Course Type	Course Code	Name of Course	L	T	P	Credit
DP	NMEC534	Mechanical Characterization Lab	0	0	3	1.5

Course Objective

Primary objective of the course is to:

- Introduce the students with mechanical behavior different materials such as Non-linear Elastic materials (Hyper elastic/Visco-elastic), Elasto-plastic materials, Orthotropic materials (FRP composites, Metal-matrix composites) & Anisotropic materials (Sedimentary rock structures).
- Expose the students to the experimental procedures to characterize these materials in terms different material properties.
- Introduce the students to the fabrication procedure of different advanced materials (Nano Metal-matrix composite & FRP composite)

Learning Outcomes

On successful completion of this course, students will understand:

- Mechanical behavior of different materials such as Non-linear Elastic materials (Hyper elastic/Visco-elastic), Elasto-plastic materials, Orthotropic materials (FRP composites, Metal-matrix composites) & Anisotropic materials (rock specimens)
- Experimental techniques to characterize such materials in term of different material properties.
- Synthesis/Fabrication of different advanced materials such as Nano-Metal Matrix composites & Laminated FRP composites

Exp. No.	Topics to be Covered	Contact Hours	Learning Outcome
1	Synthesis of Nano Metal Matrix composites (Orthotropic materials)	6	Students will learn the procedure to synthesize Nano Metal Matrix composites.
2	Characterization of Nano Metal Matrix composites (Orthotropic material behavior)	3	Students will understand the orthotropic material behavior through characterization of Nano Metal Matrix composites (microstructural, physical and surface, mechanical)
3	Stress Relaxation behavior of thermo setting resin-based polymer under tension (Visco-elastic material behavior)	3	Students will understand the visco-elastic material behavior through tensile testing of thermo-setting resin based polymers. Sample will be subjected to a constant stress and the change in stress with time will be recorded. The Prony series model will be used to fit the stress vs. time plot.
4	Stress strain behavior of thermo setting resin-based polymer under compression (Elasto-plastic material behavior)	3	Students will understand the Elasto-plastic material behavior through compression testing of thermo-setting resin based polymers.
5	Large Deformation Analysis of Silicon Rubber under tension (Hyper-elastic material behavior)	6	Students will understand the Hyper-elastic material behavior through tension testing of Silicon Rubber
6	Fabrication of laminated FRP composites (Orthotropic Materials)	3	Students will learn to fabricate laminated FRP composite plates by hand layup technique. They will also understand the importance of fibre/matrix/void volume fractions in FRP composite fabrication.
	Characterization of Laminated FRP	3	Students will learn the characterization of

7	composite materials (Orthotropic material behavior)		unidirectional Fibre Reinforced Polymer Composites in terms of Stress ~ strain behavior, Elastic modulus, Poisson's ratio and Modulus of rigidity.
8	Mechanical behavior of rock specimens (Anisotropic material behavior)	3	Students will learn to understand the behavior of anisotropic rock specimens in terms of compressive strength, tensile strength (Brazilian testing), shear strength & Hardness (point load indexing)
9	Characterization of unconfined rock specimens under compression (Anisotropic material behavior)	6	Students will learn to characterize anisotropic rock specimens in terms of Modulus of Elasticity, Poison's ratio (Unconfined Compression Testing).
10	Fracture behavior of rock specimens (Anisotropic material behavior)	6	Students will learn to quantify the fracture behavior of anisotropic rock specimens through determination of Mode-I/II Fracture toughness.
Total		42	

Text Books:

1. Composite Materials: Production, Properties, Testing & Applications. K. Srinivasan, Narosa Publishing House
2. Composite Materials: Science and Engineering. K.K. Chawla, Springer Publications

India Standard codes/Reference Books:

1. Defects and damages in Composite Materials and structures, Ricard Benton Heslehurst, CRC Press Publication
2. Anisotropic Rock joints: Direct shear strength determination: IS: 12634: 1989
3. Tensile strength of Anisotropic Rock Mass: IS: 10082-1981
4. Elasticity and Poison's ratio for anisotropic rock mass: IS: 9221-1979