

SYLLABUS

ME3392 ENGINEERING MATERIALS AND METALLURGY

UNIT I: CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast-Iron microstructure, properties and application.

UNIT II: HEAT TREATMENT

Definition – Full annealing, stress relief, recrystallisation and spheroidising –normalizing, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram – continuous cooling Transformation (CCT) diagram – Austempering, Martempering – Hardenability, Jominy end quench test -case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening – Thermo-mechanical treatments- elementary ideas on sintering.

UNIT III: FERROUS AND NON-FERROUS METALS

Effect of alloying additions on steel (Mn, Si, Cr, Mo, Ni, V, Ti & W) – stainless and tool steels – HSLA - Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons, Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys; Al-Cu – precipitation strengthening treatment – Titanium alloys, Mg-alloys, Ni-based super alloys

– shape memory alloys – Properties and Applications-overview of materials standards

UNIT IV: NON-METALLIC MATERIALS

Polymers – types of polymers, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PAI, PPO, PPS, PEEK, PTFE, Thermoset polymers – Urea and Phenol formaldehydes – Nylon, Engineering Ceramics – Properties and applications of Al_2O_3 , SiC , Si_3N_4 , PSZ and SIALON – intermetallics – Composites - Matrix and reinforcement Materials-applications of Composites - Nano composites.

UNIT V: MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

Mechanisms of plastic deformation, slip and twinning – Types of fracture – fracture mechanics - Griffith's theory - Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Micro and nano-hardness tests, Impact test Izod and charpy, fatigue and creep failure mechanisms

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Two Marks Questions and Answers

A1-E5

Solved Question Papers

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