

I Year II Semester
Code: 17CC235

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MECHANICS AND MANUFACTURING METHODS OF COMPOSITES
(ELECTIVE – IV)

Unit – I

Basic concepts and characteristics: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites, 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.

Coordinate transformations: 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, Graphic interpretation of stress – strain relations. Off - axis, stiffness modulus, off - axis compliance.

Unit – III

Elastic behavior of unidirectional composites: Elastic constants of lamina, relation ship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations. 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 – IV

Analysis of laminated composite plates. Introduction, thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.

Unit – V

Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, hand layup, pultrusion, RTM.

TEXT BOOKS:

R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.

Engineering Mechanics of Composite Materials by Isaac and M. Daniel, Oxford University Press, 1994.

REFERENCES:

B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.

L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Reinhold, New York, 1969.