Total number of printed pages–3

53 (FPT 712) FMTC

2021

(Held in 2022)

FERMENTATION TECHNOLOGY

Paper : FPT 712

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. What is stoichiometry ? Write a stoichiometric equation for cell growth and discuss all coefficients. What is theoretical oxygen demand ? What is biomass and product yield ? Draw a schematic diagram of a fermenter and mention all accessories and how control unit works. 3+5+2+4+6=20

2. Write cell growth rate equation and draw cell growth curve and discuss different phase of growth. What is doubling time ? How by graphical plot, maximum specific cell growth rate is calculated ? 10+4+6=20

Contd.

3. What is Monode equation ? Discuss with plot ? What is batch culture ? What are the advantages and disadvantages of batch culture ? 10+10=20

4. What is CSTR ? How does this operational strategy overcome the disadvantage of batch culture ? What is dilution rate ? Mention disadvantages of CSTR. Why aeration and agitation is required in fermentation ? 5+4+2+3+6=20

5. What is maintenance coefficients ? What is fed batch culture ? How oxygen is transferred from gas bubble to microbial cell in suspension culture ? What is volumetric oxygen transfer coefficient ? Write SI unit for diffusion coefficient, mass transfer coefficient and volumetric oxygen transfer coefficient. 4+6+5+2+3=20

6. What is plug flow reactor ? How is it useful for immobilized enzyme conversion ? Discuss mathematically with Michaelis-Menten equation. What is sterilization factor ? How is it determined ? Why the final desired microbial load cannot be assumed zero ? 12+8=20

7. Solve ***any two*** of the following : 10+10=20

(a) An enzyme was assayed at initial substrate concentration 2×10^{-5} moles. In 6*min*, half of the substrate was used. Calculate K. K_m is 5×10^{-3} moles. Calculate V_{Max}. Calculate the concentration of product produced after 15*min*. What fraction of V_{Max} is observed at $S = 4K_m$?

(b) Immobilized lactase is used to hydrolyse lactose in dairy waste to glucose and galactose. The enzyme is immobilized in resin and packed into $0.5m^3$ column. K_m is 1.32 kg/m^3 and V_{Max} is $45kg/m^3$ h. Lactose in feed stream $9.5kg/m^3$ and 98% substrate conversion is required. The column is operated under plug flow condition for 310 days/year. Calculate what flow rate should the reactor be operated ? How many tonnes of glucose is produced per year ?

(c) Calculate culture time in batch culture.