

B.E./B.TECH. Degree Examination, December 2020

Fourth Semester

**BT16405 BIOPROCESS PRINCIPLES**

(Regulation 2016)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions

**PART A - (8 X 2 = 16 marks)**

1. Mechanical agitation is essential in \_\_\_\_\_
  - a) Packed bed
  - b) Airlift reactor
  - c) Stirred tank
  - d) Bubble column
2. The culture medium should not \_\_\_\_\_
  - a) Be sterilized
  - b) Be cheap and readily available
  - c) Contain desired products
  - d) Allow high yield of undesired products
3. What do you mean by “Axenic culture”?
  - a) Containing single type of organism
  - b) Containing two types of organism
  - c) Containing multiple types of organism
  - d) Not containing any type of organism
4. Estimate the degree of reduction of Methane, Glucose and Ethanol?
  - a)  $\gamma(\text{CH}_4) = 6, \gamma(\text{C}_6\text{H}_{12}\text{O}_6) = 4, \gamma(\text{C}_2\text{H}_5\text{OH}) = 6$
  - b)  $\gamma(\text{CH}_4) = 6, \gamma(\text{C}_6\text{H}_{12}\text{O}_6) = 4, \gamma(\text{C}_2\text{H}_5\text{OH}) = 8$
  - c)  $\gamma(\text{CH}_4) = 8, \gamma(\text{C}_6\text{H}_{12}\text{O}_6) = 4, \gamma(\text{C}_2\text{H}_5\text{OH}) = 6$
  - d)  $\gamma(\text{CH}_4) = 4, \gamma(\text{C}_6\text{H}_{12}\text{O}_6) = 6, \gamma(\text{C}_2\text{H}_5\text{OH}) = 8$
5. Why dissolved oxygen is an important parameter that has to be monitored in fermentation processes?
6. What are the Criteria for good medium for anaerobic culture?
7. How do you sterilize heat sensitive media?
8. Differentiate structure and unstructured model.

**PART B - (4 X16 = 64 marks)**

09. (a) Critically evaluate the requirements of fermentor meant for vaccine (16) production.

(OR)

(b) How do you control a biochemical reaction in a fermentor for high yield? (16)

10. (a) Design a media for unknown bacteria culture for high yield. (16)

(OR)

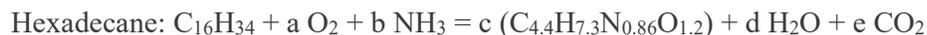
(b) What are the essentialities for design of various commercial media for industrial fermentations? Explain various medium optimization methods. (16)

11. (a) Differentiate batch and continuous heat sterilization of liquid media (16)

(OR)

(b) The temperature history of the heating and cooling of a 40,000-L tank during sterilization of medium is: 0 to 15 min,  $T = 85^{\circ}\text{C}$ ; 15 to 40 min,  $T = 121^{\circ}\text{C}$ ; 40 to 50 min,  $T = 85^{\circ}\text{C}$ ; 50 to 60 min,  $T = 55^{\circ}\text{C}$ ; > 60 min,  $T = 30^{\circ}\text{C}$ . The medium contains vitamins, the most fragile of the vitamins has activation energy for destruction of 10 kcal/g-mol, and the value of alpha is  $1 \times 10^4 \text{ min}^{-1}$ . Assume vitamin destruction is first order and the initial concentration is  $50 \text{ mg L}^{-1}$ .  $R$  is  $1.99 \text{ cal/g-mol-}^{\circ}\text{K}$ . The medium contains  $2.5 \times 10^3 \text{ spores/L}$ . The spores have an  $E_{0d} = 65 \text{ kcal/g-mol}$ , and  $k_d$  at  $121^{\circ}\text{C}$  is  $1.02 \text{ min}^{-1}$ . Estimate: (a) the probability of a successful sterilization, and (b) what fraction of the vitamin remains active? (16)

12. (a) Calculate the stoichiometric coefficients of the following biological reaction: (16)



(OR)

(b) A yeast ( $\text{CH}_{1.66}\text{N}_{0.13}\text{O}_{0.40}$ ) is growing aerobically on arabinose ( $\text{C}_5\text{H}_{10}\text{O}_5$ ) and ammonium hydroxide ( $\text{NH}_4\text{OH}$ ) with a respiratory quotient of 1.4. Estimate the stoichiometric coefficient of the equation:  
 $a\text{C}_5\text{H}_{10}\text{O}_5 + b\text{O}_2 + c\text{NH}_4\text{OH} \rightarrow \text{CH}_{1.66}\text{N}_{0.13}\text{O}_{0.40} + d\text{CO}_2 + e\text{H}_2\text{O}$  (16)