# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Master of Engineering**

**Level: PG**

**Branch : Textile Engineering**

**Subject Code : ME02025041**

**Subject Name :Textile Composites**

| | |
|---|---|
| w. e. f. Academic Year: | 2024-25 |
| Semester: | 2 |
| Category of the Course: | Professional Elective Course |

| | |
|---|---|
| **Prerequisite:** | Students should have knowledge of basic textile product like fibre, yarn and fabric. |
| **Rationale:** | Composite material is a new emerging material for various field of technical textile. The knowledge about composite material and its application is essential to meet the industrial demands. |

**Course Outcome:**

After Completion of the Course, Student will able to:

| No | Course Outcomes | RBT Level |
|---|---|---|
| 01 | Basic concepts and application of textiles composites. | R,U |
| 02 | Understand different type of textile reinforcement. | R,U |
| 03 | Understand different type of matrices. | R,U |
| 04 | Understand manufacturing of polymer matrix composite. | R,U |
| 05 | Evaluate the properties of thermoset and thermoplastic composite. | U,A,E |

**Revised Bloom's Taxonomy (RBT)*

**Teaching and Examination Scheme:**

| Teaching Scheme (in Hours) | | | Total Credits L+T+ (PR/2) | Assessment Pattern and Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | Tutorial / Practical | | |
| L | T | PR | C | ESE (E) | PA / CA (M) | PA/CA (I) | ESE (V) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 20 | 30 | 150 |

**Course Content:**

| Unit No. | Content | No. of Hours | % of Weightage |
|---|---|---|---|
| 1. | Introduction and overview of composite materials and their need, | 6 | 14 |

| | | | |
|---|---|---|---|
| | Enhancement of properties, classification of composites, Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC), Application of composites. | | |
| 2. | Application of high-performance fibre - Glass fibres, Carbon fibres, aramid fibre, UHMWPE, PBO and PEEK; Application of Natural fibres- bast, leaf, seed etc. 2D and 3D preform like woven, knitted, nonwoven, braided for various application. | 10 | 24 |
| 3. | Properties and applications of natural matrices, thermoplastic and thermoset resins; mechanism of interaction of matrices and reinforcements; optimization of matrices | 07 | 14 |
| 4. | Classification; methods of composites manufacturing for both thermoplastics and thermosets-Hand lay-up, spray-up, filament winding, resin transfer molding, compression molding, pultrusion, resin infusion/vacuum bag moulding, autoclave, Pre-peg technology.post processing of composites and composite design requirements. | 12 | 28 |
| 5. | Fibre volume and weight fraction, specific gravity of composites, tensile, flexural, impact, compression, inter laminar shear stress and fatigue properties of composites. | 10 | 20 |
| | **Total** | **45** | **100** |

**Suggested Specification Table with Marks (Theory):**

| Distribution of Theory Marks (in %) | | | | | |
|---|---|---|---|---|---|
| **R Level** | **U Level** | **A Level** | **N Level** | **E Level** | **C Level** |
| **25** | **30** | **20** | **15** | **5** | **5** |

*Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)*

**References/Suggested Learning Resources:**

**(a) Books:**


1. Composite Materials and Processing, M. Balasubramanian, CRC Press, 2013.
2. Design and Manufacture of Textile Composites, Long A C, Woodhead Publishing Limited, 2006.
3. Advanced Polymer composites, BorZ. Jang, ASM International,USA,1994.
4. Fibrous and Textile Materials for Composite Applications, Sohel Rana, Raul Fangueiro, Springer Singapore, 2016.

5. 3-D Textile Reinforcements in Composite Materials, Antonio Miravete, Woodhead Publishing Limited, 1999.
6. Composite Materials: Processing, Applications, Characterizations, Kamal K. Kar, Springer Berlin Heidelberg, 2017.
7. Fibre-Reinforced Composites Materials Manufacturing and Design, P.K. Mallick, CRC Press (Third Edition), 2007.
8. Fundamentals of Fibre Reinforced Composite Materials, A.R. Bunsell, J Renard, Institute of Physics Publishing Ltd, 2005.
9. Composite Materials: Science and Engineering by K. K. Chawla, Springer, 2015
10. NPTEL course on High Performance and speciality fibres by M. Jassal, IIT Delhi.

**(b) Open source software and website:**

1. https://nptel.ac.in
2. World Wide Web, Google Search Engine etc.

**Suggested Course Practical List:**

1. Preparation of polymeric film by casting process with & without microfillers and nanofillers.
2. Fabrication of glass fibre/ natural fibre reinforced Composites by hand lay-up technique.
3. Fabrication of Chopped fibre reinforced composite by compression moulding.
4. Fabrication of particulate composites
5. Fabrication of woven fabric composite laminates
6. Fibre content and Porosity measurement of composites
7. Mechanical Properties of Material such as Tensile strength, Compressive strength, Impact strength, Hardness
8. Thermal Properties of Material - Thermal Gravimetric Analysis, Differential Scanning Calorimetry, Thermo mechanical Analysis
9. Non Destructive Testing of composite

**List of Laboratory/Learning Resources Required:**

Sample warping machine and weaving loom, Braiding machine, Warp knitting machine, circular weaving machine, Hydraulic compression moulding machine, Vacuum chamber, Calendaring, Pultrusion, Coating and Lamination, Impact testing machine, UTM 100kN for Composite testing, etc.

1. Collection and identification of various type of reinforcement material.
2. Visit to any composite industry.

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