



FACULTY OF ENGINEERING & TECHNOLOGY

Second Year Master of Engineering

Semester III

Course Code: 102330311

Course Title: Composite materials

Type of Course: Open Elective I

Course Objectives:

The course on Composite Materials has become very essential for a process engineer to meet the demand of the today's world applications, where advances in Technological needs demands high strength, corrosion resistance, fatigue / creep resistant & stiff structure with very lesser densities such as in making of automobiles, aircrafts, space crafts, Sports items etc. This course covers various classes of composite materials, their constituents' phases, manufacturing techniques, characteristics and tastings of the composites and relevant applications in various fields.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	2	0	4	40/16	20/8	60/24	30/12	150/60

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Introduction: Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.	08
2	Manufacturing methods: Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical. Measurement of interface strength. Characterization of systems; carbon fibre/epoxy, glass fibre/polyester, etc.	10
3	Mechanical Properties -Stiffness and Strength: Geometrical aspects – volume and weight fraction. Unidirectional continuous fibre, discontinuous fibers, Short fiber systems, woven reinforcements –Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.	10



4	Laminates: Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Plate Stiffness and Compliance, Computation of Stresses, Types of Laminates -, Symmetric Laminates, Antisymmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Cross-ply Laminate, Angleply Laminate. Orthotropic Laminate, Laminate Moduli, Hygrothermal Stresses.	10
5	Major composite classes: polymer matrix, metal matrix, ceramic matrix, carbon-carbon, and intermetallic composites. Hybrid composites, Laminated composites. Examples of each class of composites.	08
6	Applications of advanced composite materials. Environmental effects in Composites, Green composites, Synthesis and Properties of Nanocomposites. Surface Composites & Surface metal matrix composites: Need, Synthesis, Properties and applications,	08

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
15%	30%	15%	15%	15%	10%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1	Analysis and Performance of Fiber Composites, Agarwal, B.D. and Broutman, L. J., John Wiley & Sons.
2	Mechanics of Composite Materials, Jones, R. M., Mc-Graw Hill.
3	Engineering Mechanics of Composite Materials, Daniel, I. M. and Ishai, O., Oxford University Press.
4	Mechanics of Composite Materials, M. Mukhopadhyay, University Press
5	Fibrous Materials, K K Chawla, Cambridge University Press
6	Engineering Mechanics of Composite Material I. S. Daniel and Ori Ishai, , Oxford University Press.

Course Outcomes (CO): At the end of the course, the student will be able to:

Sr.	Course Outcome Statements	%weightage
CO-1	To understand the specifics of mechanical behavior of layered composites compared to isotropic materials.	25
CO-2	To determine stresses and strains in composites.	25
CO-3	To understand the fabrication techniques of different types of composite materials.	25
CO-4	To understand the need of the research in the composite materials to fulfill the demand of the hi-tech applications.	25

Supplementary learning Material:

1	Video lectures available on the websites NPTEL.
2	Recommended Websites for further reference: 1. nptel.ac.in/courses/101104010/



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| | <ol style="list-style-type: none">2. www.doitpoms.com3. composite.about.com4. https://compositesuk.co.uk/composite-materials5. www.asminternational.org/documents/10192/1849770/05287G_Sample_Chapter.pdf |
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Suggested design based problems for tutorials/practicals

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| | <ul style="list-style-type: none">• Calculations to distinguish fiber length & classify as long fiber-short fiber or whiskers. –• Calculate the strength of composite materials under Longitudinal & transverse loading applications.• Justify the materials of construction in advanced materials based on the properties requirements. - Prepare a layout of Environmental friendly Green” composite materials” & suggest its suitable applications |
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Curriculum Revision:

Version:	1
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22