

Branch Name:	Mechanical Engineering
Program Code:	ET101
Course Name:	Engineering Materials and Applications
Course Code:	2ET1010302T
Pre-requisite Course:	Zeal to Learn the Subject

Course Objectives:

1. Broad understanding of different types of engineering materials and their applications.
2. Correlation between the internal structure of materials and their mechanical properties.
3. Various methods to quantify the mechanical integrity of materials and their failure criteria.
4. Interpretation of equilibrium phase diagrams of alloys.
5. Different heat treatment methods to tailor the properties of Fe-C alloys.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours Per Week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
04	03	01	-	04	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Engineering Materials and Classification: Metals, plastics, ceramics and composites; Relevant properties (physical, mechanical, thermal, electrical, chemical), cost; Range of applications; Material designation and standards; Ashby diagrams; Selection criteria and process.	04	10
2	Mechanical Properties and Testing: Tensile, compression, torsion, fatigue, fracture and wear tests; Young's modulus; Relations between true and engineering stress-strain curves; Generalized Hooke's law; Yielding and yield strength; ductility, resilience, toughness and elastic recovery; Hardness measurement their relation to strength; SN curve, endurance and fatigue limits; Introduction to non-destructive testing (NDT).	08	20
3	Metal and Alloys: Iron and steel; Stainless steel and tool steels; Copper & its alloys – brass, bronze & cupro-nickel; Aluminium & Al-Cu-Mg alloys; Nickel based superalloys & Titanium alloys; Phase diagrams and interpretation of microstructure; Iron Iron-carbide phase diagram and cooling (TTT) diagrams.	09	20

4	Heat Treatment: Heat treatment of Steel; Annealing, tempering, normalizing, spheroidising, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.	09	20
5	Polymers, Ceramics and Composites: Polymers – Classification and applications; Polymerization techniques; Ceramics – Oxide ceramics, ceramic insulators, bio-ceramics and Glasses; Composites – Reinforcement, matrix, metal matrix composites, ceramic composites, polymer composites; Other advanced materials – biomaterials, optical materials, high temperature materials, energy materials, and nanomaterials.	06	15
6	Electrical and Magnetic Materials: Conducting and resisting materials – types, properties and applications; Semiconducting materials – properties and applications; Magnetic materials – Soft and hard magnetic materials and applications; Superconductors and dielectric materials – properties and applications; Smart materials; Sensors and actuators; Piezoelectric, magnetostrictive and electrostrictive materials.	06	15

Reference Books:

1. W. D. Callister, “Materials Science & Engineering,” Wiley India, 2014.
2. K. G. Budinski and M.K. Budinski, “Engineering Materials”, PHI India, 2002.
3. V. Raghavan, “Material Science and Engineering”, PHI India, 2015.
4. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.
5. M.F. Ashby and D.R.H. Jones, Engineering Materials 1 - An Introduction to Properties, Applications and Design, Butterworth-Heinemann, USA, 2011.
6. Khanna O.P.” A text book of Material science and Metallurgy”, Dhanpat Rai Publications, 2010.

List of Tutorials:

1. Tutorial on Engineering Materials and its Classification.
2. Tutorial on Mechanical Properties and Testing.
3. Tutorial on Metal and Alloys.
4. Tutorial on Heat Treatment.
5. Tutorial on Polymers, Ceramics and Composites.
6. Tutorial on Electrical and Magnetic Materials.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_me90/preview
2. <http://nptel.ac.in/courses/122102008/>

Course Learning Outcomes (CLO):

CLO	Description	Bloom's Taxonomy Level
CLO1	Know the range of engineering materials, their mechanical properties and applications.	2 Understanding
CLO2	Know various methods to measure the mechanical properties of materials.	3 Applying 2 Understanding
CLO3	Know about the different applications of Polymers, Ceramics and Composites.	1 Remembering
CLO4	Learn how to improve the properties of ferrous alloys through various heat treatments.	3 Applying, 2 Understanding
CLO5	Understand the concept of materials testing and inspection.	5 Evaluate 3 Applying 4 Analyze
CLO6	Know about the types, properties and applications electrical and magnetic materials.	2 Understanding

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	M		L				M					M		
CLO2	H	M	M	M	M								L	
CLO3	H	H		H								M	L	
CLO4	H	M	H	M	M	L	M							
CLO5	L		H	M	H							M		
CLO6	M	L	M	L	M							M		

H: High, M: Medium, L: Low