

COURSE CODE	COMPOSITE MATERIALS	L	T	P	C
1152ME104		3	0	0	3

1. Preamble

The course provides an introduction to the need, properties, application, and manufacturing processes of various composite materials.

2. Prerequisite

Engineering Materials and Metallurgy

1151ME117

3. Links to other courses

Project work

4. Course Educational Objectives

Students undergoing this course are expected to

- Understand the need of composites in structural and non-structural applications
- Know the, properties and application of different types of reinforcements and matrices
- Understand the fabrication techniques involved in the polymer, metal, and ceramic matrix composites

5. Course Outcomes

The students would be benefitted with the following outcomes:

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Describes various types of composite materials and their applications.	K2
CO2	Describe various manufacturing processes of Polymer Matrix Composite	K2
CO3	Apply the principles of mechanics for Metal Matrix Composites	K3
CO4	Explain the need of Ceramic Matrix Composites and their practical applications	K2
CO5	Describe the advances in composite materials	K2

(K3 – Apply)

6. Correlation of COs with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	L	L										M	L
CO2	H	L	L										M	L
CO3	H	L	L										M	L
CO4	H	L	L										M	L
CO5	H	L	L										M	L

H- High; M-Medium; L-Low

7. Course Content

UNIT I- ELEMENTS OF COMPOSITES

L-9

Fundamentals of composites, characteristics, need for composites, Enhancement of properties, Reinforcements - glass fibers, boron fibers, carbon fibers, organic fibers, aramid fibers, ceramic fibers, oxide and nonoxide fibers, Forms of reinforcements - Roving , Woven fabrics Non-woven, random mats, whiskers, Matrix materials – Polymers - Thermosetting resins, thermoplastic resins , Metals, Ceramic materials

UNIT II- POLYMER MATRIX COMPOSITES

L-9

Processing of polymer matrix composites- hand lay-up, Spray lay-up processes, Compression molding- SMC Reinforced reaction injection molding, Resin transfer molding, Pultrusion, Filament winding, Applications of polymer matrix composites.

UNIT III-METAL MATRIX COMPOSITES

L-9

Characteristics of MMCs, Various types of Metal matrix composites, Advantages and limitations of MMCs, Effect of reinforcements on properties – Volume fraction – Rule of mixtures, Processing of MMCs - Liquid state processing- stir casting, squeeze casting, infiltration, solid state processing - Powder metallurgy, diffusion bonding, In situ processes, applications of MMCs

UNIT IV- CERAMIC MATRIX COMPOSITES

L-9

Need for CMCs, Processing of CMCs- cold pressing and sintering, hot pressing, infiltration, chemical vapor deposition and chemical vapor impregnation, sol-gel and polymer pyrolysis, high temperature synthesis properties and applications of CMC.

UNIT V- ADVANCES IN COMPOSITES

L-9

Carbon fiber composites – properties, chemical vapor deposition– oxidative etching, liquid phase oxidation carbon/carbon composites - properties and applications of C/C Composites, multifilament superconducting composites

TOTAL = 45 periods

8. Text Books

1. Ronald Gibson, Principles of Composite Material Mechanics, Tata McGraw Hill, 2013.
2. P.K.Mallick, Fiber-reinforced composites, Monal Deklar Inc., New York, 2013.

9. References

1. F.L.Matthews & R.D.Rawlings, Composite Materials, Engg and Sci, Chapman & hall, London, 2001.
2. Micael hyer, Stress Analysis of Fiber - Reinforced Composite Materials, Tata McGraw Hill, 2006.
3. Ronald Gibson, Principles of Composite Material Mechanics, Tata McGraw Hill, 2001.
4. Sanjay.K.Majumdar, Composites Manufacturing, Kindle edition, CRC press, 2001.