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**AE 8603 COMPOSITE MATERIALS AND STRUCTURES**

DETAILED SYLLABUS

**OBJECTIVE:**

- To make the student understand the analysis of composite laminates under different loading conditions and different environmental conditions.

**UNIT I MICROMECHANICS**

Introduction - advantages and application of composite materials – types of reinforcements and matrices - micro mechanics – mechanics of materials approach, elasticity approach- bounding techniques – fiber volume ratio – mass fraction – density of composites. effect of voids in composites.

**UNIT II MACROMECHANICS**

Generalized Hooke's Law - elastic constants for anisotropic, orthotropic and isotropic materials - macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis – determination of in plane strengths of a lamina - experimental characterization of lamina. Failure theories of a lamina. hygrothermal effects on lamina.

**UNIT III LAMINATED PLATE THEORY**

Governing differential equation for a laminate. stress – strain relations for a laminate. Different types of laminates. in plane and flexural constants of a laminate. hygrothermal stresses and strains in a laminate. failure analysis of a laminate. impact resistance and interlaminar stresses. netting analysis

**UNIT IV FABRICATION PROCESS AND REPAIR METHODS**

Various open and closed mould processes, manufacture of fibers, importance of repair and different types of repair techniques in composites – autoclave and non-autoclave methods.

**UNIT V SANDWICH CONSTRUCTIONS**

Basic design concepts of sandwich construction - materials used for sandwich construction - failure modes of sandwich panels - bending stress and shear flow in composite beams.

**TEXT BOOKS:**

1. Autar K Kaw, 'Mechanics of Composite Materials', CRC Press, 2nd edition, 2005.
2. Isaac M. Daniel & Ori Ishai, "Mechanics of Composite Materials," OUP USA publishers, 2nd edition, 2005.
3. Madhujit Mukhopadhyay, Mechanics of Composite Materials and Structures, University Press, 2004

**REFERENCES:**

1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites," John Wiley & Sons, 3rd edition, July 2006.
2. Allen Baker, Composite Materials for Aircraft Structures, AIAA Series, 2nd Edition, 2004.
3. Calcote, L R. "The Analysis of laminated Composite Structures", Von – Nostrand Reinhold Company, New York 1998.
4. Lubing, Handbook on Advanced Plastics and Fibre Glass, Von Nostran Reinhold Co., New York, 1989.