

B.TECH. DEGREE EXAMINATIONS: NOVEMBER 2009

Fifth Semester

BIOTECHNOLOGY

U07BT503: Bioprocess Principles

Time: Three Hours

Maximum Marks: 100

Answer ALL the Questions:-

PART A (10 × 1 = 10 Marks)

1. According to Gaden's classification of fermentation, citric acid is produced by the relationship of
 - a) Product formation directly related to carbohydrate utilization
 - b) Product formation indirectly related to carbohydrate utilization
 - c) Product formation apparently not associated with carbohydrate utilization
 - d) Product formation apparently associated with carbohydrate utilization

2. Baffles are incorporated in the agitated vessel
 - a) To prevent vortex and improve aeration efficiency
 - b) To improve vortex and improve aeration efficiency
 - c) To prevent vortex and reduce aeration efficiency
 - d) To improve vortex and minimize the air flow rate.

3. Antifoams are surface active agents,
 - a) Reduce surface tension and stabilize protein film
 - b) Reduce surface tension and destabilize protein film
 - c) Increase surface tension and destabilize protein film
 - d) Increase surface tension stabilize protein film

4. Phenylacetic acid is a/an ----- in penicillin production
 - a) Inducer
 - b) Precursor
 - c) Buffers
 - d) Chelators

5. In an air sterilization the collection efficiency of a fibrous filter by impaction is
 - a) $f(N_{st}, N_{Re})$
 - b) $f(N_{Pr}, N_{Re})$
 - c) $f(N_{st}, N_{Pr})$
 - d) $f(N_{Re}, N_{Pr})$

6. A sterilization was carried out at overall del factor 38.7. Del factors of heating and cooling are 7.9 and 8.5 respectively. The specific death rate of a specific organism is 3.15min^{-1} at 121°C . Find out the holding time.
 - a) 5.07 min
 - b) 7.07 min
 - c) 9.07 min
 - d) 11.07 min

7. Respiratory quotient is

- a) CO_2/O_2 b) N_2/CO_2 c) O_2/CO_2 d) N_2/O_2

8. The degree of reduction for methane and Glucose is

- a) 0.8 & 4 b) 8 & 0.4 c) 0.8 & 0.4 d) 8 & 4

9. Determine the concentration of growth limiting substrate in the vessel at quasi steady state, when the initial volume V is 1 lit at time t is 2 h and the flow rate is 200ml / h, K_s and specific growth rate is 0.1 g glucose/l and 0.3 h^{-1} respectively.

- a) 20 g glucose /l b) 2 g glucose /l c) 0.20 g glucose /l d) 0.020 g glucose /l

10. In a microbial growth curve the trophophase and idiophase falls in the order of

- a) Ist & Zeroth b) Zeroth and Ist c) Ist & IInd d) IInd & Zeroth

PART B (10 x 2 = 20 Marks)

11. Mention various commercial importances of fermentation products.

12. Define Deindoerfer's classification of fermentation

13. Mention the various criteria for media selection.

14. What is Osmolality in cell culture?

15. Define thermal death kinetics.

16. Mention the various methods of batch sterilization and write the equation for finding the Del factor in an isothermal heat source.

17. Define apparent growth yield

18. What is the degree of reduction of carbon in CO_2 and nitrogen in ammonia?

19. A culture contains 6.4×10^{12} cells. After 4 hours and 30 minutes the cell number is being reduced to 1.6×10^6 cells. Find out the endogenous metabolism rate constant.

20. *E.coli* is cultivated in continuous culture under aerobic conditions with the glucose limitations. When the system is operated at $D=0.2 \text{ hr}^{-1}$. Determine the effluent glucose and biomass concentration by using the following data

$$S_0=5\text{g/l} \quad \mu=0.25 \text{ h}^{-1} \quad K_s=100\text{mg/l} \quad Y^m_{x/s}=0.4\text{gX/gS}$$

PART C (5 x 14 = 70 Marks)

21(a) Explain the general requirement and classification of fermentation of processes.

(OR)

(b) Explain the Basic function and configuration of a fermentor

22(a) Explain the various Carbon, Nitrogen, minerals and Vitamins requirements for media formulation.

(OR)

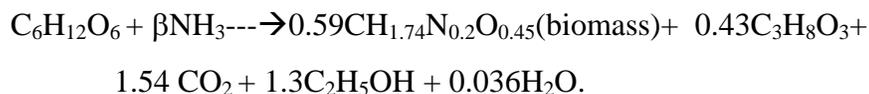
(b) Explain the Media optimization by plackett-Burman method with suitable example for 12 experimental run.

23(a) Derive an equation for designing a filter bed, packed with non absorbent glass wool for an air sterilization.

(OR)

(b) Explain various methods of Batch and Continuous sterilization of liquid media.

24(a) The growth of *S.cerevisiae* on glucose under anaerobic conditions can be described by the following overall reaction:



(i) Determine the biomass yield coefficient $Y_{X/S}$

(ii) Determine the product yield coefficients $Y_{\text{EtOH}/S}$, $Y_{\text{CO}_2/S}$, $Y_{\text{C}_3\text{H}_8\text{O}_3/S}$.

(iii) Determine the coefficient β .

(OR)

(b) Aerobic degradation of an organic compound by a mixed culture of organisms in waster water can be represented by the following reaction



i) Determine a, b, c and d e, if $Y_{X/S}=0.4\text{ gX/g S}$

ii) Determine the yield coefficient Y_{X/O_2} and Y_{X/NH_3}

iii) Determine the degree of reduction for the substrate, bacteria and RQ for the organisms.

25(a) Derive an equation for finding the optimum dilution rate for a chemostat and write its substrate and cell balance.

(OR)

(b) Calculate the productivity (i.e., DP) of a chemostat under the following conditions:

1. Assume Monod Kinetics apply. Assume that negligible amounts of biomass must be converted to product (< 1%)
2. Assume the Leudeking- pired equation for product formation.
3. Assume steady state:

$$D=0.8\mu_m$$

$$\mu_m=1.0 \text{ h}^{-1}$$

$$K_s = 10 \text{ mg/l}$$

$$\alpha = 0.4 \text{ mg P/g X}$$

$$Y^M_{X/S} = 0.5 \text{ g X/g S}$$

$$S_0 = 1000 \text{ mg/l}$$

$$\beta = 0.5 \text{ h}^{-1} \text{ mg P/g X}$$
