

OPR551 BASICS OF ENGINEERING METALLURGY

DETAILED SYLLABUS

OBJECTIVE:

To introduce the basic concepts of metallurgy, metallurgical structures and mechanical properties, testing of metals

UNIT I CONSTITUTION OF ALLOYS

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfection, point, line, planar and volume defects – Grain size, ASTM grain size number. Constitution of alloys – Solid solutions, substitutional and interstitial Solid Solutions.

UNIT II PHASE DIAGRAMS

Phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide and Iron – Carbide & Iron Graphite equilibrium diagram. Classification of steel and cast iron - microstructures of Steels & Cast irons - properties and application.

UNIT III HEAT TREATMENT

Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, hardening and tempering of steel, Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test – Austempering martempering – case hardening, carburizing, nitriding cyaniding, carbonitriding – Flame, Induction Laser and Electron beam and plasma phase hardening – Special and Duplex surface hardening processes.

UNIT IV FERROUS AND NON FERROUS METALS

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) – stainless and tool steels – HSLA – maraging steels – Gray, white, malleable spheroidal, graphite, alloy cast irons, Aluminium and Copper Alloys, Al-Cu – precipitation strengthening treatment. Shape memory alloys.

UNIT V MECHANICAL PROPERTIES AND TESTING

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – hardness tests (Brinell, Vickers and Rockwell) micro and nano hardness test impact test, Izod and Charpy, fatigue and creep mechanisms.

OUTCOMES:

Upon the completion of the course, students will be able to

1. Analyze the role of various constituents and phases in metals and alloys.
2. Understand the importance of heat treatment in ferrous and non ferrous metals and alloys.

SSLC, HSE, DIPLOMA, B.E/B.TECH, M.E/M.TECH, MBA, MCA

Notes

Syllabus

Question Papers

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3. Categorize the ferrous and nonferrous metals and alloys based on the constituents.
4. Understand the procedure involved in mechanical testing of metals and alloys.

TEXT 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

REFERENCES

1. Donald R.Askeland – The Science and Engineering of materials – 4th Edition – Thomson Engineering – 2002
2. Keneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice Hall of India Private Limited, 7th Edition Indian Reprint 2004".
3. William D Callister "Material Science & Engg – John Wiley & Sons, 2002
4. L.H.Van Vlack, "Materials Engg. Concepts and Applications, 2001.