MANUFACTURING METHODS AND MECHANICS OF COMPOSITES
(Elective - I)

Subject Code: 13ME2108

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Course Outcomes :

At the end of the course, the student will be able to

CO1: Explain basic concepts and characteristics of natural and man-made composites; recognize the reinforcement materials like fibers, glass, silica, kevlar etc.

CO2: Describe micromechanics of unidirectional composites and their properties and point out the characterization; discuss different manufacturing methods

CO3: Compute coordinate transformations and Hookes law for different type of materials

CO4: Examine elastic behaviour of unidirectional composites

CO5: Estimate strength of unidirectional lamina and explain failure mechanisms

UNIT – I

Basic concepts and characteristics: Geometric and Physical definitions, 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.

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

UNIT – III

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. axis, stiffness modulus, off - axis compliance.

UNIT – IV

Elastic behaviour of unidirectional composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

UNIT – V

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.

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

TEXT BOOK:

1. R.M. Jones, "*Mechanics of composite Materials*", Scripta Book company, Washington DC, 1999

REFERENCES:

1. MadhujitMukhopadhyay, "*Mechanics of composite materials and structures*", Universalities press, 2e, 2004.

2. Isaac and M Daniel, "*Engineering Mechanics of Composite Materials*", Oxford University Press, 1994.

3. Autar K. Kaw," *Mechanics of Composite Materials*", CRC Publishers,1997