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Total No. of Pages : 02

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B.Tech.(BT) (2011 onwards) (Sem.–6)

FUNDAMENTALS OF BIOCHEMICAL ENGINEERING

Subject Code : BTBT-601

Paper ID : [A2283]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a) What are the advantages and the challenges in bio-process engineering?

b) What are the advantages and disadvantages of bioprocesses over conventional chemical processes?

c) What is the difference between aerobic and anaerobic fermentation?

d) Define decimal reduction time.

e) State four products obtained through fermentation.

f) Define 'yield factor' and 'yield coefficient'.

g) What are macro and micro-nutrients?

h) Contrast the advantages and disadvantages of chemically defined and complex media.

i) Explain the primary and secondary metabolites.

j) What are the different sterilization methods?

SECTION-B

2. Write short notes on (a) Anaerobic bioreactor and (b) Non-agitated bioreactors.

3. What are the environmental factors that affect growth kinetics? Explain.

4. Describe with a neat sketch an ideal fermentor for an aseptic process.

5. With the help of a neat flow sheet, explain the components of a typical fermentation process.

6. Describe the formulation of synthetic and complex media for cell cultures.

SECTION-C

7. a) How do you define specific growth rate? Prove that the specific growth rate, μ is related to mass doubling time t_d by $t_d = \dfrac{0.694}{\mu}$

   b) Discuss the purpose of aeration and agitation in fermentors.

8. a) During the batch sterilization of a liquid, normally carried out at 121 °C for 10 min, the control system showed a malfunction when the temperature reached 116 °C. Due to the malfunction, the temperature remained at 116 °C for 15 min before the fault was rectified. What new holding time at 121 °C will be required to ensure that the design criterion ∇ is maintained for this batch?

   Data given: at 116 °C, k = 0.605 and 121 °C, k = 1.83.

   b) How pH and dissolved oxygen concentration can be monitored and controlled in a fermentor? Outline the principle of equipment/ instrument used for this purpose.

9. a) Experimental work on the growth of a micro-organism shows that the critical dissolved oxygen concentration required to sustain growth is 0.022 m mol/L, and the oxygen utilization rate is 1.68×10^{-4} kmol/sm^3. Determine the required mass transfer coefficient for this process. At 30°C, Henry's constant for oxygen/broth is 4.75×10^4 atmospheres/mol fraction.

   b) What are the different mass transfer resistances for the transfer of oxygen from gaseous phase to liquid phase in an aerobic fermenter?