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|--------------------|---|----------|----------|----------|----------|
| COURSE CODE | COMPOSITE MATERIALS AND POLYMERS | L | T | P | C |
| 1153ME104 | | 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

3. Links to other courses

- Composites & Nano Materials
- Composite Materials and Mechanics

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 |

(K2 – Comprehend, 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- INTRODUCTION TO 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, Engineering & Sciences, 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.

| Revised Bloom's Category | Internal | | | | University Examination % |
|--------------------------|----------------|-------------------|-----------------|--------------------|--------------------------|
| | Unit Test- I % | Mid Term Test I % | Unit Test- II % | Mid Term Test II % | |
| Remember | 40 | 40 | 10 | 20 | 30 |
| Understand | 60 | 60 | 60 | 60 | 60 |
| Apply | | | 30 | 20 | 10 |
| Analyse | | | | | |
| Evaluate | | | | | |
| Create | | | | | |

10. Revised Bloom's based Assessment Pattern

| Revised Bloom's Category | Assignments | |
|--------------------------|----------------------------------|---------------------------------|
| | 1 (CO1 &CO2) (Max marks in %) | 2 (CO3&CO4) (Max marks in %) |
| Remember | 30 | 10 |
| Understand | 70 | 80 |
| Apply | | 10 |
| Analyze | | |
| Evaluate | | |
| Create | | |