## 2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

## III B.TECH I SEMESTER SUPPLEMENTARY EXAMINATIONS METALLURGICAL THHERMO DYNAMICS (METALLURGY & MATERIAL TECHNOLOGY)

NOVEMBER 2005

TIME – 3 HOUR MARK – 80

## Answer any FIVE Questions All Questions carry equal marks

*1. (a) What is diffusion? State fick's laws of diffusion.* 

(b) Explain the mechanisms of diffusion.

(c) What do you understand by intrinsic and extrinsic regions of diffusion in a sodium chloride crystal doped with a divalent cation impurity? Explain how the enthalpies of formation and motion of Na+ ions can be evaluated from the experimental determination of electrical conductivity verses temperature.

2. (a) Explain the use of oxygen nomograms in Ellingham diagrams.

(b) Draw plot of standard free energy changes of an oxide with temperature. Discuss the properties and useful information that can be obtained from it.

3. (a) Describe lattice thermal conductivity effects and thermo electric effects of solids.

(b) Define specific heat. Explain the classical, Debye and Einsteins models of lattice specific heat of solids.

4. (a) State Raoult's law and give its derivation from first principles. What are its limitations.

(b) State and derive Gibb's-Duhem equation.

5. (a) What is allotropic transformation? Give any three examples which shows allotropic transformation.

(b) Explain the method of plotting an equilibrium diagram by the use of cooling curves.

(c) A gold-Nickel alloy containing 60% nickel is heated to 12000. Determine the composition and the amount of each phase in the metal when reaches equilibrium at the temperature.

6. (a) Explain the applications of Gibb's-Helmholtz equation to galvanic cells.

(b) Suggest methods for the experimental determination of the standard potentials of the electrodes using cells without liquid functions

(a) pb, pb++

(*b*) *Ag*, *Ag2O*(*s*)