PMT3I102 METALLURGICAL THERMODYNAMICS & KINETICS

Module I (15 Hours)

Importance of Thermodynamics, definition of thermodynamic terms; concept of states, simple equilibrium. Equation of states, extensive and intensive properties, homogeneous and heterogeneous systems. Phase diagram of a single component system. Internal energy, heat capacity, enthalpy, isothermal, and adiabatic processes.
Second law of thermodynamics, entropy, degree of reversibility and irreversibility, criteria of equilibrium, auxiliary functions, combined statements, Maxwell's relations, transformation formula, Gibbs-Helmoltz equation.
Concept of Third law of thermodynamics, temperature dependence of entropy, statistical interpretation of entropy, Debye and Einstein concept of heat capacity, relation between C_p and C_v, consequences of third law.

Module II (13 Hours)

Fugacity, activity, equilibrium constant, use of S-functions, controlled atmospheres, homogeneous and heterogeneous equilibrium.
Ellingham – Richardson diagrams, phase stability diagrams.
Solutions: partial molal quantities, ideal and non-ideal solutions, Henry's law, Gibbs – Duhem equation, regular solution, quasi-chemical approach to solution, statistical treatment. One weight percentage standard state, chemical potential, phase relations and phase rule – its applications.

Module III (15 Hours)

Free energy – composition diagrams for binary alloy systems, determination of liquidus, solidus and solvus lines. Effect of pressure on phase transformation and phase equilibria.
Thermodynamics of electrochemical cells, solid electrolytes. Thermodynamics of point defects in solids.
Introduction to metallurgical kinetics: heterogeneous reaction kinetics: gas-solid, solid – liquid, liquid – liquid and solid-solid systems. Empirical and semi-empirical kinetics, concept of Johnson – Mehl equation, Thermal analysis.