2072
## M. E. (Bio-Technology)
Second Semester
ME-BIO-202: Bioprocess and Bioreactor Engineering

Time allowed: 3 Hours

Max. Marks: 50

**NOTE:** *Attempt <u>five</u> questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section. State clearly your assumptions.*

x-x-x

1) Write briefly:                                               *(2×5 =10)*
   - a) What do you mean by aeration and agitation?
   - b) How will affect the temperature on oxygen transfer coefficient?
   - c) Explain biological concept of scale – up?
   - d) What are the reasons for non-ideality in flow reactors?
   - e) Enlist the factors affecting cellular oxygen demand.

## SECTION – A

2. A) Discuss the comparison of batch mode with continuous mode of operation for a bioreactor.

   B) What do you mean by 'scale-up'? What are the factors involved in the scale-up process? Discuss some major problems related to scale-up of a bioreactor.      *(5, 5)*

3. A) Differentiate between the working principle of continuous and batch sterilization process

   B) How microorganism type and culture characteristics are important for bioreactor design and operations?                       *(5, 5)*

4. A) Write short notes on type of ideal reactor type.

   B) Saccharomyces cerevisiae is used to convert glucose to ethanol in batch fermenter under anaerobic conditions. The yield of biomass from substrate is 0.06 gg$^{-1}$; Ypx is 7.7 gg$^{-1}$. The maintenance coefficient is 2.2 gg$^{-1}$h$^{-1}$; the specific rate of product formation due to maintenance is 1.1 h$^{-1}$. The maximum specific growth rate of S. cerevisiae is approaximately 0.3h$^{-1}$. 5 g bacteria are inoculated into 50 liters of medium containing 12 gl$^{-1}$. Determine batch culture time required to:
   - a) Produce 10 g biomass;
   - b) Achieve 90% substrate conversion
   - c) Produce 100 g ethanol.                                 *(4, 6)*

## SECTION - B

5. A) Describe how do estimate the conversions in bioreactor with non-ideal flow behaviour using dispersion model.

   B) Discuss the various measurements techniques for estimating k$_L$a in bioreactors.    *(5, 5)*

6) Briefly discuss the approaches for maintaining and control of the following parameters: Liquid flow rate, microbial biomass, oxygen and carbon dioxide in exit gas, dissolved oxygen and carbon dioxide concentration.                          *(10)*

7) Write notes on the following:
   - a) Reactor stability.
   - b) Significance of bioreactor modeling.                                 *(5, 5)*

x-x-x