} = 0.5$ g/g.			
Q.5(a) With the help of a flow diagram, illustrate ethanol production process using lignocellulosic biomass.	[5]	5	3
(b) An organism is used in chemostat culture in a 50 m ³ fermenter. The feed contains 12 g/L glucose and μ_{max} and K_s of the organism is 0.3 h ⁻¹ and 0.2 g/L respectively. What flow rate is required for steady state substrate concentration to reach 1.5 g/L? What will be the cell density at that flow rate? $Y_{x/s} = 0.05$ g/g	[5]	5	5

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