

GUJARAT TECHNOLOGICAL UNIVERSITY

MANUFACTURING ENGINEERING

B. E. SEMESTER: III

Subject Name: **Engineering Materials and Metallurgy**

Subject Code: **133403**

Sr. No	Course Content
1.	<p>Constitution Of Alloys And Phase Diagrams</p> <p>Constitution of alloys – Solid solutions, substitutional and interstitials – Phase diagrams and microstructure development: Isomorphous, eutectic, peritectic, eutectoid and peritectoid alloy systems. Iron-Iron carbide equilibrium diagram, Development of microstructures in Iron- carbon alloys</p>
2.	<p>Heat Treatment</p> <p>Full annealing-stress relief, Recrystallisation- Spheroidizing, Normalising, Hardening and tempering of steel. Isothermal transformation diagrams- TTT– CCT cooling curves - Hardenability, Jominy end quench test – Austempering, martempering – case hardening, carburizing, nitriding, cyaniding, carbonitriding –flame and induction hardening – vacuum and plasma hardening – current trends- thermo-mechanical treatments- elementary ideas on sintering.</p>
3.	<p>Ferrous And Non Ferrous Metals</p> <p>Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W)- classification of steels (tool steel, stainless)– cast irons – alloy cast irons- Copper and Copper alloys –Aluminum and its alloys- Magnesium and its alloys– Titanium and its alloys- Nickel and Cobalt alloys, properties and applications of these materials.</p>
4.	<p>Non-Metallic Materials</p> <p>Types, properties and applications: Polymers – Commodity Plastics, Engineering Plastics, Specialty Plastics – Thermosetting Plastics – Bio-Degradable Plastics, Ceramics and Composites– Super conductors- nanomaterials and their properties.</p>
5.	<p>Mechanical Properties And Testing</p> <p>Crystal imperfections- Dislocations- Strengthening mechanisms- Elastic, anelastic and viscoelastic behaviour – modulus of elasticity- plastic deformation- Mechanical tests- tension, compression, impact, hardness- effect of temperature, grain size , solutes and precipitates on dislocation dynamics – Mechanism of Fracture - mechanism of creep-creep resistant materials- creep tests- fracture toughness- ductile-brittle transition –deformation mechanism maps- fatigue fracture-fatigue test.</p>

Text Books:

1. Raghavan. V. Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd, 5th edition, 2007.
2. Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, Revised Indian edition 2007.

Reference Books:

1. George E. Dieter, Mechanical Metallurgy, McGraw Hill, 2007.
2. Sydney H Avner, “Introduction to Physical Metallurgy”, 2/E Tata McGraw Hill Book Company, 2007.
3. Kenneth G. Budinski and Michael K. Budinski “Engineering Materials”, PHI / Pearson Educations, 8th Edition, 2007.
4. G.S. Upadhyay and Anish Upadhyay, “Materials Science and Engineering”, Viva Books Pvt. Ltd, 2006.
5. James F. Shackelford and Madanpalli K. Muralidhara, Introduction to Materials Science for Engineers, Pearson Education, 6th edition, 2007.
6. Donald R. Askeland and Pradeep P. Phulé, The Science and Engineering of Materials, Thomson 5th edition, 2007.