Printed Pages : 3

EBT-042

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

PAPER ID : 154754

Roll No.

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 1^{-1} of glucose to g 1^{-1}

(iii) 3 kg/m^3 to lb/m^3

(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 kg m^{-3} 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.