Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**

PBT6I101

6th Semester Regular Examination 2017-18

BIOREACTOR DESIGNING & ANALYSIS

BRANCH : BIOTECH

Time : 3 Hours

Max Marks : 100

Q.CODE : C140

Answer Question No.1 and 2 which is compulsory and any FOUR from the rest.

The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) The mass transfer rate is independent of :
A. Turbulence effect
B. Physical properties
C. Chemical properties

b) According to the two film theory, the diffusion coefficient and the mass transfer coefficient are :
A. Directly proportional to each other
B. Inversely proportional to each other
C. Not related to each other

c) Fourier's law explains heat transfer due to :
A. Convection
B. Conduction
C. Radiation

d) -------is not produced during fermentation :
A. O_2
B. CO_2
C. Ethanol

e) Foaming can be prevented by :
A. Mixing
B. Increasing oxygen supply
C. Adding a surfactant

f) What are the units for a first order reaction?
A. $MolL^{-1}S^{-1}$
B. S^{-1}
C. $Mol^{-1}LS^{-1}$

g) For a rate equation: A + B = C, Rate = k[A][B], the rate of reaction is :
A. Independent of concentration of A
B. Independent of concentration of B
C. Dependent of concentration of A and B

h) In batch cell growth, the phase whereby all nutrients are utilized and cells die is called :
A. Lag
B. Death
C. Stationary

i) As agitation increases in an aerobic maintained bioreactor :
A. The oxygen transfer coefficient increases
B. The oxygen transfer coefficient decreases
C. The oxygen transfer coefficient is not changed

j) The disengagement zone in an airlift bioreactor :
A. Increases the velocity of the air bubbles
B. Decreases the velocity of the air bubbles
C. Enables reduction in liquid loss

Q2 **Answer the following questions :** **(2 x 10)**

a) Write down the rate equations for homogeneous and heterogeneous reactions
b) Name any two important parameters that should be taken into account while constructing a fermenter
c) What do you understand by the term “Chemical Kinetics”.
d) What is aF-curve and a C-curve.
e) What is the difference between a batch and fed-batch reactor?
f) Define immobilized cells. Give any two examples of materials that can be used for formation of immobilized matrix.
g) Write down the importance of rheology concept.
h) Write down the three ways in which heat transfer may occur in a reactor.
i) What is an adiabatic reactor? Give an example for the same.
j) Explain the term” inter-space area” in a packed bed reactor.

Q3 **a)** Explain the different types of air lift bioreactors with appropriate diagrams. **(7.5)**
b) Describe the working principle of perfusion reactor for animal and plant cell culture with its advantages and disadvantages. **(7.5)**

Q4 **a)** Illuminate in detail about the enzyme catalysed reactions in CSTRs **(7.5)**
b) Write in detail about the CSTR reactors with recycle and wall growth facility. **(7.5)**

Q5 **a)** What is RTD? What are the reasons for non-ideality? **(7.5)**
b) Explain with a neat diagram the working of a bubble column reactor. **(7.5)**

Q6 **a)** Give appropriate pathway for the transfer of oxygen from a bubble to the respiratory site of a fermenting cell in a reactor. **(7.5)**
b) Write down in detail about the scale-up and scale-down processes. **(7.5)**

Q7 **a)** Write four requirements of online sensors in monitoring of bioreactors **(7.5)**
b) Explain in deep about the requirement and the working of any two types of valves that are used in bioreactor **(7.5)**

Q8 Explain in detail about the various theories for mass transfer in a biochemical processes **(15)**

Q9 **Write short answer on any TWO :** **(7.5 x 2)**

a) Plug low reactor
b) Agitation system
c) Biosensors
d) Steps in cleaning of production plants