Course code	Course Name	L-T-P-Credits	Year of Introduction
AO407	COMPOSITE MATERIALS	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To understand the analysis of composite laminates under different loading conditions and different environmental conditions

Syllabus

Introduction to composite materials – reinforcements -mechanics - Generalized Hooke's Law - plane strengths of a lamina - experimental characterization of lamina- failure theories of a lamina - Governing differential equation for a laminate - types of laminates- failure analysis of a laminate -netting analysis - Manufacture and repair of composites - Basic design concepts of sandwich construction - materials - failure modes of sandwich panels -Carbon / carbon composites - Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications

Expected Outcome

The students will be able to

- Understand the mechanics of composite materials
- Analyse the laminated composites for various loading eases
- Know about manufacture of composites

Text Books:

1. Autar K Kaw, 'Mechanics of Composite Materials', CRC Press, 1997.
2. Madhuji Mukhapadhyay, Mechanics of Composite Materials and Structures, University Press, 2004.

References:

1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites," John Wiley and sons. Inc., New York, 1995.
2. Allen Baker, "Composite Materials for Aircraft Structures", AIAA Series, II Edition, 1999.
3. Calcote, L R. "The Analysis of laminated Composite Structures", Von – Nostrand Reinhold Company, New York 1998.
4. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.

Course Plan

Module	Contents	Hours	End sem exam marks
I	Introduction - advantages and application of composite materials	1	15%
	Types of reinforcements and matrices - micro mechanics	1	
	mechanics of materials approach, elasticity approach-bounding techniques – fiber volume ratio – mass fraction	2	
	density of composites. effect of voids in composites	2	
II	Generalized Hooke's Law - elastic constants for anisotropic, orthotropic and isotropic materials	1	15%

	macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis	3	
	Determination of in plane strengths of a lamina - experimental characterization of lamina. Failure theories of a lamina.	2	
	hygrothermal effects on lamina.	4	
FIRST INTERNAL EXAM			
III	Governing differential equation for a laminate.stress – strain relations for a laminate.	2	15%
	different types of laminates. in plane and flexural constants of a laminate. hygrothermal stresses and strains in a laminate.	2	
	failure analysis of a laminate. impact resistance and interlaminar stresses.	3	
	netting analysis	2	
IV	Various open and closed mould processes	1	15%
	manufacture of fibers, importance of repair	2	
	different types of repair techniques in composites	2	
	autoclave and non-autoclave methods.	2	
SECOND INTERNAL EXAM			
V	Basic design concepts of sandwich construction	1	20%
	materials used for sandwich construction	1	
	failure modes of sandwich panels	1	
	bending stress and shear flow in composite beams	2	
VI	Carbon / carbon composites – Advantages of carbon matrix	2	20%
	limitations of carbon matrix	2	
	Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform.	2	
	Sol gel technique. Composites for aerospace applications	2	
END SEMESTER EXAM			

Question Paper Pattern

Maximum marks: 100 Exam duration: 3 hours

The question paper shall consist of three parts

Part A
4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)
Part B
4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)
Part C
6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.