Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2020-2021
Course Handout Part II

Date: 16-01-2021

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : MEF452
Course Title : Composite materials and design
Instructor-in-Charge : Phaneendra Kiran chaganti

Scope and Objective of the Course:
Composite Materials have gained considerable importance over the years due to their outstanding mechanical properties, less weight, flexibility, ease of fabrication, corrosion resistance, impact strength and fatigue resistance. Introduction to composites, concepts of reinforcement, strengthening mechanisms, fibrous reinforcements, matrix materials, micro-mechanical aspects of composites, manufacturing methods, composite production design methods, design of tensile members, pressure vessels, storage tanks, and other chemical process equipment made of FRP, design of joints, damage of composites by impact, FRP grids, recent
development in manufacturing of composites and technologies.

Textbooks:
1. Composite materials, K.K. Chawala, 2nd ed., (1987) Springer-Verlag, New York.

Reference books
1. Analysis and Performance of Fiber Composites - BD Agarwal, L J Broutman and K Chandrashekhara, Wiley, 3rd Edition, 2006
2. Mechanics of composite materials, Robert Jones, Taylor & Francis (2nd Edition).

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-2	Definition and constituents of composites	Introduction, applications and classification of composites fibers and matrices, distribution of constituents,	Ch1-T1,R1
3-5	Types of reinforcements	Reinforcements; Glass, Carbon, Aramid , metallic and non-metallic fibers, Manufacturing of fibers	Ch2-T1,R1
6-7	Types of matrix materials;	Polymers, metals and ceramics	Ch3-T1, Ch2-R1
8-9**	Effect of interface on composite behaviour	Interfaces, Wettability, Interactions and bonding at interfaces, Tests to measure	Ch4-T1,

		interfacial strength	
10-12	Processing methods of various composites	Manufacturing of composites: Hand layup, Bag molding and RTM, Pultrusion and preformed molding composites	Ch6&Ch7-T1, Ch2-R1
13-16	Strength and modulus of a unidirectional composite	Micromechanics of composites; Behavior of unidirectional lamina, Predictive models: Longitudinal modulus and longitudinal strength and other properties	Ch10-T1, Ch3-R1
17-22	Application of basic stress-strain relations to different class of materials	Important terminologies in composites: 3D stress-strain relations; Isotropic, transversely isotropic, orthotropic materials, analysis of orthotropic lamina	Ch11-T1, Ch5-R1
23-25	Failure of orthotropic lamina	Transformation of stresses and strains Maximum stress, Maximum strain and Maximum work (Tsai-Hill) criteria	Ch11-T1, Ch5-R1
26-32	Analysis of multi-layer composite	Strain field in a laminate Resultant forces and moments in a laminated composite Stiffness matrix of laminate, Special laminate sequences:	Ch11-T1, Ch6-R1
33-36	Failure criteria	Failure of composites due to longitudinal tension and compression and out of plane loading	Ch12-T1, Ch9-R1
37-41	Design of composites for various loads	Strengthening mechanisms in composite Design procedures, design of tensile members, Design of pressure vessels and storage tanks	Ch14-T1, Ch9-R1

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Exam	90 min	25	06/03 9.00 - 10.30AM	Open book
Surprise quiz		15		
Assignments/Project		15		Open book
Comprehensive Examination	2 hr	40	17/05 FN	Open book

Chamber Consultation Hour:
To be announced in the class, Chamber: E-120

Notices: All notices related to this course will be put on CMS only.

Make-up Policy:
Make-up will be granted **<u>ONLY</u>** in genuine cases with ***prior permission***. The request application for make-up test must be reached to the Instructor-in-charge before commencement of the scheduled test (<u>documentary proof is essential</u>).

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE