

AMPR05 ENGINEERING METALLURGY

UNIT-1 CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

- 1.1 Crystal structure- BCC, FCC and HCP structure- unit cell- crystallographic planes and directions, miller indices – crystal imperfection, point, line, planar and volume defects
- 1.2 Grain size, ASTM grain size number. Constitution of alloys
- 1.3 Solid solutions, substitutional and interstitial- phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions,
- 1.4 Iron – Iron carbide and Iron- Charbide & Iron Graphite equilibrium diagram.
- 1.5 Classification of steel and cast iron- microstructures of Steels & Cast irons- properties and application.

UNIT-2 HEAT TREATMENT

- 2.1 Definition- Full annealing, stress relief, recrystallization and spheroidizing- normalizing, hardening and tempering of steel,
- 2.2 Isothermal transformation diagram- cooling curves superimposed on I.T. diagram CCR- Hardenability, Jominy end quench test- Austempering martempering
- 2.3 Case hardening, carburizing, nitriding cyaniding, carbonitriding
- 2.4 Flame, Induction Laser and Electron beam and plasma phase hardening
- 2.5 Special and duplex surface hardening processes.

UNIT-3 FERROUS, NON FERROUS METALS

- 3.1 Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W)- stainless and tool steels
- 3.2 HSLA – maraging steels- Gray, white, malleable spheroidal, graphite, alloy cast irons Copper and Copper alloys, Brass, Bronze and Cupronickel
- 3.3 Aluminium and Al-Cu- precipitation strengthening treatment
- 3.4 Bearing alloys, Alloys of Ti, Zn Mg and Ni- Intermetallics, Ni, Ti Aluminides
- 3.5 Shape memory alloys.

UNIT-4 MECHANICAL PROPERTIES AND TESTING

- 4.1 Mechanism of plastic deformation, slip and twinning
- 4.2 Types of fracture- Testing of materials under tension, compression and shear loads
- 4.3 Hardness tests (Brinell, Vickers and Rockwell) micro and Nano hardness test impact test,
- 4.4 Izod and charpy, fatigue and creep mechanisms- types of wear- preventions.

UNIT-5 WELDING AND FOUNDRY METALLURGY

- 5.1 Weld thermal cycle- Microstructure of HAZ in Steel and Aluminium alloys
- 5.2 Weldability of steel, cast iron and non-ferrous alloys
- 5.3 Pre and Post weld heat treatment- Residual stress and distortion- casting solidification
- 5.4 Formation of dendrite, columnar and equiaxed grains
- 5.5 Castability of steel, cast iron, Stainless Steel Al and Cu alloys.

References Books:

1. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw Hill Book Co., 2001
2. Raghavan V. Materials Science & Engg” Prentice Hall of India Pvt.Ltd., 2004
3. William D Callister “Material Science & Engg – John Wiley & Sons, 2002
4. Van Vlack. L.H., “Materials Engg. Concepts and Applications, 2001.

