

Code No: R09222305

R09**Set No. 2**

II B.Tech II Semester Examinations, APRIL 2011
BIOPROCESS ENGINEERING
Bio-Technology

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
 All Questions carry equal marks

1. Write short notes on:
 - (a) Maximum Biomass Yield.
 - (b) Product stoichiometry. [7+8]
2. Give summary of some of the important parameters, Phenomena and interactions which determine cell population kinetics. What are primary and secondary metabolites with suitable examples? [15]
3. Compare and contrast a batch bioreactor and continuous bioreactor. Mention the relative advantages and disadvantages of each. [15]
4. Write short notes on the following:
 - (a) inhibitors added to media
 - (b) restricted nutrient levels in media [7+8]
5. What do you mean by upstream and downstream process? Explain various unit operations involved in them. [15]
6. Determine standard heats of reaction from heats of combustion. [15]
7. Steam output of boiler is measured by measuring feed water. The tank level reading from 8.00 a.m. to 8.00 p.m. was 600 m³. Continuous blow down was given at 1% of the boiler feed rate during the above period. Find out the average actual steam delivered per hour? [15]
8. The growth of bakers yeast (*S. cerevisiae*) on glucose may be simply described by the following equation:

$$C_6H_{12}O_6 + 3O_2 + 0.48NH_3 \rightarrow 0.48C_6H_{10}NO_3 + 4.32H_2O + 3.12CO_2$$
 In a batch reactor of volume 10 l, the final desired concentration is 50gdw/l. Using the above reaction stoichiometry:
 - (a) Determine the concentration and total amount of glucose in the nutrient medium
 - (b) Determine the yield coefficients $Y_{X/S}$ (biomass/glucose) and Y_{X/O_2} (biomass/oxygen) [15]

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R09**Set No. 4**

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Answer any FIVE Questions
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1. Write about heat evaluation in aerobic cultures. [15]
2. Write short notes on:
 - (a) Total balance
 - (b) Component balances. [7+8]
3. Discuss in detail the requirement for growth and formulation of media. [15]
4. Write short notes on:
 - (a) Degree of reduction
 - (b) Elemental balances. [7+8]
5. Write about simple unstructured model for microbial growth. [15]
6. Outline the various steps involved in integrated Bioprocess. [15]
7. Fumaric acid is produced from mallic acid using the enzyme, fumarase. Calculate the standard heat of reaction for the following enzyme transformation;
$$C_4H_6O_5 \rightarrow C_4H_4O_4 + H_2O$$

(Mallic acid \rightarrow Fumaric acid + water) [15]
8. Write a brief note on biosensors, and describe how they are used for measuring process parameters. [15]

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R09**Set No. 1**

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1. Why should we do energetic analysis? What is Gibbs energy balance for a growing cell. [15]
2. What is bioreactor and write about the basic functions of a bioreactor for microbial or animal cell culture? [15]
3. Write shorts note on:
 - (a) Reference states
 - (b) State properties [7+8]
4. Write Material balance equations for unsteady state. [15]
5. Write in detail about growth of filamentous organisms. [15]
6. What factors do you consider as essential for a successful design of fermenter and the various parameters that need to be controlled for successful operation of fermenter. [15]
7. Aerobic degradation of benzoic acid by a mixed culture of microorganisms can be represented by the following reaction

$$C_6H_5COOH(\text{substrate}) + aO_2 + bNH_3 \rightarrow cC_5H_7NO_2(\text{bacteria}) + dH_2O + eCO_2$$
 Determine the coefficients a, b, c, d and e where RQ = 0.9. [15]
8. How the addition of precursors, inhibitors and inducers to the medium help regulate the fermentation process? [15]

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R09**Set No. 3**

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Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
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1. Explain energy balance equations. [15]
2. Write short notes on the following:
 - (a) Factors influencing the choice of nitrogen source.
 - (b) Media formulation. [7+8]
3. Explain aerobic and anaerobic metabolism with respect to energetics. [15]
4. Explain the following:
 - (a) Basic differences between fermentation and chemical reaction.
 - (b) Basic components of a biotechnological process line. [8+7]
5. Assume that experimental measurements for a certain organism have shown that cells can convert two-thirds (wt/wt) of the substrate carbon (alkane) to biomass. Calculate the stoichiometric coefficients for the following biological reaction:
 Hexadecane: $C_{16}H_{34} + aCO_2 + bNH_3 \rightarrow c(C_{4.4}H_{7.3}N_{0.86}O_{1.2}) + dH_2O + eCO_2$ [15]
6. Explain Material balance equations for recycle, bypass and purge streams. [15]
7. Explain substrate and product inhibitions analyses. [15]
8. Describe various physical process parameters that need to be controlled in a fermentation process. Explain them briefly. [15]
