

10 ME 223 MATERIALS SCIENCE AND METALLURGY

II B.Tech II Semester

(with effect from the academic year 2011-2012)

Lectures /Week : 4Hrs

University Exam:3 Hrs

Credits: 4

Sessional marks: 40

End Examination Marks: 60

UNIT -1

Space lattice and unit cells, Crystal structures of common metallic materials – bcc –fcc–hcp – Atomic packing factor – Miller indices –spacing of lattice planes –Relation between density and lattice constant- Properties of Engineering Materials. Crystal imperfections –point, line and surface defects. Edge and screw dislocations – Burger’s vector.

Plastic deformation by slip and twinning .Critical resolved shear stress for slip. Work hardening – mechanism and sages of work hardening. Cold working and hot working. Recovery, Recrystallization and Grain growth.

UNIT – II

Testing of Engineering materials –tensile, compressive, hardness and impact tests. Creep –creep test-creep curve-Mechanism of creep. Fatigue – fatigue stress cycles – fatigue test – S-N-curve –Mechanism of fatigue. Fracture – Ductile and brittle fracture –Griffith’s criterion.

UNIT – III

Construction of cooling curves for a pure metal and a solid solution / alloy – Gibb’s phase rule for a metal system – Construction and interpretation of binary phase diagrams-Types of phase diagrams –Eutectic ,Eutectoid, Peritectic, Peritectoid.-Iron-Carbon system – cooling curve of pure iron. Iron – carbide equilibrium diagram

UNIT – IV

Production of Pig – Iron in the Blast furnace. Production of steel in Bessemer, Open Hearth and Basic Oxygen steel making. Plain carbon steels – Uses and limitations of plain carbon steels. Alloy steels. Effect of alloying elements in steels. High speed tool steel, stainless steels, High nickel and High chromium steels. Codification of steels .IS, AISI –SAE classifications. Cast irons-grey, white, malleable and SG irons. Non- Ferrous metals and alloys – Copper, Aluminum, Magnesium, Nickel and Zinc-Properties and applications.

UNIT –V

Transformation points – Construction of TTT diagram – TTT diagram and cooling curves. Heat treatment of steels – Annealing, Normalizing, Hardening, Tempering, Austempering, Mar tempering. Surface hardening of steels – Carburizing, Nitriding, Cyaniding, Flame Hardening and Induction Hardening.

Powder Metallurgy –production of metal powders- Basic steps in powder metallurgy - advantages limitations and applications of powder metallurgy. Introduction to Nano materials.

TEXT BOOKS:

1. Introduction to Physical Metallurgy : Avner
2. Materials Science and Metallurgy : Kodgire V.D.

REFERENCE BOOKS:

1. Physical Metallurgy : Raghavan V
2. Materials Science and Metallurgy : Krishna Reddy. L
3. Materials Science and Metallurgy : Khanna O.P.