PMM205: PHASE TRANSFORMATION AND HEAT TREATMENT

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3	1	0	3.5

Course Objective: To understand variation in structure of different metallic System with variation in composition and heat treatment procedures

Introduction: Review of phase diagrams and phase reactions, Some common phase diagrams, Cu-Zn, Al-Cu, FeO-SiO_2, Evolution of microstructure on cooling.

Diffusion: Concept of diffusion, Fick's laws of diffusion, Kirkendell effect

Iron - cementite Phase Diagram: Allotropic changes in iron, Fe-Fe_3C phase diagram, role of alloying elements, types of steels.

Basics of Heat Treatment: Formation of austenite, decomposition of austenite, TTT diagram, Pearlitic transformation, Bainitic transformation, Martensitic transformation, Retained austenite.

Heat Treatment Process: Stress relieving, Annealing, Normalizing, Spheroidizing hardening, Tempering, Austompering, Martemporing, sub-zero treatment, Patenting

Hardness and Hardenability: Significance of hardness and hardenability, Hardenability with transformation rates, Determination of hardenability, Factors influencing hardenability.

Quenchants: Heat transfer during quenching, Different types of quenchants, Quenching media, Synthetic quenchants.

Chemical Heat Treatment of Steels: Carburizing (solid, liquid, gas vacuum), Post carburizing treatment, Cyaniding and Carbonitriding, Nitriding, Boronizing, Chromizing.

Surface Hardening: Flame hardening, Induction hardening, Electron beam hardening, Laser hardening, Case depth measurement.

Thermo-mechanical Treatment: Classification (HTMT, LTMT), Ausforming, isoforming, Marstraining, cryoforming.

Cast Iron and Their Heat Treatment: Grey, white, malleable, Heat treatment of non-ferrous materials, SG iron, Alloy cast irons,

Course Learning Outcomes (CLO):
Student will be able to selecting proper composition and heat treatment cycles to end applications of metallic materials

Recommended Books:

1. *Reed, R.E., Physical Metallurgy Principles, Tata McGraw Hill (1991).*
2. *Rajan, T.V., Sharma, C.P. Sharma, Ashok, Heat Treatment Principles and Techniques, PHI (1997).*
3. *Sidney H.H, Introduction to Physical Metallurgy, Tata McGraw Hill (1974).*