

COMPOSITE MATERIALS AND STRUCTURES

VII Semester								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE29	PCC	3	0	0	3	30	70	100
COURSE OBJECTIVES								
1. To provide knowledge on developing fundamental relationships for predicting the mechanical response of composite materials. 2. To impart knowledge on micromechanical relationships for lamina and laminated composite plates with emphasis on continuous filament.								
UNIT-I	BASIC CONCEPTS AND CHARACTERISTICS							
Introduction to materials, natural and man-made composites, Aerospace and structural applications, types and classification of composites. Reinforcements: Fibres – Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites.								
UNIT-II	MICROMECHANICS							
Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties. Advanced manufacturing methods								
UNIT-III	COORDINATE TRANSFORMATION							
Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation Elastic behavior of unidirectional composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.								
UNIT-IV	STRENGTH OF UNIDIRECTIONAL LAMINA							
Micro mechanics of failure, Failure mechanisms, strength of an orthotropic lamina, strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micro mechanical predictions of elastic constants.								
UNIT-V	ANALYSIS OF LAMINATED COMPOSITE PLATES							
Introduction thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.								
Text Books:								
1. R. M. Jones, "Mechanics of Composite Materials", 2nd Edition, Taylor & Francis 2. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and Structures", Orient Blackswan Pvt Ltd.								
Reference Books:								
1.D. Agarwal, L. J. Broutman and K. Chandrashekhara, "Analysis and Performance of Fiber Composites", 3rd Edition, John Wiley & Sons.								

2. R.F. Gibson, " Principles of composite material mechanics",3rd Edition, CRC press.

COURSE OUTCOMES

Upon successful completion of this course, the student are able to

1. Exemplify the properties and applications of composite materials used in aircraft
2. Determine the material properties of the composites using micromechanics approach
3. Exemplify the transformation of stress and strain in composite material
4. Illustrate the elastic behaviour of unidirectional composites subjected to stress
5. Predict the strength of the unidirectional lamina and laminate by major analysing techniques