

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BRANCH NAME: AERONAUTICAL ENGINEERING**  
**SUBJECT NAME: MECHANICS OF COMPOSITE MATERIALS**  
**SUBJECT CODE: 2170103**  
**B.E. 7<sup>th</sup> SEMESTER**

**Type of course: Analytical**

**Prerequisite: Mechanics of Solids**

**Rationale: Composite materials are extensively used in aviation industry for the manufacturing of various parts of an aircraft. Composites are known to have high strength to weight ratio and they therefore become the material of choice for aircraft manufacturing. There are several other benefits of using composite materials. This subject offers the knowledge and understanding of the engineering behavior of composite materials, preliminary design concepts and their appropriate use.**

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
4	0	0	4	70	20	10	-	-	-	100

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
1	<b>Introduction to Composite Materials:</b> Definitions: Composite material, Fiber, Matrix. Types of fibers and Raw Fiber Properties, Types of Matrix, Prepegs, Fillers and other Additives	2	10
2	<b>Advantages and applications:</b> Advantages of Composite Materials and Structures. Applications and Use of Composite materials in present world	2	10
3	<b>Basics of composites:</b> Mechanical Behavior of Composite Materials. Lamina, Laminate: The basic building block of a composite material	2	20
4	<b>Micromechanical Analysis of Composite Strength and Stiffness:</b> Properties of typical composite materials. Volume and Weight Fractions. Longitudinal Strength and Stiffness. Transverse Modulus. In-plane shear Modulus. Poisson's ratio	9	20

<b>5</b>	<b>Elastic Properties of the Unidirectional Lamina:</b> Stress-strain relationships. Engineering Constants. Stress strain relations of a Thin Lamina. Examples	<b>08</b>	<b>20</b>
<b>6</b>	<b>Analysis of Laminated Composites:</b> Laminates, Basic Assumptions, Strain-Displacement Relationship, Stress-Strain Relationships, Equilibrium Equations, Laminate Stiffness, Determination of Lamina Stresses and Strains, Types of Laminate Configuration, Balanced Laminate, Anti-symmetric Laminate, Examples	<b>12</b>	<b>20</b>

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

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>25%</b>	<b>30%</b>	<b>10%</b>	<b>20</b>	<b>15</b>	<b>0%</b>

**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. Mechanics of Composite Materials and Structures**  
-Madhujit Mukhopadhyay  
Universities Press
- 2. Mechanics of Composite Materials**  
- R M Jones  
CRC Press  
Taylor & Francis

**Course Outcome:**

After learning the course the students should be able to:

1. Understand the significance of replacing existing metal structures with composite materials wherever beneficial
2. Highlight the appropriate use of composite structures in the industry
3. Comprehend the complexity of design of composite materials and structures
4. Mainly understand the mechanics of composite materials

**List of Experiments:**

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**Design based Problems (DP)/Open Ended Problem:**

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**Major Equipment:**

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**List of Open Source Software/learning website:** <http://nptel.ac.in/>

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.