# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3172920**

**Semester:** VII
**Subject Name:** Textile Reinforced Composites

**Type of course :** Open Elective

**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.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 3 | 0 | 0 | 3 | 70 | 30 | 0 | 0 | 100 |

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | **Introduction to Composite:** Definition, classification of composites, function of the matrix and reinforcement in composites, advantages & disadvantages of composites, properties of composites, application of composites. | 4 |
| 2 | **Textile Reinforcement Material:** Fiber reinforcements- glass fibres, carbon fibres, aramid fibre, ceramic fibres, polyethylene fibre, natural fibers- bast, leaf, seed etc ; 2d fabric: woven fabric, knitted fabric, nonwoven fabric, braided fabric; 3d fabrics for composites, nanocomposite, biocomposites. | 10 |
| 3 | **Matrix Materials:** Polymer matrix, properties of polymers, thermoset polymers, thermoplastics, comparison of thermoset polymers and thermoplastics, introduction of metallic matrix materials & ceramic matrix materials. | 6 |
| 4 | **Processing of Polymer Matrix Composites:** Hand lay-up process, spray-up process, resin transfer molding, resin infusion/vacuum bag moulding, autoclave process, compression molding, filament winding process, pultrusion; thermoplastic composite processing: film stacking, thermoplastic tape-laying etc. Meaning of lamina, laminates, and representation of laminates. Pre-peg technology. | 12 |
| 5 | **Testing of Textile Composite:** Characterization of physical constituents of composites, composite density, fibre volume fraction, void content, testing of tensile strength of composites, 3 & 4 point bending of composites, compression testing of composites. | 6 |
| 6 | **Application of Textile Composites:** Applications of textile reinforced composites in structural components, ballistic, aerospace, automotive, medical, sporting goods, marine, infrastructure etc. | 4 |

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**Suggested Specification table with Marks (Theory): (For BE only)**

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| 15 | 25 | 25 | 5 | 0 | 0 |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

**Reference Books:**


1. Design and Manufacture of Textile Composites, Long A C, Woodhead Publishing Limited, 2006.
2. Handbook of Polymer Composites for Engineering, Leonard Hollaway, Woodhead Publishing Limited, 2007.
3. Composite Materials and Processing, M. Balasubramanian, CRC Press, 2013.
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. Polymer Nanocomposites Handbook, Rakesh K. Gupta, Elliot Kennel and Kwang-Jea Kim, CRC Press Taylor & Francis, New York, 2010.
8. Fiber-Reinforced Composites Materials Manufacturing and Design, P.K. Mallick, CRC Press (Third Edition), 2007.
9. Fundamentals of Fibre Reinforced Composite Materials, A.R. Bunsell, J Renard, Institute of Physics Publishing Ltd, 2005.


**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Understand basic concepts of textiles reinforce composite. | 30 |
| CO-2 | Compare different type of polymer matrix and it's application for composite. | 25 |
| CO-3 | Understand different manufacturing processes of polymer matrix composite. | 30 |
| CO-4 | Test physical and mechanical properties of textile composite. | 15 |

**List of Open Source Software/learning website:** Any Search Engine, NPTEL, Swayam portal etc.