MECHANICS OF COMPOSITE MATERIALS

CourseCode	20ME6702	Year	IV	Semester	I
Course Category	HONORS	Branch	ME	Course Type	Theory
Credits	4	L – T – P	3 – 1 – 0	Prerequisites	Material Science and Metallugy
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

	Statement	Skill	BTL	Units
CO1	Understand the features of Composite materials, elastic parameters at micro and macro level and related failures.	Understand, Communication	L2	1,2,3,4,5
CO2	Apply constitutive equations of composite materials and quantify mechanical behavior at micro and macro levels	Apply	L3	2,3,4
CO3	Determine stresses and strains relation in composites materials and understand the failure analysis of the composite	Apply	L3	5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1									3	1
CO2	3	3	1	1									3	1
CO3	3	3	1	1									3	1

Syllabus

Unit	Contents	Mapped COs
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.	CO1
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	CO1, CO2
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	CO1, CO2

	material under plane stress and isotropic materials, relations between mathematical and engineering constants.	
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	**CO1, CO2**
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	**CO1, CO3**

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