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

B.E.(Full Time) DEGREE END SEMESTER EXAMINATIONS – NOV/DEC 2011

MATERIALS SCIENCE AND ENGINEERING

THIRD SEMESTER (REGULATION 2008)

ML 9202 – THERMODYNAMICS AND KINETICS OF MATERIALS

Time : 3 Hours Max. Marks : 100

Answer ALL Questions

PART – A (10 X 2 = 20 MARKS)

1 Distinguish Homogenous and Heterogeneous phases with examples.
2. Mention the criteria of equilibrium for a process undergoing change of state.
3. What do you understand by Degree of Measure of Irreversibility?
4. Differentiate between 'Microstate' and 'Macrostate' of a system.
5. What do you understand by the term Complexions?
6. Define the term Chemical potential.
7. State Le Chatelier's principle.
8. What is 'solid electrolyte'?
9. State Dulong and Pettit's rule.
10. What do you mean by 'activity coefficient'?

PART – B (5 X 16 = 80 MARKS)

11. i) Derive Maxwell's equation and show that the enthalpy of an ideal gas is independent of its pressure. **(8)**
    ii) State and prove claussius theorem. **(8)**

12. a) i) Prove that Thermodynamic temperature scale is identical with Ideal gas temperature scale. **(8)**

    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. **(8)**

(OR)

b) i) Obtain the relationship between the heat capacities C_p and C_v. **(8)**
   ii) Briefly discuss one of the ways of theoretically calculating the heat capacities. **(8)**

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) Determine the most probable microstate within a single macro state by fixing the independent variables of the system. Also discuss the influence of thermal energy on the distribution of the particles among the energy levels.

14. a) i) State 3rd Law of thermodynamics and prove that at absolute Zero, the coefficient of thermal expansion of any substance vanishes. **(8)**

ii) explain the incompleteness in Nernst's theorem with an example and the proposed correction. **(8)**

(OR)

b) Briefly discuss the thermodynamics of point defects in solids.

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

(OR)

b) i) Discuss briefly Raoult's Law and Henry's Law as they apply to the behaviour of solutions **(8)**

ii) Determine the change in Gibbs free energy due to the formation of a solution. **(8)**