

IIT Mandi
Proposal for a New Course (Modified)

Course Name: Mechanics of Composite Materials

Course Number: ME 617

Credit: 3-0-0-3

Prerequisites: Mechanics of Solids

Students intended for: MS/PhD

Elective or Compulsory: Elective

Semester: Odd/Even: Odd

Course Objectives

This course serves as an introduction to the use of composite materials in modern structures. The bulk of the material covers the solid mechanics issues needed for preliminary design purposes.

Course Outline:

Introduction, Classification of Composite Materials, Linear Anisotropic Materials: Generalized Hooke's Law, Fundamental Equations and Variational Solution Procedures. Effective Material Moduli for Composites: Elementary Mixture Rules for Fiber-Reinforced Laminae, Improved Formulas for Effective Moduli of Composites. Strength criteria of lamina. Classical Laminate Theory. Modeling and Analysis of Beams and Plates, strength of laminate.

Course Modules:

1. Introduction, Classification of Composite Materials, advantage of composite materials and application. (4 Contact hours)
2. Macro-mechanical Behavior of a lamina
Stress strain relationships for anisotropic materials, stiffness's and compliances, restrictions of engineering constants, invariant properties of lamina. Strength of the lamina. (10 Contact hours)
3. Micromechanical behavior of lamina
Mechanics of material approach for stiffness, elasticity approach, imperial approaches, strength estimations. (12 Contact hours)
4. Micromechanical behavior of laminates
Classical laminate theory, special cases of laminates, strength of laminates, Interlaminar stresses. (12 Contact hours)
5. Experimental characterization of composites
Uniaxial, biaxial tension and compression tests, interfacial and Inter laminate shear stress characterizations. (4 Contact hours)

Text & Reference Books:

1. Laszolo P Kollar and George S. Springer, Mechanics of Composite Structures, Cambridge University Press, 2003.
2. J. N. Reddy, Mechanics of Laminated Composite Plates and Shells Theory and Analysis.