



Year II Semester I
Fundamentals of Biochemical Engineering (TEA 221-2)

End Semester Examination – December 2009
Structured & Essay Type Questions

I. Write short notes on:

- a) Viscosity of a fluid.
- b) Overall Heat Transfer Coefficient of a heat exchanger

II. In a counter flow heat exchanger, water is being chilled by using sodium chloride brine. If the rate of flow of the brine is 2 kg s^{-1} and that of the water is 1.5 kg s^{-1} .

Estimate the temperature, to which the water is cooled if the brine enters at -8°C and leaves at 10°C , and if the water enters the exchanger at 32°C .

(Take the specific heats to be 3.38 and $4.18 \text{ kJ kg}^{-1} \text{ }^\circ\text{C}^{-1}$ for the brine and the water respectively.)

2.

I. **“Aeration and agitation are implemented in most fermentation processes”.**

Comment on this statement.

II. Briefly discuss the factors considered in designing & operation of a bioreactor.

III. Briefly explain the importance of dissolved oxygen (DO) level in a bioreactor.

PART II

Question 01

I. Write short notes on:

- a) Critical Reynold's Number (07 marks)
- b) Overall Heat Transfer Coefficient of a heat exchanger (08 marks)

II. In a counter flow heat exchanger, water is being chilled by using brine. If the rate of flow of the brine is 2 kg s^{-1} and that of the water is 1.5 kg s^{-1} .

Assuming that there is no any gains or losses of energy in the system, estimate the temperature to which the water is cooled if the brine enters at -8°C and leaves at 10°C , and if the water enters the exchanger at 32°C .

(Take the specific heats to be 3.38 and $4.18 \text{ kJ kg}^{-1} \text{ }^\circ\text{C}^{-1}$ for the brine and the water respectively.) (10 marks)

Question 02

- I. Briefly explain the significance of Aeration and agitation processes implemented in most bioreactors. (07 marks)
- II. How does the behavior of flow during agitation process characterize with the Reynold's Number. (08 marks)
- III. Briefly discuss the factors considered in designing & operation of a bioreactor. (10 marks)