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: Teaching hours: 45

Unit 1: Characteristics and Applications **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