

ENGINEERING MATERIALS SELECTION AND DESIGN

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	FMD403	Engineering Materials Selection and Design	3	0	0	9

Course Objective

The main objective of this course is to give students appropriate competence for qualified materials selection and their design for engineering applications.

Learning Outcomes

- Students will have a thorough systematic approach to construct and use material property and material processing charts to discern a small set of promising materials for specific applications.
- Students can conceive and design new and hybrid material solutions that will fill white spaces on the material property charts.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	The evolution of engineering materials: materials families and classes, material properties	4	Students will learn the breadth of engineering materials, their properties and means for processing them.
2	Material design process: material and process information for design, the selection strategy: translation, screening, ranking and documentation	6	Students will learn methodologies to develop a strategy for selecting materials and processes that is design-led.
3	Materials selection based on properties: density, stress, strain stiffness, moduli, material property charts, manipulating the modulus and density, material acoustics	6	Students will learn different ways to use the property charts to identify combinations of properties for selection of materials.
4	Materials selection for damage resistance and damage tolerance: solutions to elastic and plastic problems, fracture and fatigue, material property charts for strength, toughness and endurance limit, manipulation of properties	8	Students will examine methodologies for coping with constraints and conflicting objectives in materials design.
5	Materials for high temperature applications: temperature dependence of material properties, diffusion and creep damage, charts for creep behaviour, selection and design to cope with creep	5	Students will learn ways in which properties change with temperature, and design methods to deal with the changes.
6	Design for wear and corrosion resistance: tribological properties, friction and wear, corrosion protection: mechanism, design and material choice	7	Students will learn methodologies for the selection and design of materials for wear resistance and corrosion resistance.
7	Latest developments in the use of materials: Nature inspired materials, hybrid materials: composites, foams, laminates, case studies	6	Students will learn materials selection and design processes to develop products that require the balancing of many priorities.
	Total	42	

Text Books:

S. No.	Resource/Book Name	Author(s)/Editor(s)	Publisher
1	Materials: Engineering, Science, Processing and Design	M. Ashby, H. Shercliff and D. Cebon	Elsevier

Reference Books:

S.No.	Resource/Book Name	Author(s)/Editor(s)	Publisher
1	Engineering Materials 1: An Introduction to Properties, Applications and Design	Michael F. Ashby and David R. H. Jones	Elsevier
2	Engineering Materials 2: An Introduction to Microstructures, Processing and Design	Michael F. Ashby and David R. H. Jones	Elsevier
3	ASM Handbook, Volume 1, Properties and Selection: Irons, Steels, and High Performance Alloys		ASM International
	ASM Handbook, Volume 2, Properties and Selection: Nonferrous Alloys and Special-Purpose Materials		ASM International