2023
FERMENTATION TECHNOLOGY

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer *any five* questions.

1.	a)	Write cell growth rate equation and draw cell growth curve and discuss different phase of growth.	2+5=7
	b)	What is doubling time?	2
	c)	How by graphical plot, maximum specific cell growth rate is calculated?	4
	d)	In microbial growth cycle, actually what metabolic reactions are carried on in lag phase?	3
	e)	What is maintenance coefficient?	4
2.	a)	What is Monode equation? Discuss with plot?	3+5=8
	b)	Why nutrient medium is required to sterilize before initiating fermentation? Mention required temperature and pressure for sterilization.	4+2=6
	c)	. For heat labile nutrient medium, what is the sterilization process?	3
	d)	For air to be supplied to fermenter how air is sterilized?	3
3.	a)	What is stoichiometry?	2
	b)	What is Batch culture? Discuss with plot.	5
	c)	What are the advantage and disadvantages of batch culture?	4
	d)	What is CSTR? How does this operational strategy overcomes the disadvantage of batch culture?	4+5
4.	a)	What is dilution rate in CSTR? . What is wash out point in CSTR?	3+2
	b)	Mention disadvantage of CSTR.	5
	a)	What is Fed batch culture? When Fed batch culture strategy is to be applied? What are the advantages of Fed batch?	4+4+2
5.	a)	What is plug flow reactor? How it is useful for immobilized enzyme conversion?	8

	b)	Why aeration and agitation is required in fermentation?	5
	c)	How oxygen is transferred from gas bubble to microbial cell in suspension culture?	4
	d)	Write SI Unit for diffusion coefficient, mass transfer coefficient and volumetric oxygen transfer coefficient.	3
6.	a)	Immobilized lactase is used to hydrolyse lactose in dairy waste to glucose and galactose. The enzyme is immobilized in resin and packed in to 0.5m 3 column. Km is 1.32 kg/m 3 and V Max is 45 kg/m 3 h. Lactose in feed stream 9.5 kg/m 3 and 98% substrate conversion is required. The column is operated under plug flow condition for 310 days/ year. Calculate At what flow rate should the reactor be operated? How many tonnes of glucose is produced per year?	10
	b)	a)An enzyme was assayed at initial substrate concentration 2x10 -5 moles. In 6 min, half of the substrate was used. Calculate K. K m is 5x10 -3 moles. Calculate V Max . Calculate the concentration of product produced after 15 min. What fraction of V_{Max} is observed at S=4K m ?	10
7.	a)	Find out the ratio of substrate concentration when the velocity of enzyme-substrate reaction is 90% of V_{Max} and 10 % of V_{Max}?	8
	b)	Yeast was cultured in CSTR. The medium flow rate was varied and steady state concentration of cell & glucose was measured and recorded in table. The inlet glucose concentration 100g/l. The reactor volume 500ml. The inlet medium stream is sterile.	12

Flow rate ml/hr	Cell concentration g/l	Substrate concentration g/l
31	5.97	0.5
50	5.94	1.0
71	5.88	2.0
91	5.76	4.0
200	0	100

Find the rate equation for cell growth.

What should be the range of flow rate to prevent wash out in CSTR?