Register Number: .....

B.TECH DEGREE EXAMINATIONS: APRIL/ MAY 2012

Sixth Semester

BIOTECHNOLOGY

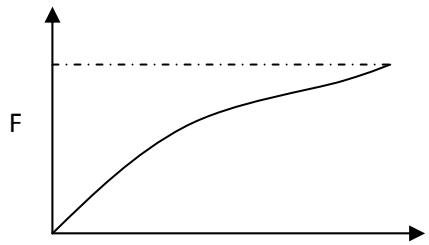
BTY118: Bioprocess Engineering

Time: Three hours **Maximum Marks: 100**

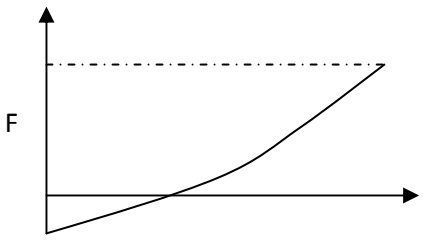
Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

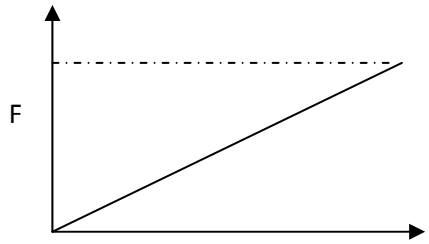
1. The F curve for an ideal CSTR is

(a) 

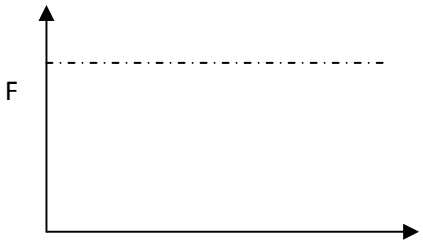
(a)

(b) 

(b)

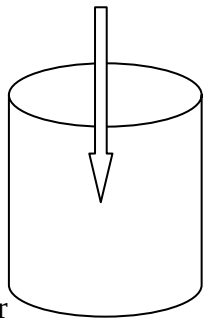
(c) 

(c)

(d) 

(d)

2. The reactor shown in the figure is a

(a) CSTR 

(b) Batch reactor

(c) Semi batch reactor

(d) Recycle rector

3. The sum of all physical and chemical processes by which biochemical substances is produced and maintained is

(a) Anabolism (b) Catabolism (c) Intermediary metabolism (d). Primary metabolism.

4. During scale-up studies, the main problem exhibited in bioreactor is wall growth. These may alter the cell metabolic charactertics mainly due to

M. Mass Transfer

N. Substrate uptake

O. Product release

P. Cell death

(a) N &P (b) O & M (c) M, N &O (d) M, N & P

5. The ratio of the rate of advection of a physical quantity by the flow to the rate of diffusion of the same quantity driven by an appropriate gradient

(a) Peclet number (b) Reynolds Number (c) Schmit number (d) Dispersion number

6. In a well aerated and agitated microbial culture, the supply of oxygen is equal to demand of the growing culture. The KLa for such a system will be (KLa is volumetric mass transfer coefficient, C* dissolved oxygen concentration in liquid in equilibrium with gaseous oxygen, C is instantaneous value of dissolved oxygen concentration, S is the specific oxygen uptake rate per unit weight of cells, X is cell dry weight per unit volume

(a) (S*X)/(C*-C) (b) S/X*(C*-C) (c) (C*-C)/S*X (d) X/S*(C*-C)

7. ---------- are methods for analyzing and converting business requirements into specifications and ultimately, computer programs, hardware configurations and related manual procedures

(a) Structured Design (b) Un Structured Design

(c) Single cell model (d) Compartmental model

8. Modeling of dynamical systems plays a very important role in applied science, and ----------are among the most important tools used for analyzing dynamical systems

(a) compartment models (b) Structured Design

(c) Un Structured Design (d) Single cell model

9. Transformation occurs naturally in some species of

(a) Bacteria (b) Fungi (c) Virus (d) Algae

10. Analysing the related genes in a DNA restriction fragment is called as

(a) Northern blotting technique (b) Southern blotting technique

(c) Western blotting technique (d) Dot blot blotting technique

PART B (10 x 2 = 20 Marks)

11. A continuous process is set up for treatment of wastewater. Each day, 10^5 kg cellulose and 10^3 kg bacteria enter in the feed stream, while 10^4 kg cellulose and 1.5×10^4 kg bacteria leave in the effluent. The rate of cellulose digestion by the bacteria is 7×10^4

kg d^{-1}. The rate of bacterial growth is 2 x 10^4 kg d^{-1}; the rate of cell death by lysis is 5 x 10^2 kg d^{-1}. Write balances for cellulose and bacteria in the system

12. Write short notes on specific growth rate of bacteria
13. Write down the difference between the CSTR and Batch reactor
14. List the any THREE factors affecting cellular oxygen demand.
15. Write down the use of calorimetry in microbial process
16. Define metabolites
17. What is meant by host vector system?
18. Define high copy and low copy number plasmid.
19. Define structural model.
20. Explain transient culture metabolism.

PART C (5 x 14 = 70 Marks)

21. a) Explain the brief of following

(i) Bubble column reactors (ii) Air lift reactors (iii) Fluidized bed reactors

(OR)

b) Describe the two models available for predicating the non-ideal flow behaviour in bioreactor.

22. a) Explain the measurement of K_La using gas liquid reactions for biological reactors.

(OR)

b) Write down the scale-up criteria for bioreactors based on oxygen transfer rate(KLa) and power consumption.

23. a) Write short notes on

(i) Cell determination by dry weight method

(ii) Gas analysis

(iii) Microbial calorimetry

(OR)

b) With an example, explain in detail about working principle of Flow in Injection analysis (FIA)

24. a) Explain the following

(i) Plasmid structural instability

(ii) Host cell mutation

(iii) Growth – rate – dominated instability

(OR)

b) Consider an industrial scale batch fermentation of 10000 L fermenter with 5 x 10^{10} cells/ml is desired to scale up operation. The inoculum for the large tank is brought through a series of seed tanks beginning with a pure colony growing on an agar slant. Assume that a colony (10^6 plasmid containing cells) is picked and placed in a test tube with 1 ml of medium.

(i) Calculate how many generations will be required to achieve this required density in 10000 litre fermenter.

(ii) What fraction of total population will be the plasmid free cells if $\mu_+ = 1\ hr^{-1}$ and $\mu_- = 1.2\ hr^{-1}$ and probability of plasmid free cells p=0.0005

25. a) Give brief notes on structured models for growth and product formation with relevant examples.

(OR)

b) Write notes on

a) Single cell model

b) Compartment models

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