

Code No: R09222305

R09

Set No. 2

II B.Tech II Semester Examinations, April/May 2012
BIOPROCESS ENGINEERING
Bio-Technology

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. What is the purpose of material balance calculations? Write about elemental balance? [15]
2. Discuss about "Fermentation products - Future trends". [15]
3. Write short notes on
 - (a) Heat of reaction with oxygen not the electron acceptor
 - (b) Energy balance equation for cell culture. [10+5]
4. 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]
5. How the nitrogen requirements of an industrial fermentation medium are met? Describe with examples. [15]
6. Assume that experimental measurements for a certain organism have shown that cells can convert two-thirds (wt/wt) of the substrate carbon (glucose) to biomass. Calculate the stoichiometric coefficients for the following biological reaction:
Glucose : $C_6H_{12}O_6 + aO_2 + bNH_3 \rightarrow c(C_{4.4}H_{7.3}N_{0.86}O_{1.2}) + dH_2O + eCO_2$ [15]
7. (a) A bacteria is doubling in every thirty minutes, find out its specific growth rate assuming first order growth kinetics.
(b) Derive Monod model from Konak model. [5+10]
8. A textile dryer is found to consume $4 \text{ m}^3/\text{hr}$ of natural gas with a calorific value of 800 kJ/mole . If the throughput of the dryer is 60 kg of wet cloth per hour, drying it from 55% moisture to 10% moisture, estimate the overall thermal efficiency of the dryer taking into account the latent heat of evaporation only. [15]

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1. Write differences between aerobic and anaerobic fermentation process What are the various types of bioreactors? [15]
2. Explain growth pattern and kinetics in a batch culture. [15]
3. What is thermodynamic efficiency of growth? Write energy balance equation for cell culture. [15]
4. Estimate the theoretical growth and product yield coefficients for ethanol fermentation by *S.cerevisiae* as described by the overall following reaction:
$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$
 [15]
5. What do you mean by upstream and downstream process? Explain various unit operations involved in them. [15]
6. How can we calculate energy balance calculations for biological systems with and without reactions? [15]
7. (a) How the minerals requirements of an industrial fermentation medium are met? Describe with examples.
(b) What are various nutrients required in the formulation of an industrial medium, and how they are met? [8+7]
8. Corn steep liquor contains 2.5% invert sugars and 50% water. The rest of the feed is considered as residual solids. Beet molasses containing 50% sucrose, 1% invert sugar, 18% water and remainder solids are mixed with corn steep liquor in a mixing tank. Water is added to produce a diluted mixture with 2% invert sugar, 125 kg corn steep liquor and 45 kg molasses, which is fed into an enzymatic hydrolysis tank.
(a) How much water is required?
(b) What is the concentration of sucrose in the final mixture? [7+8]

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R09

Set No. 1

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BIOPROCESS ENGINEERING
Bio-Technology

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks

1. Write different perspectives for cell population kinetic representations. [15]
2. Write a note on solid - state and submerged fermentation processes. [15]
3. Explain the following:
 - (a) Elemental balances
 - (b) Available electron balances
 - (c) Maintenance coefficient. [5+5+5]
4. Explain the following:
 - (a) Elemental balances
 - (b) Available electron balances
 - (c) Maintenance coefficient. [5+5+5]
5. How can we calculate the standard heats of reaction for heats of combustion? Explain in detail. [15]
6. Determine standard heats of reaction from heats of combustion. [15]
7. How the addition of precursors, inhibitors and inducers to the medium help regulate the fermentation process? [15]
8. Explain how down stream processing steps decide economic feasibility of the product. [15]

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1. Explain aerobic and anaerobic metabolism with respect to energetics. [15]
2. What is the role of a bioprocess engineer in biotechnology industry? [15]
3. How will you design and optimize media requirements for the industrial fermentation process? [15]
4. Explain the Method for Preparing Process Flow Chart. [15]
5. Write about yield coefficients of biomass and product formation. [15]
6. Write short notes on:
 - (a) Heat of reaction with oxygen as electron acceptor.
 - (b) Heat of reaction with oxygen not the principle electron acceptor. [7+8]
7. What are the aerobic and anaerobic reactions? What is diffusion in bioprocess? [15]
8. A strain of mold was grown in batch culture on glucose and the following data were obtained.

Time(h)	Cell conc.(g/l)	Glucose conc.(g/l)
0	1.25	100
9	2.45	97
16	5.1	90.4
23	10.5	76.9
30	22	48.1
34	33	20.6
36	37.5	9.38
40	41	0.63

- (a) Calculate the maximum net specific growth rate
- (b) Calculate the apparent growth yield
- (c) What maximum cell concentration could one expect if 150g of glucose were used with the same size inoculums? [15]
