COMPOSITE MATERIALS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB29	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

In this course, students will gain insight into the manufacturing processes for composites, from choosing appropriate reinforcement fibers to integrating them with suitable matrices. They will develop an understanding of the challenges and considerations involved in achieving desired strength properties. This knowledge will enable them to evaluate and optimize the manufacturing processes for different types of composites based on specific application requirements.

II. COUSE OBJECTIVES:

The students will try to learn:

I. The manufacturing processes of reinforcement fibers and matrices for composites.
II. The concept of tailored design philosophy.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Identify the basic mechanical behavior of composite materials and make sound prediction on the likely behavior of new combinations of materials.	Understand
CO 2	Explain the properties of and applications of fibers, particle reinforcements and make use of rule of mixtures	Understand
CO 3	Interpret Manufacturing of Metal Matrix Composites, Properties and applications.	Understand
CO 4	Understand Manufacturing of polymer Matrix Composites, Properties and applications	Understand
CO 5	Recall the concepts of failure criteria of strength	Remember

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 09

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT-II	REINFORCEMENTS	Classes: 09

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT-III	MANUFACTURING OF METAL MATRIX COMPOSITES	Classes: 09

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. Properties and applications.

UNIT-IV	MANUFACTURING OF POLYMER MATRIX COMPOSITES	Classes: 09
Preparation of Moulding compounds and prepregs, hand layup method, Autoclave method, Filament winding method, Compression moulding, Reaction injection moulding. Properties and applications.		
UNIT-V	**STRENGTH**	**Classes: 09**
Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.		
Text Books:		
1. R.W.Cahn, "Material Science and Technology" VCH, West Germany. 2. WD Callister, Jr., Adapted by R. Balasubramaniam, "Materials Science and Engineering, An introduction", John Wiley & Sons, NY, Indian edition, 2007.		
Reference Books:		
1. ed-Lubin, "Hand Book of Composite Materials" 2. Deborah D.L. Chung, "Composite Materials Science and Applications" 3. Danial Gay, Suong V. Hoa, and Stephen W. Tasi, "Composite Materials Design and Applications"		
Web References:		
1. https://freevideolectures.com/course/3479/processing-of-non-metals/5		
E-Text Books:		
1. https://www.asminternational.org/documents/10192/1849770/05287G_Sample_Chapter.pdf		