GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

B. Tech Degree Examinations, November – 2021

(Seventh Semester)

BBTPC7010 – BIOREACTOR DESIGN AND ANALYSIS

(Biotechnology)

Time: 3 hrs Maximum: 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) **(2 x 10 = 20 Marks)**

Q.1. Answer *ALL* questions		[CO#]	[PO#]
a.	Unsteady state mass balance for dynamic model of continuous stirred tank reactor (CSTR) is	CO1	PO3
	(i) time rate of total amount in rector = rate of addition to reactor -rate of removal + rate of formation	(ii) total amount in rector = rate of addition to reactor – rate of removal + rate of formation	
	(iii) rate of total amount in rector = rate of addition to reactor – rate of removal + rate of formation	(iv) none of the above	
b.	A chemostat has a liquid volume of 2 litres and is being fed at a rate of 4 litres per hour. Dilution rate for this reactor will be	CO1	PO4
	(i) 2 litres	(ii) 2 litres per hour	
	(iii) 2 h-1	(iv) 4 litres per hour	
c.	Fluidized bed bioreactors provide higher mass transfer rates than packed bed bioreactors because	CO1	PO4
	(i) mixing is higher in fluidized bed bioreactors	(ii) particles move with the fluid in a fluidized bed bioreactor	
	(iii) immobilized particles are smaller in the fluidized bed bioreactors	(iv) all of the above	
d.	For organisms growing in a chemostat, the specific growth rate	CO2	PO4
	(i) cannot be determined	(ii) can be determined from the dilution rate	
	(iii) equals to the maximum specific growth rate of the culture	(iv) none of the above	
e.	In the rate equation, when the concentration of reactants is unity then the rate is equal to	CO2	PO3
	(i) specific rate constant	(ii) average rate constant	
	(iii) instantaneous rate constant	(iv) None of the above	
f.	The average rate and instantaneous rate of a reaction are equal	CO2	PO3
	(i) at the start	(ii) at the end	
	(iii) in the middle	(iv) when two rates have a time interval equal to zero	
g.	Which of the following(s) is/are non-mechanically agitated reactors?	CO3	PO5
	(i) Stirrer tank reactor	(ii) Bubble column	
	(iii) Air lift reactor	(iv) Both (ii) and (iii)	
h.	In a/an _____ vessel, the fluid enters and leaves following plug flow	CO3	PO5
	(i) Close-opened	(ii) Open-closed	
	(iii) Open	(iv) Closed	
i.	Most important characteristics of gas-liquid reactors are the:	CO4	PO3
	(i) Liquid hold up	(ii) Specific inter facial area	
	(iii) Gas hold up	(iv) None of these	

j. Variables affecting the rate of homogeneous reactions are: CO4 PO3

(i) Pressure and composition only (ii) Temperature and composition only

(iii) Pressure, temperature and composition (iv) Pressure and temperature only

PART – B: (Short Answer Questions) (2 x 10 = 20 Marks)

Q.2. Answer ***ALL*** questions		[CO#]	[PO#]
a.	Write down the rate equations for homogeneous .	CO1	PO3
b.	Differentiate between a fermenter and a chemical reactor.	CO1	PO4
c.	Describe the working principle of a batch reactor.	CO1	PO3
d.	Define residence time distribution?	CO2	PO4
e.	Differentiate between a bubble column and a membrane reactor.	CO2	PO4
f.	Enumerate the concept of multiphase bioreactors?	CO3	PO4
g.	Describe the working principle of packed bed reactor with reference to immobilized enzymes?	CO3	PO5
h.	Enumerate the working principle of off-line sensor?	CO4	PO4
i.	What is rheology?	CO4	PO4
j.	What do you understand by scale up?	CO4	PO4

PART – C: (Long Answer Questions) (15 x 4 = 60 Marks)

Answer ***ALL*** questions		Marks	[CO#]	[PO#]
3. a.	What are enzyme catalysed reactions.	5	CO1	PO5
b.	Explain briefly about the enzyme catalysed reactions in CSTRs .	10	CO1	PO5
	(OR)			
c.	Define chemical kinetics with an example?	5	CO1	PO4
d.	Explain the mass balance equation for CSTR.	10	CO1	PO3
4. a.	Explain about principle and operation of batch reactor.	10	CO2	PO3
b.	Discuss different applications of batch reactor.	5	CO2	PO4
	(OR)			
c.	Explain about principle and operation and application of fed batch reactor.	10	CO2	PO3
d.	Discuss different applications of fed batch reactor.	5	CO2	PO4
5. a.	Explain briefly the mass transfer phenomena of immobilized enzymes/cells in packed bed reactors.	10	CO3	PO4
b.	What are different advantages of using cells instead of immobilized enzymes in a reactor.	5	CO3	PO4
	(OR)			
c.	Explain the working principle of perfusion bioreactor.	8	CO3	PO4
d.	Explain the working principle of fluidized bed reactor.	7	CO3	PO4
6. a.	What do you mean by biosensors?	3	CO4	PO1
b.	Explain different types of biosensors along with their uses.	12	CO4	PO2
	(OR)		CO4	PO3
c.	Describe the scale up and scale down concept with reference to bioreactor design.	10	CO4	PO4
d.	Discuss benefits of scale and scale down process in terms of product formation.	5	CO4	PO6

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