

III Year B.Tech. Mechanical Engg. II-Semester	L	T	P	To	C
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ME330 COMPOSITE MATERIALS

Course Description and objective:

This course focuses on constituent materials, processing, testing and various applications of the composites materials.

Course Outcomes:

Upon completion of this course, the students will be able to:

- 1. know various composite components e.g. reinforcement and matrices*
- 2. develop a knowledge of the manufacturing of composite materials.*
- 3. employ principles of material selection and design for composite materials.*
- 4. demonstrate basic knowledge on the various composite processing techniques.*
- 5. explain International and national standard testing methods*

UNIT –I Introduction to Composites:

General introduction & concept, Historical development, Concept of Composite materials, material properties that can be improved by forming a composite material & its engineering potential. Basic definitions, Types of composites based on matrix and fiber. Advantages & limitations of Composites

UNIT-II Constituent materials in Composites :

Role and Selection of reinforcement materials, Types of fibers, Mechanical properties of fibers, Glass fibers, Carbon fibers, Aramid fibers, Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc. Functions of a Matrix, Desired Properties of a Matrix Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc. Fiber reinforced Polymer (FRP) Laminated composites. Lamina & Laminate Lay-up, Ply-orientation definition

UNIT-III Composite Manufacturing Processes :

Fabrication Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films. Hand Lay-up, Autoclave molding, Fiber-only performs, Wet Lay-up and Spray-up, Filament winding, Pultrusion, Resin Transfer Molding (RTM), Compounding, Injection molding
Recycling of Composites Categories of scrap composites, Recycling methods for: Thermoplastic matrix composites, Thermoset matrix composites.

UNIT-IV Characterization of Composites:

Mechanical testing of composites, Tensile testing, Compressive testing, Intralaminar shear testing, Inter laminar shear testing, Thermal testing, Fracture testing etc. Environmental Effects on composite.

Strength and Failure theories: Strength of Laminates Failure Mechanics of Composites, Macromechanical Failure Theories, Maximum stress theory, Maximum Strain Theory, Tsai-Hill Theory, Tsai-Wu Theory, Comparison of Failure Theories

UNIT-V Engineering Applications :

Applications of FRP composites. Applications related to Aerospace, Automobile, Bridge and other Civil Engineering Structures.

Civil Engineering Applications : Typical Applications of FRP Composites in Civil Engineering Adhesively Bonded FRP composites in strengthening of civil engineering structural components such as beams, Columns, Masonry etc. Various Strengthening Techniques, Advantage and Disadvantage of FRP composites laminated plate bonding & Misc. Issues

TEXT BOOKS:

1. Hull D. and Clyne T.W., An Introduction to Composite Materials, 2nd Ed., Cambridge University Press 2013
2. Mallick, P.K. and Newman S., (edition), " Composite Materials Technology Processes and properties", Hansen Publisher, Munish, 1990.

REFERENCE BOOKS:

1. Mallick, P.K., Fiber Reinforced Composites Materials, Manufacturing and Manufacturing and Design", Maneeel Dekker Inc, 1993.
2. Chawla K.K., Composite Materials: Science and Engineering 3rd Ed., Springer 2012