PHYSICAL METALLURGY

Module I (12 hours)

Crystal structures in metallic materials, packing factor, lattice sites and vacancies, indexing, defects in crystals

Concept of dislocation, concept of alloying, effect of alloying additions on structure and engineering properties, introduction to diffusion, Fick's laws of diffusion, mechanisms of diffusion, Kirkendall effect, role of diffusion in modification of engineering properties,

Module II (10 hours)

Concept of phase diagrams, phase rule, invariant reactions, eutectic, eutectoid, peritectic and peritectoid reactions, free energy composition curves, microstructural changes during cooling, indicative examples for binary and ternary systems

Module III (14 hours)

Introduction to phase transformations, nucleation and growth, solidification, pearlitic transformation, bainitic transformation, martensitic transformation, precipitation and age hardening, recovery, recrystallization and grain growth, heat treatment, annealing, normalizing, quenching, tempering, hardenability, case hardening, concept of strengthening mechanisms

Introduction to ferrous and non-ferrous alloy systems, equilibrium diagrams, important special steels and non ferrous alloys

Text and Reference Books:

1. Avner, S. H., "Introduction to Physical Metallurgy", second edition, McGraw Hill, 1985.
2. Raghavan, V., "Physical Metallurgy", Prentice Hall of India, 1985.