QP Code: R252B067 | Reg. No | | | | | | | | | | | AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (Second Semester) Regular Examinations, July – 2025

24MCHPE12001 – Bioprocess Engineering

(Chemical Engineering)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

		CO #	Blooms Level
Q.1.	Answer ***ALL*** questions		
a.	What is a fed-batch culture? How is it different from batch culture in terms of biomass and product formation?	CO2	K1
b.	Sketch a simple diagram of a bubble column reactor and label its main components?	CO3	K1
c.	Define microbial oxygen demand. Why is it important in understanding microbial growth in a system?	CO3	K2
d.	How does temperature affect the K_La value in a bioreactor?	CO4	K1
e.	List and briefly describe any four methods used for immobilizing enzymes or cells.	CO4	K3

PART – B **(10 x 5=50 Marks)**

		Marks	CO #	Blooms Level
	Answer ***ALL*** the questions			
2. a.	Define standard free energy of formation in the context of biochemical reactions. Explain how the formation free energies of reactants and products determine the overall free energy change of a biological reaction.	5	CO1	K1
b.	Examine the thermodynamics of biological reactions where variation of reaction free energies for different electron donors and acceptors takes place	5	CO2	K2
	(OR)			
c.	Analyze the major Electron-Donor Half-Reactions of Glucose.	5	CO1	K1
d.	Aerobic oxidation of glucose is accompanied by microbial growth. NH4+ is used as the nitrogen source and the end products are CO2 and H2O. The formula for bacterial cell is $C_5H_7NO_2$.Determine the coefficients for this microbial conversion. Assume that 40% of total electrons are used for biosynthesis and 60% are used for energy generation.	5	CO2	K2
3.a.	Apply the Leudeking-Piret model to calculate product formation in a fermentation process when given biomass growth data and carbon source concentration.	5	CO2	K2
b.	Explain how product synthesis is linked to cell growth and energy metabolism in growth-associated and non-growth-associated kinetics.	5	CO2	K1
	(OR)			
c.	Compare and contrast the physiological and metabolic changes that occur during the different phases of microbial growth.	5	CO2	K2
d.	Formulate the Methods for Measurement of Cell Biomass and Cell Numbers for unicellular organisms.	5	CO3	K3
4.a.	Describe the flow patterns generated by radial and axial flow impellers in bioreactors.	5	CO3	K2

b.	Describe few Significant things of concern that should be taken into account while designing a fermenter**.**	5	CO4	K3
	(OR)			
c.	Justify the major advantages of the spiral heat exchanger .	5	CO3	K1
d.	Illustrate the design aspect of continuous sterilization processes a time period during which the medium is heated to the sterilization temperature, a holding time at the desired temperature, and a cooling period to restore the medium to the fermentation temperature.	5	CO4	K2
5.a.	Calculate biomass and product yield coefficients using given experimental data for substrate consumption and product formation.	5	CO2	K1
b.	Explain the resistance involved in transport of oxygen from a bubble to biochemical reaction site. Explain clearly the assumptions made and explain the importance of oxygen mass transfer determination for aerobic fermentation with suitable examples.	5	CO3	K2
	(OR)			
c.	Describe in detail the analysis of film and pore diffusion effects in enzyme immobilized in porous matrix.	5	CO2	K1
d.	How will you design the fluidized bed reactor for immobilized enzyme reaction?	5	CO4	K3
6.a.	Examine the thermodynamics of biological reactions where variation of reaction free energies for different electron donors and acceptors takes place	4	CO4	K1
b.	Calculate the Free-energy changes in bio reactions are calculated by using the formation free energies of products and reactants.	6	CO2	K2
	(OR)			
c.	Illustrate the role of bioprocess engineering in the production of bio fuels.	4	CO3	K1
d.	Describe how bioprocess engineering contributes to environmental protection.	6	CO4	K2

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