

(ME 509) MECHANICS OF COMPOSITE MATERIALS (ELECTIVE - I)

Objective of the Course:

Composite materials are being increasingly used in the engineering structures. This subject provides knowledge about types of composites, failure behaviour and stress analysis techniques.

UNIT - I

Introduction, classifications of composites, particulate composites, fiber composites, sandwich structures, applications, geometric and physical definitions, classification of fibers, classification of matrices, types and classification of FRPs, applications, production methods.

UNIT - II

Micro mechanics and macro mechanics, stress strain diagrams, fiber, matrix, composite. Micro mechanical estimation of elastic properties of lamina, different modes of failures, factors influencing the strength and stiffness, experimental characterization of composites.

UNIT - III

Hooke's law for orthotropic materials, relations between engineering constants and elements of stiffness and compliance matrices, restrictions on elastic constants, stress strain relations for lamina with arbitrary orientation, transformation of engineering constants.

UNIT - IV

Strength of an orthotropic lamina subjected to biaxial stress field, theories of failures, failure envelope, importance of sign of shear stress on strength of composites, multi directional laminates, stress-strain relations, load deformation relations, different types of laminates, compliances, laminate engineering properties.

UNIT - V

Stress analysis and safety factors for first-ply failure of laminates, computational procedure for stress and failure analysis of general multi directional laminates, hygrothermal stresses micromechanics of progressive failure, stiffness reduction, ultimate laminate failure, interlaminar stresses, edge effects.

TEXT BOOKS:

1. Isaac and M Daniel, "Engineering Mechanics of Composite Materials", 2nd Edition, Oxford University Press, 2006.

REFERENCE BOOKS:

1. B.D. Agarwal and L.J. Broutman, "Analysis and performance of fibre Composites", 3rd Edition, Wiley- Inter-science New York, 2006.
2. R.M. Jones, "Mechanics of Composite Materials", 2nd Edition, Taylor and Francis Publications, 1999.