Reg. No. : | | | | | | | | | | |

R 3125

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Fifth Semester

Biotechnology

BT 1303 — BIOPROCESS PRINCIPLES

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between online and offline fermenters.

2. What are the different types of dissolved Oxygen probe?

3. What is crude medium?

4. What is the difference between complex and simple media?

5. What is meant by inactivation factor?

6. What is Del factor?

7. Define Yield Coefficient.

8. What do you understand from the value of K_s, Monod's constant?

9. Give two examples for growth inhibitors.

10. What is meant by product inhibition?

PART B — (5 × 16 = 80 marks)

11. (a) With suitable flow diagram, explain the steps involved in the fermentation process takes place in an alcohol manufacturing industry. (16)

Or

(b) Explain with neat diagram, the working principle of different types of sensors used in bioreactors to measure pH and Dissolved Oxygen? (16)

12. (a) Explain the procedure involved in the optimization of medium using Plackett Burman design and its significance. (16)

Or

(b) (i) Describe simple and complex media used with suitable examples. (8)

(ii) What are the characteristics of good medium? (8)

13. (a) A steam sterilizer is used to sterilize liquid medium for fermentation. The initial concentration of contaminating organisms is 10^8 per litre. For design purposes, the final acceptable level of contamination is usually taken to be 10^{-3} cells; this corresponds to a risk that one batch in a thousand will remain contaminated even after the sterilization process is complete. For how long should 1 m^3 medium be treated if the temperature is (i) 80°C (ii) 121°C (iii) 140°C. For these spores the activation energy for thermal death is 283 kJ/gmol and the Arrhenius constant is $10^{36.2}$ s^{-1}. (16)

Or

(b) (i) Explain the thermal death kinetics of microorganisms. (8)

(ii) Explain the different methods used in sterilization of liquid media and air. (8)

14. (a) The chemical reaction equation for conversion of ethanol (C_2H_6O) to acetic acid ($C_2H_4O_2$) is : $C_2H_6O + O_2 \rightarrow C_2H_4O_2 + H_2O$. Acetic acid is produced from ethanol during growth of *Acetobacter aceti*, which has the composition $CH_{1.8}O_{0.5}N_{0.2}$. Biomass yield from substrate is 0.14 $g.g.^{-1}$; production yield from substrate is 0.92 $g.g^{-1}$. Ammonia is used as nitrogen source. How does growth in this culture affect oxygen demand for acetic acid production? (16)

Or

(b) (i) Write notes on thermodynamics of cell growth. (8)

(ii) What is maintenance coefficient and explain its role in energetic analysis of microbial growth kinetics? (8)

15. (a) (i) Describe the substrate limited and product inhibited cell growth. (8)

(ii) Explain the concept of structured models. (8)

Or

(b) (i) Find the maximum specific growth (μ_m) and Monod constant (K_s), following the literalized Monod equation procedure using the data given in the table given below for the growth of *Saccharomyces cerevisiae*, on glucose in a 20 L fermenter. The cell growth is reasonably represented by Monod growth kinetics. (8)

Substrate (g/L)	10	5	3.3	2.25	2.0	1.7	1.4
$\mu, (h-1)$	0.4	0.36	0.3	0.27	0.25	0.22	0.2

(ii) Discuss the advantages and disadvantages of batch, fed-batch and continuous cultivation of cells. (8)