



**M.TECH. DEGREE EXAMINATIONS: JAN 2015**

(Regulation 2014)

First Semester

**BIOTECHNOLOGY**

P14BTT106: Chemical Process Engineering

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. Raoult's law holds good for \_\_\_\_\_ solutions. [K<sub>2</sub>]  
a) Ideal and concentrated                      b) Ideal and dilute  
c) Non-ideal and dilute                      d) Non-ideal and concentrated
2. If fractional yield is 1, then the value of selectivity is [K<sub>3</sub>]  
a) 1    b) 0  
c) 0.5    d) 0.25
3. Consider the following statements: [K<sub>2</sub>]  
1. Reynolds number is used to provide knowledge on type of flow in pipes and ducts.  
2. Critical Reynolds number marks the upper boundary for laminar flow in pipes.  
3. Reynolds number calculation for pipes is same as that for impeller.
- The correct statements are:  
a) 1,2,3    b) 1,2  
c) 2,3    d) 1,3
4. Match the following: [K<sub>1</sub>]

<b>List I</b>	<b>List II</b>
A. Gases	1. Casson plastic
B. Paint	2. Newtonian
C. Quick sand	3. Dilatant
D. Orange juice	4. Pseudoplastic

Codes:

- a) A-2, B-4, C-3, D-1                      b) A-4, B-3, C-2, D-1  
c) A-1, B-2, C-3, D-4                      d) A-2, B-1, C-3, D-4

5. Consider the following modes of heat transfer: K<sub>4</sub>
1. Conduction
  2. Convection
  3. Radiation
- The correct sequence, in terms of their applications in bioprocessing, is
- a) 3,1,2    b) 1,2,3  
c) 2,3,1    d) 3,2,1
6. The following items consist of two statements, one labeled as the “Assertion (A)” and the other as “Reason (R). You are to examine those two statements carefully and select the answers to these items using the codes given below: [K<sub>5</sub>]
- Assertion (A) : Solid metals have higher thermal conductivity than gases.  
Reason (R) : Molecular arrangement in metals is not tight as that of in gases.
- Codes:
- a) both A and R are individually true but R is the correct explanation of A      b) both A and R are individually true but R is not the correct explanation of A  
c) A is true but R is false                      d) A is false but R is true
7. The basic equation for convective mass transfer is [K<sub>2</sub>]
- a)  $N_A = k_L a (C_{AL}^* - C_{AL})$                       b)  $N_A = k_L a (C_{AL} - C_{AL}^*)$   
c)  $N_A = k_L a (C_{AL}/C_{AL}^*)$                       d)  $N_A = k_L a (C_{AL}^*/C_{AL})$
8. \_\_\_\_\_ causes a range of reactor operating problems. [K<sub>6</sub>]
- a) Foaming    b) Antifoams  
c) Foam disperser                                      d) Foam control
9. In circular motion, the acceleration from the centrifugal force is [K<sub>2</sub>]
- a)  $r\omega^2$     b)  $r^2\omega^2$   
c)  $r^2\omega$     d)  $r^3\omega^2$
10. A typical laboratory filtration apparatus is \_\_\_\_\_ [K<sub>1</sub>]
- a) Filter paper    b) Separating funnel  
c) Buchner funnel    d) Conical funnel

**PART B (10 x 2 = 20 Marks)**

11. Write short notes on conversion. [K<sub>2</sub>]
12. Differentiate recycle and purge. [K<sub>3</sub>]
13. What is the objective of viscosity measurement in fluids? [K<sub>1</sub>]
14. List the importance of fluid dynamics in process engineering. [K<sub>4</sub>]
15. Give a brief account on radiation in bioprocessing. [K<sub>6</sub>]
16. Write the applications of shell-and-tube heat exchanger in food process engineering. [K<sub>5</sub>]
17. State Fick's first law of diffusion. [K<sub>1</sub>]
18. List the factors affecting cellular oxygen demand. [K<sub>2</sub>]
19. What are the purposes of agitation? [K<sub>1</sub>]
20. A centrifuge having a radius of the bowl of 1/3 ft is rotating at 1000 rpm. [K<sub>6</sub>]  
Calculate the centrifugal force developed in terms of gravitational force.

**PART C (6 x 5 = 30 Marks)**

21. Pure glucose is used for lactic acid production by *Lactobacillus delbrueckii*. [K<sub>2</sub>]  
Calculate the theoretical lactic acid production from 1 ton of glucose.
22. Classify fluids with suitable examples. [K<sub>4</sub>]
23. Give a brief account on heat-transfer configurations for bioreactors. [K<sub>1</sub>]  
(Diagrams not required)
24. A 20 L stirred fermenter containing *Bacillus spp.* Culture at 30°C is used for [K<sub>5</sub>]  
the production of microbial insecticide.  $k_L a$  is determined using the dynamic  
method.  $C_{AL}^* = 78\%$  air saturation. Calculate  $k_L a$  with the following results  
are obtained:

Time (s)	5	15
DO (% air saturation)	50	66

25. Explain the flow patterns in agitation. [K<sub>3</sub>]
26. An evaporator is used to concentrate cane sugar solution. A feed of 10 tpd of a solution containing 38% sugar is evaporated to a solution containing 74% sugar. Calculate the quantity of product. [K<sub>6</sub>]

**PART D (4 x 10 = 40 Marks)**

27. Elaborate on the construction and working of cone-and-plate viscometer. [K<sub>1</sub>]
28. Describe the construction and working of double pipe heat exchanger. [K<sub>1</sub>]
29. Explain the construction and working of rotary drum filter. [K<sub>1</sub>]
30. List the steps for oxygen transfer from gas bubble to cell. [K<sub>1</sub>]

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