Course code	Course Name	L-T-P-Credits	Year of Introduction
ME363	COMPOSITE MATERIALS AND MECHANICS	3-0-0-3	2016

Prerequisite : Nil

Course Objectives:

1. To understand various matrices and reinforcements used in composites
2. To know about polymer matrix composites, metal matrix composites, ceramic matrix composites and its manufacturing and applications
3. To introduce post processing operations and micromechanics of composites

Syllabus

Composites – Reinforcements – Matrices – Polymer matrix composite – Metal matrix composite – Ceramic matrix composite – Post processing operations – Micromechanics of composites

Expected outcome:

- The students will be able to gain knowledge about composites, reinforcements, matrices, post

Text Books:

1. K. K. Chawla, Composite Materials : Science and Engineering, Springer, 3e, 2013.
2. Reddy J N (Ed.), Mechanics of Composite Materials; Selected Works of Nicholas J. Pagano, Springer, 1994
3. Robert M. Jones, Mechanics of Composite Materials, CRC Press, 1998

References Books:

1. F.L.Matthews & R.D.Rawlings, Composite Materials, Engineering and Sciences, Chapman & hall, London, 1994
2. Hand Book of Composites, George Lubin. Van Nostrand, Reinhold Co. 1982
3. Micael hyer, Stress Analysis of Fiber - Reinforced Composite Materials , Tata McGraw Hill, 1998.
4. P.K.Mallicak, Fiber-reinforced composites , Monal Deklar Inc., New York, 1988.
5. Ronald Gibson, Principles of Composite Material Mechanics , TMH, 1994.

Course Plan

Module	Contents	Hours	End Sem. Exam. Marks
I	Composite : Introduction, definition, characteristics, functions	1	15%
	classification of composites based on structure and matrix	1	
	smart composites, advantages and limitations	1	
	history, industrial scene and applications	1	
	Interfaces: wettability and bonding interface in composites	1	

	types of bonding at interface.	**1**	
II	Fibers : Introduction, types of fibers, natural fibers	**1**	**15%**
	glass fiber fabrication, structure, properties and applications	**2**	
	boron fiber fabrication, structure, properties and applications	**1**	
	carbon fiber, Ex-Pan carbon fiber	**1**	
	Ex cellulose carbon fiber, Ex-Pitch carbon	**1**	
	carbon fiber structure, properties and applications	**1**	
	aramid fiber fabrication, structure, properties and applications	**1**	
	whiskers: characteristics, properties and applications.	**1**	
	FIRST INTERNAL EXAMINATION		
III	Polymer matrix composites (PMC) : thermoset, thermoplastic and elastomeric polymers	**1**	**15%**
	properties, characteristics and applications as matrix materials	**1**	
	processing of polymer matrix composites: hand methods, Lay up method, spray up method	**2**	
	moulding methods, pressure bagging and bag moulding methods,	**1**	
	pultrusion and filament winding process.	**1**	
IV	Metal matrix composites (MMC) : classification of metals, intermetallics, alloys and their potential role as matrices in composites	**1**	**15%**
	properties, characteristics and applications of metals as matrix materials	**1**	
	production techniques: powder metallurgy, diffusion bonding, melt stirring	**2**	
	squeeze casting, liquid infiltration under pressure, spray code position, insitu process.	**2**	
	SECOND INTERNAL EXAMINATION		
V	Ceramic matrix composites (CMC) : classification of ceramics and their potential role as matrices,	**1**	**20%**
	properties, characteristics and applications of ceramics as matrix materials	**1**	
	conventional techniques : cold pressing and sintering, hot pressing, reaction bonding,	**1**	
	hot pressing and reaction bonding new techniques : liquid infiltration, pultrusion,	**1**	
	lanxide process, insitu chemical technique, sol-gel technique	**2**	

V1	Post processing operations : machining, cutting, polishing,	**1**	**20%**
	welding, rivetting and painting	**1**	
	Advanced post processing methods : ultrasonic welding, plasma coating,	**1**	
	Water jet cutting and laser machining	**1**	
	Micromechanics of composites: maximum stress and strain criterion (derivations)	**2**	
	Tsai-Hill and Tsai-Wu failure criterion (derivations)	**2**	
	mechanics of load transfer from matrix to fiber (description)	**1**	
END SEMESTER EXAMINATION			

Question Paper Pattern

Maximum marks: 100 **Time: 3 hrs**

The question paper should consist of three parts

Part A
There should be 2 questions each from module 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
There should be 2 questions each from module 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
There should be 3 questions each from module V and VI
Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: Each question can have a maximum of four sub questions, if needed.