2006 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
II B.TECH I SEMESTER REGULAR EXAMINATIONS
CHEMICAL AND BIO-THERMODYNAMICS
(BIO-TECHNOLOGY)

NOVE 2006

TIME:3 HOUR
MARK:80

ANSWER ANY FIVE QUESTIONS ALL QUESTIONS CARRY EQUAL MARKS

1. (a) What do you mean by chemical equilibrium process?

(b) Write the "Phase Rule" and its significance in finding the degrees of freedom.

2. Steam is flowing through a horizontal, well-insulated 3-in. - ID iron pipe, 1500 ft long. The velocity at the entrance to the pipe, where the steam is dry and saturated at 150 psia, is 100 ft/sec. The steam discharges from the exit of the pipe into an adiabatic reversible turbine which exhausts at 14.7 psia. The steam leaving the turbine is in the dry-saturated condition.

(a) Calculate the horsepower produced by the turbine.

(b) Represent by a sketch on T-S plane the change in the state of the steam as it flows through the pipe and the turbine.

(c) What is the state of the steam entering the turbine?

3. Consider the steady-state, adiabatic, irreversible flow of an incompressible liquid

in a horizantal pipe of constant cross sectional area. Show that:

(a) The velocity is constant.

(b) The temperature increases in the direction of flow

(c) The pressure decreases in the direction of flow.

4. What is the ideal work for separation of an equimolar mixture of methane and ehtane at 1750C and 3 bar in a steady-flow process in to product streams of the pure gases at 350C and bar if Ts=300K?

5. Explain the relation between equilibrium and stability in a closed system.

6. For a system in which the following reaction occurs
$CH_4 + H_2O ! CO + 3H_2$
Assume there are present initially 2 mol CH4, 1MolH2O, 1molCO, and4MolH2.Determine expression for the mole fraction yi as functions of e.

7. Relation between TCA and lipid synthesis.

8. Discuss the average yield coefficient for activated sludge.