



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 154754

Roll No.

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B. Tech.

(SEM. VII) (ODD SEM.) THEORY
EXAMINATION, 2014-15

BIOPROCESS ENGINEERING – II

Time : 3 Hours]

[Total Marks : 100

Note: Attempt all questions.

1. Attempt any two parts of the following: **10x2=20**
- (a) Do following conversion
- (i) 5 miles/min to meter/sec
 - (ii) 30 mmol l⁻¹ of glucose to g l⁻¹
 - (iii) 3 kg/m³ to lb/m³
 - (iv) 0.60 quarts to ml
 - (v) -19.7°Celsius to °Kelvin
- (b) Write short notes on :
- (i) Presentation of experimental data
 - (ii) Methods of experimental data analysis
- (c) Define following measurement conventions
- (i) Temperature
 - (ii) Density and Specific gravity

2. Attempt any two parts of the following: **10x2=20**

- (a) Explain the following
- (i) Law of conservation of mass and types of material balance
 - (ii) Material balances with recycle, by-pass and purge streams.
- (b) Corn-steep liquor contains 2.5 % invert sugars and 50% water; the rest can be considered solids. Beet molasses containing 50% sucrose, 1% invert sugars, 18% water and the remainder solids, is mixed with corn-steep liquor in a mixing tank. Water is added to produce a diluted sugar mixture containing 2% (w/w) invert, sugars. 125 kg corn-steep liquor and 45 kg molasses are fed into the tank.
- (a) How much water is required?
 - (b) What is the concentration of sucrose in the final mixture?
- (c) Define Biomass yield, product yield, Theoretical oxygen demand and Maximum possible yield for the stoichiometry of cell growth and product formation.

3. Attempt any two parts of the following: **10x2=20**

- (a) Explain the design and configuration of a stirred tank bioreactor. What are the alternatives to stirred reactors which involved no mechanical agitation?
- (b) Under ideal reactor operation condition discuss the continuous operation of a plug flow reactor in detail.

(c) Immobilised lactase is used to hydrolyse lactose in dairy waste to glucose and galactose. Enzyme is immobilised in resin particles and packed into a 0.5m^3 column. The total effectiveness factor for the system is close to unity; K_m for the immobilised enzyme is 1.32 k m^{-3} and V_{max} is $45\text{ kg m}^{-3}\text{ h}^{-1}$. The lactose concentration in the feed stream is 9.5 kg m^{-3} . A substrate conversion of 98% is required. The column is operated with plug flow for a total of 310 days per year.

- (a) At what flow rate should the reactor be operated?
- (b) How many tonnes of glucose are produced per year?

4. Attempt any two parts of the following: **10x2=20**

- (a) Discuss the method of mixing operation performed in a bioreactor. How do we determine the mixing time in agitated tanks.
- (b) What are the different models for non-ideal flow reactors? Discuss with suitable diagram.
- (c) Explain in detail the different practical considerations involved in bioreactor construction.

5. Attempt any two parts of the following: **10x2=20**

- (a) Discuss the general aspects and the major difficulties arise during the scale up of industrial bioreactors. What are the basic criteria and principles of scale-up of bioreactors?

- (b) How Physical, Chemical and Biological processes are being control in industrial scale Bioreactor? Discuss the different instruments used in the measurement of temperature, pressure and foam in a bioreactor.
- (c) What is a fuzzy logic control system? Discuss the working principle of Proportional, Integral and Derivative controllers used in bioprocess control.
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