B 410

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Fourth Semester

Industrial Biotechnology

IB 244 — BIOPROCESS PRINCIPLES

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the various operations involved in down stream processing.

2. Name any four parameters that are used in the monitoring of fermentation process.

3. What are the applications of solid-substrate fermentation?

4. Distinguish the complex and simple media.

5. Define Damkohler number.

6. Define yield co-efficient.

7. What is meant by the term Respiratory Quotient?

8. Calculate the degree of freedom for the substrates

   (a) Ethanol

   (b) Glucose.

9. Classify the microorganisms based on the temperature.

10. Write short notes on product inhibition.

PART B — (5 × 16 = 80 marks)

11. Aerobic degradation of benzoic acid by a mixed culture of micro-organisms can be represented by $C_6H_5CooH + a\,O_2 + b\,NH_3 \rightarrow c\,C_5H_7\,NO_2 + d\,H_2O + e\,CO_2$

   (i) Determine a, b, c, d and e if RQ = 0.9 (8)

   (ii) Determine the yield co-efficient $Y_{x/s}$ and $Y_{x/O2}$ (4)

   (iii) Determine degree of reduction of substrate and bacteria. (4)

12. (a) Explain with neat sketch the various types of fermentors and its applications. (16)

Or

(b) (i) Determine the amount of $(NH_4)_2SO_4$ to be supplied in a fermentation medium where the final cell concentration is 30 g/l in a 10^3 lit culture volume. Assume that the cells are 12% N_2 by weight and $(NH_4)_2SO_4$ is the only nitrogen source. (10)

(ii) What are the basic components of fermentation process? (6)

13. (a) Explain the various immobilization techniques, its advantages and disadvantages.

Or

(b) The specific growth rate for inhibited growth in a chemostat is given by the following equation.

$$\mu_g = \mu_m S/(K_s + S + lK_s/K_l)$$

Where $S_o = 10\,g/l, X_o = 0$

$$K_s = 1\,g/l, K_l = 0.01\,g/l$$

$$l = 0.05\,g/l,\ \mu_m = 0.5\,\mu^{-1}$$

$$Y^{\mu}_{X/S} = 0.1\,g\ cells/g\ \text{sub};\ K_d = 0$$

(i) Determine X and S as a function of D when $l = 0$ (4)

(ii) With inhibitor added to a chemostat, determine the effluent substrate concentration and X as a function of D. (8)

(iii) Determine the cell productivity, DX, as a function of dilution rate. (4)

14. (a) (i) Discuss the kinetics of growth inhibitors. (8)

(ii) Explain in detail the nutrients required for the growth of microorganisms. (8)

Or

(b) Ethanol formation from glucose is accomplished in a batch culture of Saccharomyces cerevisiae, and the following data were obtained.

Time (h)	Glucose (s)	Biomass (x)	Ethanol (P)
	g/l	*g/l*	*g/l*
0	100	0.5	0.0
2	95	1.0	2.5
5	85	2.1	7.5
10	58	4.8	20.0
15	30	7.7	34.0
20	12	9.6	43.0
25	5	10.4	47.5
30	2	10.7	49.0

(i) By fitting the business data to the logistic equation, determine the carrying capacity co-efficient k.

(ii) Determine yield co-efficient $Y_{P/S}$ and $Y_{X/S}$.

15. (a) Discuss any four major development in the historical development of biotechnology, indicating how new things became possible.

Or

(b) Compare and contrast design of media for plant and animal cell culture.
