Roll No. | | | | | | | | | | |

M. Tech. (BIOTECHNOLOGY)

FIRST SEMESTER EXAMINATION, 2010-11

BIOPROCESS ENGINEERING

Time : **3 Hours** Total Marks : **100**

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

1. By dimensional analysis. State the whether the following are dimensionally homogenous. **20**

(a) $$\mu = \frac{M_T}{4\pi h\Omega}\left(\frac{1}{R_0^2} - \frac{1}{R_i^2}\right)$$

Where $\mu = L^{-1} MT^{-1}$,

$h = L$

$MT = L^2 MT^{-2}$

$R_0 = L$; $R_i = L$

$\Omega = T^{-1}$

(b) $$\alpha = \alpha_0 e^{-E/RT}$$

Where α = Number of mutations per unit time

α_0 = Number of mutations per unit time

E = Joules

R = Joules per degree centigrade

T = Temperature (Degree Centigrade)

2. What is the difference between Newtonian and Non-Newtonian fluids? Explain the various types of Non-Newtonian fluids w.r.t. to their stress-strain plots. **20**

3. Derive Bernoulli's Equation and explain the following terms: **20**

   (a) Gravity head

   (b) Pressure head

   (c) Kinetic Energy Correction factor

4. Explain the following : **20**

   (a) Thermal boundary layer

   (b) Working of counter current and co-current heat exchangers

   (c) AMTD and LMTD

5. Discuss the steps involved in the transfer of oxygen from gas bubble to the individual cells, also explain the significance of K_La and how it is determined. **20**

6. Anaerobic digestion of volatile acids by methane bacteria is represented by the following equation : **20**

$$CH_3COOH + NH_3 \rightarrow \text{biomass} + CO_2 + H_2O + \underset{\text{(Methane)}}{CH_4}$$

The composition of Methane bacteria is approximated by the empirical formula $CH_{1.4}\ O_{0.4}\ N_{0.22}$. For each kilogram acetic acid consumed 0.67Kg Carbon dioxide is evolved. How does the yield of methane compare with the maximum possible yield?

7. Explain the following : **20**

   (a) Pressure drop in packed bed reactors

   (b) Factors affecting oxygen transfer