UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Mechanical Engineering (2019-20)

Title of Course: Engineering Materials
Course Code: MEC406
L-T Scheme: 3-0 **Course Credits: 3**

Lesson Plan

Sl.No.	Syllabus	Contact Hrs.
1.	**Introduction:** Material Science—its importance in engineering; Classification of Materials—metals, polymers, ceramics, composites; Advanced materials—semiconductors, smart materials, nano-materials; Review atomic structure, Atomic bonding in solids—bonding forces and energies; ionic/covalent/metallic bonding.	1
2.	**Crystal Structure:** Fundamental concepts; Unit cells; seven crystal systems; single crystal, polycrystalline and non-crystalline materials; Metallic crystal structures—FCC, atomic packing factor, BCC & HCP structures, crystallographic Notation of atomic planes and Directions (Miller Indices), polymorphism and allotropy, Crystal imperfection.	6
3.	**Imperfections in Metals:** Point defects due to vacancy & impurities, alloys, solid solutions; Dislocations—linear defects, interfacial defects, grain boundaries.	2
4.	**Phase Diagrams:** Definition and basic concepts; solubility limit; Phase equilibria, one-component phase diagram, binary phase diagram, interpretation of phase diagrams.	3
5.	**Iron-carbon System:** allotropy of iron, iron-iron carbide phase diagram, properties and uses of plain carbon steel	2
6.	**Classification of Metals and Alloys- compositions, general properties and uses:** 6.1 **Ferrous alloys:** Classification –low carbon steels, medium carbon steels, high carbon steels, stainless steels, alloy steels, tool and die steel, cast irons. 6.2 **Non-ferrous alloys:** Copper & Copper alloys; Aluminum alloys; Zinc alloys; Nickel alloys; Lead & Tin alloys;	6
7.	**Mechanical Properties of Materials:** Elastic properties of materials—tensile and compressive stress and strain, stress-strain behaviour, modulus of elasticity (Young's modulus), yield strength, tensile strength, plastic deformation, true stress and strain; Ductility; Resilience; Toughness, impact tests; Hardness- Brinell, Rockwell and Vickers hardness and their testing procedures, correlation between hardness and tensile strength; Fatigue strength; Effect of temperature on tensile strength & impact properties, creep failure.	6
8.	**Heat Treatment:** Definition and purposes; Heat treatment processes for steels—Hardening, structural change during heating and cooling, factors affecting hardening; Tempering; Austempering; Normalizing; Annealing—full annealing, spheroidising annealing, stress–relieving, recrystallisation annealing; Preciptation or Age Hardening of non-ferrous alloys.	4

9.	**Polymers & Elastomers:** Definition; How polymers are made- polymerization; Polymer molecular structures; Thermoplastics & Thermosets; Special characteristics like low sp. gravity, optical, electrical & thermal property, decorative color, easy formability, low corrosion etc; Uses of polymers and elastomers.	2
10.	**Ceramic Materials:** What is ceramics; common ceramic materials and their characteristics; How ceramics are made—sintering and vitrification process; Ceramic structures; Properties and applications.	2
11.	Introduction to non-destructive testing (NDT), Introduction to corrosion, Introduction to various standards used in industry for testing.	2

Text Book:

1. Donald R Askeland and Pradeep, P.Phule (2006), The Science
2. Engineering of Materials for Science and Engineering, 5th edition
3. Materials Science, R.S. Khurmi and Sedha

References

1. Materials Science and Engineering by W.D. Callister and adapted by R.Balasubramaniam,Willey India, 2010 Ed.
2. Engineering Materials: properties and selection by Budinski&Budinski,9thEd.,Prentice HallIndia
3. Engineering Materials and Metallurgy byR.Srinivasan, 2ndEd.,TataMcGrawHill.
4. Materials & Processes in Manufacturing by E. P. Degarmo and adapted by Black & Kosher, 10thEd.,Wiley India.
5. Materials Science and Engineering by V. Raghavan, 5thEd.,Prentice HallIndia.