MATERIALS ENGINEERING

III Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEC07	Core	3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Prerequisite: Engineering Chemistry and Modern Physics

I. COURSE OVERVIEW:

Materials Engineering subject is backbone to mechanical engineering discipline. The students are given inputs on fundamentals of crystallography, microstructures and relation to properties of materials. Also students acquire knowledge on phase diagrams, heat treatment which will enable them to select materials for industrial applications. Inputs are also planned on ceramics, glasses, polymers and composites as present day designs are based on many advanced materials.

II. COURSE OBJECTIVES:

The students will try to learn:

I	The fundamental knowledge of crystallography and phase diagrams under various chemical compositions of ferrous and non ferrous metals.
II	The mechanical behavior of materials, phase diagram, heat treatment, failure of materials and applications with recent materials..
III	The mathematical modeling of determinant structures to present a wealth of real world engineering examples how material science is useful in engineering practices.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Recall** the concepts of basic crystallography and imperfections ofvarious crystals for improving the performance of materials.	Remember
CO 2	**Identify** the atomic packing factor of unit cells of various crystalstructures to study the properties of materials.	Apply
CO 3	**Choose** the percentage of chemical composition of various materials to determine the proportions and identity of the majoroxides of materials.	Apply
CO 4	**Explain** the concept of phase diagram and the basic terminologies associated with metallurgy to construction andidentify the phase diagrams and reactions.	Understand
CO 5	**Experiment with** the structure of materials at different levels of crystalline materials for calculating atomic packing factor andco-ordination number.	Apply
CO 6	**Explain** features and classification of newer class material for better performance at lower cost, and less dependence on importsof strategic and critical materials.	Understand

IV. COURSE SYLLABUS:

MODULE –I: STRUCTURE OF CRYSTALLINE SOLIDS (09)

Structure of crystalline solids: Atomic structure & bonding in solids- Unit cell, Space lattice, Crystal structures and its types-calculations of radius, Coordination Number and Atomic Packing Factor for different cubic structures, Indices for planes and directions - Imperfection in solids, point defects, Line defects and Planar defects.

MODULE –II: PHASE DIAGRAMS (09)

Phase diagrams: Basic terms-Solid solutions - Gibbs phase rule- Lever rule – cooling curves Phase diagrams - construction of phase diagrams- binary phase diagrams - Al-Si phase diagram- Invariant reactions, eutectic, peritectic, eutectoid, peritectoid reactions, metatectic & monotectic reactions.

MODULE –III: ENGINEERING MATERIALS-I (09)

Engineering Materials I: Steels and Iron - Carbon phase diagram and heat treatment, study of iron – carbon diagram. Construction of TTT diagrams, annealing, normalizing, hardening and tempering of steels.

MODULE –IV: ENGINEERING MATERIALS-II, III (09)

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, titanium and its alloys.

MODULE-V: ENGINEERING MATERIALS-IV (09)

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.

V. TEXT BOOKS:

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.

VI. REFERENCE BOOKS:

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. Er. Amandeep Singh Wadhva, "Engineering Materials and Metallurgy", Laxmi Publications, 1st Edition, 2008.
5. Traugott Fisher, "Material Science", Academic Press Elsevier, 1st Edition, 2013.

VII. WEB REFERENCES:

1. https://www.youtube.com/user/MaterialsScience2000
2. http://www.nptel.ac.in/courses/113105023/

VIII. E-TEXT BOOKS:

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