NIRMA UNIVERSITY

Institute of Technology

School of Engineering

Bachelor of Technology - Civil Engineering Open Electives (all branches except Mechanical Eng.)

L	T	P	C
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Course Code	2CLOE03	
Course Name	Composite Materials	

Course Outcomes:

At the end of the course, students will be able to -

- 1. explain characteristics and applications of composite materials
- 2. illustrate manufacturing process for development of composite materials
- 3. assess the mechanical behaviour of composite materials
- 4. apply failure theories for strength assessment of the laminate.

Syllabus:

Unit 1: Characteristics and Applications

Teaching hours: 45

Hours: 10

Definition of composite materials, classification and characteristics, Advantages and applications, Functional requirements of reinforcement and matrix, Effect of reinforcement: size, shape, distribution, volume fraction.

Unit 2: Manufacturing Process

Hours: 12

Manufacturing of metal matrix composites: Casting - Solid state diffusion technique, Cladding - Hot isostatic pressing, Properties and applications, Manufacturing of ceramic matrix composites: Liquid metal infiltration - liquid phase sintering, Manufacturing of Carbon - Carbon composites: Knitting, Braiding, Weaving, Manufacturing of polymer matrix composites: Preparation of moulding compounds and prepregs - hand layup method, autoclave method, filament winding method, compression moulding, reaction injection moulding, Properties and applications

Unit 3: Mechanical Behaviour

Hours: 10

Preparation layup, Curing, Properties and application of various type of fibers, Properties and applications of whiskers, Particle reinforcements, Rule of mixtures, Inverse rule of mixtures, Isostrain and Isostress conditions.

Unit 4: Failure Mechanism of Laminates

Hours: 13

Laminate failure criteria: strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure, laminate first ply failure; Laminate strength, Stress concentration.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings:

- 1. Callister Jr, W.D. and Rethwisch, D.G., Fundamentals of materials science and engineering: an integrated approach, John Wiley & Sons.
- 2. Lubin, G. Composite Materials, Springer publication.
- 3. Deborah, D.C., Composite Materials: Science and Applications, Engineering Materials and Processes, Springer.
- 4. Chawla, K.K., Composite Materials: Science and Engineering. Springer Science & Business Media.
- 5. Gay D., Composite Materials Design and Application, Taylor & Francis

L= Lecture, T= Tutorial, P= Practical, C= Credit

w.e.f. academic year 2020-21 and onwards