Roll No. ..... **Total Pages : 03**

BT-4/M-20 **34036**

THERMODYNAMICS OF BIOPROCESS

BTT-210E

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Define heat capacity at constant pressure and volume and their relationship. Also explain first law of thermodynamics. **10**

(b) Define Thermodynamics parameter internal energy, enthalpy, their relationship and their significance. **10**

2. Write notes on the following : **20**

(a) Entropy and life processes

(b) Third law of thermodynamics.

Unit II

3. (a) What do you understand by steady state condition ? Explain free energy and its relationship with equilibrium constant. **10**

(b) Derive Gibbs-Duhan equation and explain their application. **10**

4. Explain the following : **20**

(a) Structural transition in biological molecules

(b) Independent and non-cooperative binding.

Unit III

5. (a) Describe Onsager's phenomenological coefficient of its reciprocal relation. **10**

(b) Explain non-equilibrium thermodynamics and its biological application. **10**

6. (a) What are coupled reaction ? Illustrate with suitable examples. Explain the concept of group transfer potential. **10**

(b) Write down the concept of flexed forces. **10**

Unit IV

7. (a) Describe thermodynamics of oxidative phosphorylation. **10**

(b) Write down Prigogine-Curie law. **10**

8. Briefly discuss the following : **20**

(a) Thermodynamic properties of water

(b) Biological clocks and biochemical oscillation.