Ref. No. : Ex/FTBE/T/414/2018(S)

B.E. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING
FOURTH YEAR, FIRST SEMESTER, SUPPLEMENTARY EXAM 2018

SUBJECT: BIOCHEMICAL ENGINEERING-II

Time: 3hrs **Full Marks: 100**

Use separate answer scripts for each part

PART-I **Marks: 50**

Answer question no 1 and any two from the rest **(10×1)+(20×2) = 50**

1. Mention different parts of an aerobic fermentor and their functions. 10
2. (a) Find the relationship between dilution rate and specific growth rate of a CSTR under steady state condition.
   (b) During aeration, a cylindrical reactor has a height of 10m. Without aeration, the height was 7.5m. Under these aeration and mixing conditions, calculate the gas hold up percentage.
   © What is the minimum fluidization velocity? Derive the expression for same.
   7+5+8 = 20
3. (a) What are the different types of photo-bioreactor depending upon their configuration?
   (b) Discuss the problem related to gas liquid interaction in photo bioreactors.
   © How can we overcome the limitations of photo bioreactors? 8+6+6 = 20
4. (a) Write short note on bubble column reactors.
   (b) Briefly discuss about the different types of air lift fermentors. 10+10 = 20

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

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

Biochemical Engineering-II

Time: 3 hrs. Full Marks : 100

Part-II

[Answer any four questions, Marks 50]

1. Why do we require sterilization for fermentation media. Define 'Nabla Factor'. Find the relation between survival fraction and time of sterilization for a microorganism. (4 +3 + 5.5)

2. Establish the relation between 'Nabla Factor' and temperature of sterilization. What is Q_{10} value? (10 +2.5)

3. A fermentation system contains an initial spore concentration of 6.5×10^{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})	6.5×10^{10}	4.0×10^{9}	3.2×10^{7}	1.5×10^{6}	4.0×10^{4}	30

Find the thermal death kinetics rate constant in sec^{-1} 12.5

4. The specific death constants of heating and cooling during sterilization of a medium at 121^0C are 0.1 min^{-1} and 0.2 min^{-1}, respectively. $T_{heating}$= 20 min, $t_{holding}$ = 30 min, $t_{cooling}$ = 30min. The D_{10} value during holding is 2 min. the initial batch contained 4×10^{15} organism at 30^0C . Find the sterilization effect. 12.5

5. The thermal death kinetic data of a bacterial strain are as follows at three different temperatures.

Temp (^{0}C)	115	120	125
k_d (min^{-1})	0.036	0.114	0.348

Calculate the activation energy and Arrhenius constant for the sterilization (12.5)

6. State the advantages and disadvantages of continuous sterilization process over batch process. With proper sketch show two different types of protocol of continuous sterilization processes . (3.5 + 4.5x2)

7. Name the different methods of air 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. What is efficiency of a filter and what is its relation with thickness of the bed? (4+2+3+3.5