

METALLURGY AND MATERIAL SCIENCE ENGINEERING

III Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME005	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45		Tutorial Classes: 15		Practical Classes: Nil			Total Classes: 60	
<p>OBJECTIVES:</p> <p>The course should enable the students to:</p> <ol style="list-style-type: none"> I. Understand the physical and mechanical, metallurgical engineering concepts for metals and preparation of alloys II. Analyze the microstructures of metals, alloys and relationship to heat treatment. III. Compare the properties of ceramics, glasses, composites and polymers for industrial applications. <p>COURSE LEARNING OUTCOMES (CLOs):</p> <ol style="list-style-type: none"> 1. Analyze the structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, Atomic packing factor, Coordinate number etc. 2. Explain the necessity of alloying, types of solid solution and intermediate alloy phases. 3. Explain the concept of phase and phase diagram and understand the basic terminologies associated with metallurgy. 4. Construction of phase diagrams and identification of different phases and invariant reaction. 5. Understand and suggest the heat treatment processes and types, and significance of mechanical and metallurgical properties with respect to microstructures. 6. Explain the concept of Hardenability and demonstrate the test used to find the Hardenability of steels. 7. Analyze the microstructure of metallic materials using phase diagram and modify the microstructure and properties using different heat treatment processes. 8. Define and differentiate engineering materials on the basis of structure and properties for engineering applications. 9. Explain features, classification, and application of materials like polymers like thermosetting, thermoplastics. 10. Explain features, classification, and application of materials like ceramics. 11. Explain features, classification, and application of materials like composites. 12. Differentiate the properties and application of various materials like ceramics, composites and polymers. 13. Enable students to understand various material standards. 14. Enable students for selection of material for product design 15. Enable students for selection of material for manufacture. 16. Develop skills for lifelong learning in specialized materials in engineering areas 								
Unit-I	STRUCTURE OF METALS						Classes: 12	
Structure of metals: Crystallography, Miller indices, packing efficiency, Density calculations, Grains and grain boundaries, Effect of grain size on the properties, Determination of grain size by different methods. Constitution of alloys: Necessity of alloying, Types of solid solutions, Hume-Rothery's rules, Intermediate alloy phases								

Unit -II	PHASE DIAGRAMS	Classes: 12
<p>Joint probability distributions, joint probability mass, density function, marginal probability mass, density functions; Correlation: Coefficient of correlation, the rank correlation; Regression: Regression coefficient, the lines of regression, multiple correlation and regression. Phase Diagrams: Construction and interpretation of phase diagrams, Phase rule, Lever rule. Binary phase diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.</p>		
Unit -III	ENGINEERING MATERIALS-I STEELS	Classes: 12
<p>Engineering Materials-I Steels: Iron –Carbon phase diagram and heat treatment: Study of iron-iron carbide phase diagram, Construction of TTT diagrams, Annealing, Normalizing, Hardening and Tempering of steels, Hardenability, Alloy steels.</p>		
Unit -IV	ENGINEERING MATERIALS –II &III	Classes: 12
<p>Engineering Materials –II: Cast Irons: Structure and properties of White cast iron, malleable cast iron Grey cast iron. Engineering materials –III: Non-ferrous metals and alloys: Structure and properties of aluminum copper and its alloys, Al-Cu phase diagram, Titanium and its alloys.</p>		
Unit -V	ENGINEERING MATERIALS –IV	Classes: 12
<p>Engineering materials –IV: Ceramics, Polymers and composites: Crystalline ceramics, glasses, cermets: Structure, properties and applications. Classification, properties and applications of composites, Classification, properties and applications of polymers.</p>		
Text Books:		
<ol style="list-style-type: none"> 1. Sidney H Avner, “Introduction to Physical Metallurgy”, McGraw-Hill Education, 2nd Edition, 2008. 2. Donald R Askeland, Thomson, “Essentials of Material Science and Engineering”, Thomson Press, 1st Edition, 2005 		
Reference Books:		
<ol style="list-style-type: none"> 1. Kodgire, “Material Science and Metallurgy”, Everst Publishing House, 12th Edition, 2002 2. William, Callister, “Material science and Engineering”, Wiley, 9th Edition, 2014. 3. V Raghavan, “Elements of Material Science”, PHI Learning Company Pvt Ltd, 6th Edition, 2015 4. Dr. Amandeep Singh Wadhva, “Engineering Materials and Metallurgy”, Laxmi Publications, 1st Edition, 2008. 		
Web References:		
<ol style="list-style-type: none"> 1. https://www.youtube.com/user/MaterialsScience2000 2. http://www.nptel.ac.in/courses/113105023/ 		
E-Text Books:		
<ol style="list-style-type: none"> 1. http://engineeringstudymaterial.net/ebook/material-science-and-engineering-an-introduction 2. http://www.scoopworld.in/2015/04/metallurgy-sciencem-text-books-and-notes.html 3. http://engineeringstudymaterial.net/ebook/material-science-and-engineering-an-introduction/ 4. https://books.google.co.in/books/about/Material_Science_and_Metallurgy.html?id=au1bg8ba_z8c 		