Register Number.....

M.TECH. DEGREE EXAMINATIONS: DECEMBER 2009

First Semester

BIOTECHNOLOGY

BTY 504: Biochemical Engineering and Fermentation Technology

Time: Three Hours **Maximum Marks: 100**

Answer All the Questions:-

PART A (10 x 2 = 20 Marks)

1. Give the principle of dissolved oxygen probe
2. What do you mean by upstream and downstream bioprocessing?
3. Fifteen grams of *Bacillus subtilis* biomass is produced from 40 grams of glucose. No other product is formed, calculate the yield coefficient.
4. Calculate the maximum biomass that can be supported in a batch fermenter with 7.0 g/L of fructose substrate, if $Y_{x/s}$ = 0.42 g biomass / g substrate.
5. Under what circumstances a defined media is preferred instead of a complex medium for fermentation?
6. Usually inorganic phosphate is incorporated in the medium for fermentation processes. What are roles of inorganic phosphate?
7. Why do we maintain $\mu = D$ in continuous cultures?
8. Name the three different types of fed-batch cultures
9. Corn steep liquor enhances the production of penicillin – justify the statement
10. Draw the general structure of a steroid

PART B (5 x 16 = 80 Marks)

11. (a) (i) What are the different configurations of spargers, baffles, and agitators used in fermenters? (10)

(ii) Write the important milestones in fermentation technology in 20th century. (6)

(OR)

(b) (i) What are the different chemical parameters to be monitored and controlled in fermentation processes? (10)

(ii) Draw the figures for the different configurations of fermenters. (6)

12. (a) (i) Write in detail about degree of reduction of substrate and biomass. (8)

(ii) Write notes on thermodynamic efficiency of growth. (8)

(OR)

(b) (i) Assume that experimental measurements for a certain organism have shown that cells can convert two-thirds (wt/wt) of the substrate carbon (hexdecane or glucose) to biomass:

1. Calculate the stoichiometric coefficients for the following biological reactions: (7)

Hexane: $C_{16}H_{34} + a\ O_2 + b\ NH_3 \rightarrow c\ (C_{4.4}H_{7.3}N_{0.86}O_{1.2}) + d\ H_2O + e\ CO_2$

Glucose: $C_6H_{12}O_6 + a\ O_2 + b\ NH_3 \rightarrow c\ (C_{4.4}H_{7.3}N_{0.86}O_{1.2}) + d\ H_2O + e\ CO_2$

2. Calculate the yield coefficients $Y_{X/S}$ (g dw cell/g substrate), $Y_{X/02}$ (g dw cell/g O_2) for both reactions. Comment on the differences. (5)

(ii) What is available electron balances in stoichiometry? (4)

13. (a) (i) What is the role of sulfur, iron, magnesium and copper in growth medium. (8)

(ii) Write notes on oxygen requirements for fermentation process. (8)

(OR)

(b) (i) Describe the criteria for good medium. (8)

(ii) Explain response surface methodology of medium design. (8)

14. (a) (i) Describe unstructured kinetic models for microbial growth. (10)

(ii) Write notes on growth of filamentous organisms. (6)

(OR)

(b) (i) Describe different types of fed-batch cultures and their applications. (12)

(ii) Write notes on mixed-growth-associated product formation kinetics. (4)

15. (a) (i) Describe the method of production of cephalosporin. (14)

(ii) How are monoclonal antibodies used as therapeutic agents? (2)

(OR)

(b) (i) Describe the biotransformation of steroids (8)

(ii) Discuss about the production of extra cellular fungal amylase with a flow chart. (8)

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