Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NMED505	Composite Materials	3	0	0	3

Course Objective

- To understand the constitutive relationship of non-isotropic materials
- To develop a comprehensive knowledge of a high-performance reinforced composites.
- To learn the mechanical performance of laminated composites, including failure behavior.

Learning Outcomes

Upon successful completion of this course, students will:

- Learn the brief idea on the synthesis and development of various types of composite materials
- Evaluate the properties of fiber reinforcementscomposites.
- Explain elastic anisotropy and the special cases relevant for composites: orthotropy and transversal isotropy
- Explain the elastic properties and simulate the mechanical performance of composite laminates, and understand and predict the failure behavior of fiber-reinforced composites
- Understanding the derivation and calculation of engineering constants for a composite ply based on homogenisation of a fiber-matrix unit cell
- Apply knowledge of composite mechanical performance and manufacturing methods to a composite design project

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Introduction to Cartesian tensor, concept of isotropic, homogeneous and anisotropic materials and the constitutive relationship.	3	Understanding the basic mathematical preliminaries and the concept of material selection.
2	Introduction to composite materials and their fabrication process. Brief History, Constituent Materials, MMCs, Laminate, FRP, micro-mechanics & macro-mechanics	9	Introduce of various kinds of engineering materials
3	Analysis of lamina: Assumptions, strength-stiffness, Shear, Poisson ratio, Elastic Properties of Unidirectional Lamina: stress-strain relations for general anisotropic, specially orthotropic and transversely isotropic materials, Transformation Matrix	11	Knowledge of physical properties of the materials and strengthening mechanism and the possible techniques to improve the properties.
4	Analysis of Laminated Composites: Classical Laminate Theory, Displacement Field, Strain Displacements Relations, Constitutive Relations, Classification of Laminates and their properties.	12	Knowledge on the behavior of the material at high temperature and cyclic loading
5	Hygrothermal Effects of Laminates , Failure Theories and Strength of Unidirectional Lamina	7	Develop the relationships of mechanical and hygrothermal loads applied to a laminate to strains and stresses in each lamina
	Total	42	

Text Books:

1. Mechanics of Composite Material, Autar K. Kaw, CRC Press
2. Mechanics of Composite Material & Structures, M Mukhopadhyay, Universities press 2013.

3. Mechanics of Composite Materials, by Robert M Jones, Taylor & Francis

Reference Books:

1. An Introduction to Composite Materials, By D. Hull and Clyne, Cambridge University Press 2010
2. Engineering mechanics of composite materials, I. M. Daniel & O. Ishai, 2nd edn., oxford university press, 2006.
3. Principles of composite material mechanics, R. F. Gibson, 2nd edn. CRC Press, 2007.