Ref. No. : Ex/FTBE/T/414/2018

B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING
FOURTH YEAR FIRST SEMESTER – 2018

Subject: BIOCHEMICAL ENGINEERING II

Time:3 hours **Full Marks : 100**

Part-I

Use Separate Answer scripts for each Group

Answer question No.1 and any two from the rest. 10+20×2 = 50

1. What are the Significant things of concern that should be taken into account while designing a Fermenter? What are the basic requirements of bioreactors? 5+5 = 10

2. (a) Derive the material balance equations in a constant stirred tank reactor.

   (b) Write short note on fluidized bed reactor.

   © What is gas hold up in a bioreactor? Briefly discuss about gas hold up nature in bubble column reactor. 10+5+5 = 20

3. (a) What are the different types of air lift fermenter? Discuss about different types of gas separators used in air lift fermenter.

   (b) Write the advantages of air lift fermenter.

   (c) What are the different interaction between geometric and fluid dynamic variables in an Air lift fermenter? 10+3+7 = 20

4. (a) How photo bioreactor is important in Food Technology & biochemical Engineering? Write the interaction of different operating parameters in photo bioreactor.

   (b) What *are the* different types of bioreactor depending on their configuration?

   © What are the limitations of photo bioreactors and how would you overcome these limitations? 8+4+8 = 20

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BACHELOR OF ENGINEERING (F.T.B.E) EXAMINATION, 2018

(4^{th} Year -1^{st} Semester)

Biochemical Engineering-II

Time: 3 hrs. Full Marks : 100

Part-II

[Answer any four questions, Marks 50]

1. What is 'Nabla Factor' (▼). Establish the relation between '▼' and temperature of sterilization. (3.5+9)

2. The thermal death kinetic data of *B. stearothermophilus* are as follows at three different temperatures.

Temp (^{0}C)	116	121	125
k_d (min^{-1})	0.037	0.115	0.348

Calculate the activation energy , Arrhenius constant for the sterilization and also k_d at 130^0C (12.5)

3. A fermentation system contains an initial spore concentration of 6.0×10^{10}. The medium is sterilsed thermally at 121^0C and the spore density was noted with the progress of time. The data as follows :

Time (min)	0	5	10	15	20	30
Spore density (m^{-3})	6.0×10^{10}	4.23×10^9	6.2×10^7	1.8×10^6	4.5×10^4	32.5

Find the thermal death kinetics rate constant and also calculate the 'inactivation factor' at 40 min (12.5)

4. The specific death constants of a microbe at heating and cooling period during sterilization of a medium at 121^0C are 0.1 min^{-1} and 0.2 min^{-1}, respectively. $T_{heating}$= 20 min, $t_{holding}$ = 25 min, $t_{cooling}$ = 30min. The D_{10} value during holding is 1.8 min. the initial batch contained $9x10^{14}$ organism at 30^0C . find the survival factor. (12.5)

5. Name the different methods of sterilization and recommend the most effective industrial method with justification. Write the difference between absolute and fibrous type of air filter. State the mechanisms by which microbes are removed from air by fibrous type of air filter. Show how efficiency of a filter can be related to the thickness of the filter bed. (3 + 3 + 2.5 + 4)

6. State the advantages and disadvantages of continuous sterilization process over batch process. With proper sketch explain the mechanism of action of plate heat exchanger type and steam injection flash cooling type continuous sterilization process. Also show the time – temperature for both type of operation. (2.5+ 7 +3)