IV B.TECH - I SEMESTER
MECHANICS OF COMPOSITE MATERIALS

Course Code: ME7T5C	**Credits: 3**
Lecture: 3 periods/week	**Internal assessment: 30 marks**
Tutorial: 1 period/week	**Semester end examination: 70 marks**

COURSE OBJECTIVES:

- Explain the behavior of constituents in the composite materials
- Enlighten the students in different types of reinforcement
- Develop the student's skills in understanding the different manufacturing methods available for composite material.
- Illuminate the knowledge and analysis skills in applying basic laws in mechanics to the composite materials.

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

1. Explain the mechanical behavior of layered composites compared to isotropic materials.
2. Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro levels.
3. Determine stresses and strains relation in composites materials.

Pre-Requisites: Mechanics of solids, Metallurgy& material science

UNIT I
INTRODUCTION TO COMPOSITE MATERIALS:

Introduction, Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, nature-made composites, and applications. Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT II
ELASTIC BEHAVIOR OF COMPOSITE LAMINA USING MICROMECHANICS:

Introduction, Strength of Materials Approach, Semi- Empirical Models, Elasticity Approach, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, , Ultimate Strengths of a Unidirectional Lamina

UNIT III
ELASTIC BEHAVIOR OF COMPOSITE LAMINA USING MACROMECHANICS:

Introduction, Definitions: Stress, Strain, Elastic Moduli, Strain Energy, stress strain relations for general anisotropic materials, specially orthotropic materials, transversally isotropic materials, orthotropic material under plane stress and isotropic materials, relations between mathematical and engineering constants.

UNIT IV

ELASTIC BEHAVIOR OF MULTIDIRECTIONAL LAMINATES

Basic assumptions, laminate code, strain-displacement relations, stress-strain relations of a layer within a laminate, force and moment resultants, Laminate stiffness and laminate compliance, symmetric laminates, balance laminates

UNIT V

FAILURE, DESIGN OF LAMINA AND LAMINATES:

Lamina Strength Failure Theories of an Angle Lamina: Maximum Stress Failure Theory Strength Ratio, Failure Envelopes, Maximum Strain Failure Theory, Tsai–Hill Failure Theory, Tsai–Wu

Laminate: Introduction, Special Cases of Laminates, and Failure Criterion for a Laminate, and Design of a Laminated Composite

Learning Resources

Text Books:

1. Engineering Mechanics of Composite Materials, (2nd edition), by Isaac and M Daniel, Oxford University Press, 2006 .
2. Analysis and performance of fibre Composites, (Second Edition), by B. D. Agarwal and L. J. Broutman, John Wiley & sons, NewYork , New York, 1990.

Reference Books:

1. Mechanics of Composite Materials, (3ed edition), by R. M. Jones, Mc Graw Hill Company, New York, 2006.
2. Analysis of Laminated Composite Structures, by L. R. Calcote, Van Nostrand Rainfold, New York, 1969.
3. Mechanics of Composite Materials, (Second Edition), by Autar K. Kaw, CRC, 2010.