

GANPAT UNIVERSITY										
FACULTY OF ENGINEERING & TECHNOLOGY										
Programme	Bachelor of Technology			Branch/Spec.			Mechanical Engineering /Mechatronics Engineering /Automobile Engineering			
Semester	II			Version			1.0.0.0			
Effective from Academic Year	2026-27			Effective from the batch admitted in			July 2026			
Course Code	<b>2ESC1108</b>			Course Name			<b>Engineering Materials and Applications</b>			
Course Category	Engineering Science Courses (ESC)									
Teaching & Learning Scheme						Examination scheme (Marks)				
	L	TU	P	Total	SL	TSL		CE	SEE	Total
Credit	3	0	0	3	45	90	Theory	50	50	100
Hours (per week)	3	0	0	3			Practical	0	0	0
L: Lecture, TU: Tutorial, P: Practical/Lab., SL: Minimum Self-Learning or Term Work Hours per Semester, TSL: Minimum Total Teaching & Self-Learning Hours per Semester, CE: Continuous Evaluation, SEE: Semester End Examination.										
Pre-requisites:										
Physics										
Course Outcomes										
COs	Description									
CO1	<b>Remember</b> different types of engineering materials and recall key material properties, designations/standards, and selection criteria.									
CO2	<b>Explain</b> mechanical behaviour and testing concepts such as stress–strain, Young’s modulus, yielding, hardness correlation, fatigue S–N curve/endurance limit etc. and describe basic NDT methods.									
CO3	<b>Apply</b> material-selection criteria to choose suitable metals/alloys and non-metals, for given engineering applications.									
CO4	<b>Analyse</b> application requirements and compare electrical, magnetic, smart materials and surface-coating methods to justify material/process choice.									
Theory Syllabus										
Unit	Content									Hours
1	<b>Engineering Materials and Classification:</b> Classification of metals, polymers, ceramics, and composites; study of relevant material properties such as physical, mechanical, thermal, electrical, and chemical properties, material designations and standards, material selection criteria and effect of processing on properties.									4
2	<b>Mechanical Properties and Testing:</b> Fundamentals of mechanical testing including tensile, compression, fatigue, fracture, and wear tests; elastic behaviour and evaluation of Young’s modulus; engineering and true stress–strain relationships; yielding behaviour and yield strength; mechanical properties, hardness testing methods and their correlation with material strength; fatigue characteristics including S–N curves, endurance limit, and fatigue strength; overview of non-destructive testing (NDT) techniques.									9
3	<b>Metal and Alloys:</b> Classification- Characteristics- Properties- Applications of Steel and its alloys, Copper and Its Alloys, Aluminium and its Alloys, Nickel-Based Superalloys, Titanium and Titanium Alloys									5
4	<b>Polymers, Ceramics and Composites:</b> Polymers: classification, properties, and applications; polymerization techniques. Ceramics: oxide ceramics, ceramic insulators, bioceramics, and glasses. Composites: reinforcements and matrix materials; metal matrix composites, ceramic matrix composites, and polymer matrix composites. Other advanced materials: biomaterials, optical materials, high-temperature materials, energy materials, and nanomaterials.									12
5	<b>Electrical and Magnetic Materials:</b> Conducting and resisting materials – types, properties and applications; Semiconducting									7

	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.	
6	<b>Surface Coating:</b> Introduction to Surface Coating, Need for surface coatings in engineering applications, Types of surface coatings methods, Powder Coating Materials, Advantages and limitations of surface coating, Industrial applications, Environmental and safety aspects	8
<b>Practical and Self Learning Content</b>		
Practical, assignments, quiz, industrial visit, field survey and tutorials are based on the above syllabus.		
<b>Text Books</b>		
1	Dr. O.P. Khanna, “Material science and metallurgy”, Dhanpat rai publications (P) Ltd.	
2	Callister’s Material Science and Engineering, 2ed, R. Balasubramaniam, Wiley India.	
<b>Reference Books</b>		
1	V. Raghavan, “Material Science and Engineering’, PHI India	
2	George E. Dieter, “ Mechanical Metallurgy ”, Tata McGraw Hill	
3	U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.	
4	K. G. Budinski and M.K. Budinski, “Engineering Materials”, PHI India	
<b>ICT/MOOCs Reference</b>		
1	<a href="https://onlinecourses.nptel.ac.in/noc22_me90/preview">https://onlinecourses.nptel.ac.in/noc22_me90/preview</a>	
2	<a href="https://nptel.ac.in/courses/112108150">https://nptel.ac.in/courses/112108150</a>	
3	<a href="https://nptel.ac.in/courses/112104173">https://nptel.ac.in/courses/112104173</a>	
4	<a href="https://nptel.ac.in/courses/112105053">https://nptel.ac.in/courses/112105053</a>	

<b>Mapping of COs, POs, and PSOs</b>														
COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	1	0	0	0	0	0	1	2	0	1
CO2	3	2	1	2	2	0	0	0	1	0	2	3	0	2
CO3	3	3	3	2	2	2	0	0	1	1	2	3	2	3
CO4	3	3	3	3	3	2	0	0	0	1	2	3	2	3

<b>Bloom's Taxonomy Level</b>				
Unit	Unit Title	Aligned COs	Learning Hours	BTL Level
1	Engineering Materials and Classification	CO1	4	R
2	Mechanical Properties and Testing	CO2	9	U
3	Metal and Alloys	CO3	5	U, A
4	Polymers, Ceramics and Composites	CO3	12	U, A
5	Electrical and Magnetic Materials	CO4	7	U, N
6	Surface Coating	CO4	8	U, N

**Note:**

- Version 1.0.0.0 (First Digit= New syllabus/Revision in Full Syllabus, Second Digit=Revision in Teaching Scheme, Third Digit=Revision in Exam Scheme, Forth Digit= Content Revision)
- 1 Hour Lecture = 1 Credit, 1 Hour Tutorial = 1 Credit, 2 Hours Practical = 1 Credit, 2 Hours Internship/Project/Seminar = 1 Credit
- As per NCrF/NEP 2020, Minimum Self-Learning or Term Work Hours per Semester should be calculated in such a way that 1 Credit should have a minimum 30 Hours of Teaching and Self Learning Engagement per semester
- Bloom's Taxonomy Level (BTL) : R: Remember, U: Understand, A: Apply, N: Analyze, E: Evaluate, and C: Create.