B.FTBE 4TH YEAR 1ST SEM EXAM SUPPLEMETARY-2017

Biochemical Engineering-II

Time: 3 hrs. Full Marks : 100

Part-I

[Answer any four questions, Marks 4x15= 60]

1. 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. $t_{heating}$= 15 min, $t_{holding}$ = 25 min, $t_{cooling}$ = 30min. The D_{10} value during holding is 2.5 min. the initial batch contained $2x10^{15}$ organism at 30^0C . (a) Find the sterilization effect. (15)

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

Temp (^{0}C)	110	121	125
k_d (min^{-1})	0.035	0.112	0.347

Calculate the activation energy and Arrhenius constant for the sterilization (15)

3. Establish the relation between del factor and temperature of sterilization.

A fermentation system contains an initial spore concentration of 8.0×10^{10}. The medium is sterilized 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})	8.0×10^{10}	4.20×10^9	6.0×10^7	1.6×10^6	4.2×10^4	30.0

With above data , calculate the 'inactivation factor' at 35 min

(5 + 10)

[Turn over

4. State the advantages and disadvantages of continuous sterilization process over batch process. With proper sketch show the protocol of plate heat exchanger type . 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?. (2+4+2+2+2+3)

5. A bacterial fermentation is going on in a fermenting vessel . The required information about the fermentation is given below:
The capacity of the vessel is 25 liter, $H_L = 1.3\ D_t$; $D_i = D_t/3$; $(F/V) = 2.0$ vvm and there are 2 sets of flat blade type of impellers inside the vessel.
However, the production is to be transferred to a large scale fermenter of capacity 30,000 liter and therefore, you are supposed to estimate (F/V) and (v_s) for this larger fermenter.
Actual working volume of each of the fermenter is 60% of the geometrical volume of each tank. All the physical properties of the broth are similar with those of pure water at room temperature. Also assume, $(F/V) \alpha\ 1/H_L^{2/3}$
(15)

6. Assuming power requirement per unit volume to be the scale up factor (basis), find the ratios of the following parameters in two different scales. Assume small scale fermenter to be of 80 liter volume and the large scale one of 10,000 liter capacity. The parameters to be considered are : P/ V , n , D_i , F, F/ V , nD_i. The terms bear normal meanings. (15)

EX/FTBE/T/414/2017(S)

BACHELOR OF ENGINEERING (F.T.B.E.) SUPPLEMENTARY EXAMINATION, 2017

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

Biochemical Engineering-II

Time: 3 hrs. Full Marks: 100

Part-II

(Answer any two questions, Marks: 2×20 = 40)

1. (a) Write applications of packed bed column reactor in biochemical industries.
   (b) Briefly describe about different types of air lift bioreactor.
   © What are the disadvantages of air lift fermenter?
   (d) What are the different disadvantages of packed bed column reactor?
   4+6+6+4 = 20
2. (a) Write the applications of photo bioreactor.
   (b) Structurally classify photo bioreactor and mention their specialty.
   © What are the different short coming of photo bioreactor design? 4+8+8 = 20
3. (a) What are the advantages and disadvantages of CSTR? Give application of such type of bioreactor.
   (b) Define gas hold up and minimum fluidization velocity.
   © What are the different phases of packed bed reactor depending on the feed velocity?
   8+6+6 = 20
4. (a) Draw a schematic diagram of a CSTR and level its different parts and write there functions.
   (b) Write different material balance equations inside a CSTR. 10+ 10 = 20