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## M. TECH. (BIOTECHNOLOGY)

FIRST SEMESTER EXAMINATION, 2009-10

### BIOPROCESS ENGINEERING

Time : 3 Hours

Total Marks : 100

- Note : (i) Attempt any FIVE questions.  
(ii) Marks are indicated against each question.

1. (a) Explain the relevance of Bioprocess Engineering in the modern era for technological development. 10  
(b) What do you understand by boundary layer? Explain its formation and significance. 10
  
2. Write short notes on : 5 x 4 = 20
  - (a) Fermentation
  - (b) Heat Transfer
  - (c) Diffusion
  - (d) Valves and pumps used in fermentation industry
  
3. (a) Differentiate between 'Fluids' vs 'Solids' and salient aspects of Fluid Mechanics. 10  
(b) Explain any Two : 10
  - (i) Fourier law of heat conduction
  - (ii) Newton's law of viscosity
  - (iii) Bioreactors

- 4. (a) Discuss the principle and working of various types of Manometer 10
- (b) What are the common types of Heat exchanges used in fermentation industry. (Support with schematic diagram) 10
  
- 5. Explain the following :
  - (a) Newtonian and Non-Newtonian fluids. 10
  - (b) Pressure drop in packed bed and fluidized bed reactor. 10
  
- 6. (a) Discuss the factor affecting oxygen transfer in fermentors. 10
- (b) Explain the methods use for determination of oxygen transfer coefficient ( $K_L a$ ). 10
  
- 7. Explain how the study of heat transfer, fluid mechanics and material balances helps in the understanding of fermentation process. 20

