B.E (Full time- Arrear) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2011

Materials science and Engineering

THIRD SEMESTER (REGULATION 2008)

ML 9202 – THERMODYNAMICS AND KINETICS OF MATERIALS

(3)

Time : 3 Hours Max. Marks : 100

Answer ALL Questions

PART – A (10 X 2 = 20 MARKS)

1. What do you understand by state function? Give example.
2. Distinguish homogenous and heterogeneous system.
3. State zeroth law of thermodynamics.
4. Define molar heat capacity.
5. What do you understand by the term "Degree of irreversibility".
6. What do you understand by chemical potential?
7. What is the significance of Van-Hoff's equation?
8. State Gibbs phase rule.
9. What is 'solid electrolyte'?
10. What do you understand by 'Kirkendall's effect'?

PART – B (5 X 16 = 80 MARKS)

11. i) What do you understand by microstate? Determine the most probable microstate. (10)
    ii) Discuss the influence of temperature on the number of arrangements within the most probable distribution. (6)

12. a) i) State and Prove Clausius statement. (10)
    ii) Discuss the consequence of combined first law and second law of thermodynamics. (6)

(OR)

b) i) Obtain the relationship between pressure and volume of an ideal gas undergoing reversible adiabatic process. (6)

ii) An ideal gas at 300 K has a volume of 15 liters at a pressure of 15 atm. Calculate

I) Final volume of the system,
II) Work done by the system
III) Heat entering or leaving the system
IV) The change in internal energy and
V) The change in enthalpy

when the gas undergoes a reversible isothermal expansion to a pressure of 10 atm. (10)

13.a) i) Establish that Gibbs free energy can only decrease or remain constant and the attainment of equilibrium in the system coincides with the system having a minimum value of Gibbs free energy, G, consistent with values of P and T. (8)
    ii) Derive the Gibbs – Helmoltz equation. (8)

(OR)

b) i) Derive Maxwell's equation and explain how its is useful in determining the internal energy and entropy of a closed system of fixed composition. (10)

ii) Prove that $C_p - C_v = (VT\alpha^2)/\beta$ where α and β are the isobaric thermal expansivity and isothermal compressibility respectively. (6)

14. a) i) Derive Gibbs-Duhem equation and explain how it is useful in the determination of activity of a binary solution. (10)

ii) Determine the change in Gibbs free energy due to the formation of a solution. (6)

(OR)

b) i) Discuss in detail the effect of pressure on phase stability. (10)

ii) Briefly discuss the thermodynamics of point defects in solids.(Frenkel) (6)

15. a) Write a brief note on the kinetics involved in i) Heterogenous reaction and ii) compound formation.

(OR)

b) i) Explain why in a binary solution of copper and zinc, the lower melting component diffuses much faster than the other. (8)

ii) Prove that $K = -(2.303/t) \log (1-x/[a]_0)$ (8)