DESIGN AND ANALYSIS OF COMPOSITE STRUCTURES

I Semester: AE

Course Code	Category	Hours /Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BAEC08	Elective	3	-	-	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				TotalClasses:45		

I. COURSE OVERVIEW:

The course focuses on properties of constituent materials and composite laminates, and also provides insight into different analysis approaches of composite materials. It imparts knowledge about different theories of analysis of laminated beams and plates. The course is aimed to obtain knowledge also in different failure theories and concepts of composite materials.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The contribution of constituent materials to the mechanical properties of composite laminates.
II. The various analysis approaches of composite plates and beams.
III. The different failure theories of composite materials.

III. COURSE OUTCOMES:

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

CO 1	**Apply** the knowledge of properties of constituent materials to analyse the composite materials	**Apply**
CO 2	**Develop** stress-strain relations of isotropic, orthotropic, and anisotropic composite materials to design the composite laminates	**Apply**
CO 3	**Apply** the knowledge of classical lamination theory for analysing various composite materials	**Apply**
CO 4	**Explain** the mechanical behavior of layered composites compared to isotropic materials	**Understand**
CO 5	**Develop** relationships of mechanical loads applied to a laminate to analyze the strains and stresses in each lamina	**Apply**
CO 6	**Identify** the failure of individual lamina in a laminate to analyze the failure criteria of composite laminates	**Apply**

IV. SYLLABUS:

MODULE-I: PROPERTIES OF CONSTITUENT MATERIALS & COMPOSITE LAMINATES (09)

Introduction to laminated composite plates- mechanical properties of constituent materials such as matrices and filaments of different types. Netting analysis of composite materials, determination of properties of laminates with fibers and matrices.

MODULE-II: ELASTIC PROPERTIES (09)

Stress-strain relations of isotropic, ortho tropic and anisotropic materials, transformation of material properties for arbitrary orientation of fibers.

MODULE-III: METHODS OF ANALYSIS-I & METHODS OF ANALYSIS –II (09)

Mechanics of materials approach to determine Young's modulus, shear modulus and Poisson"s ratio. Brief mention of elasticity approach and macro mechanics of laminates.

Anisotropic elasticity, stress –strain relations in material coordinates - Transformation of geometric axes, strength concepts, biaxial strength theories, maximum stress and maximum strain.

MODULE-IV: ANALYSIS OF LAMINATED BEAMS AND PLATES (09)
Classical plate theory, Classical lamination theory – Special cases of single layer, symmetric, anti-symmetric & unsymmetric composites with cross ply, angle ply layup. Deflection analysis of laminated plates, Analysis of laminated beams and plates.

MODULE-V: SHEAR DEFORMATION ANALYSIS& BUCKLING ANALYSIS (09)
Shear deformation theories for composite laminated beams, plates- first, second and third order theories. Nth order theory. Buckling analysis of laminated composite plates with different orientation of fibers, Tsai-wu criteria and Tsai– Hill Criteria.

V. TEXT BOOKS:

1. Agarwal.B.D, Broutman.L.J, "Analysis and Performance of Fibre Composites", John Wiley and sons, New York, 1980.
2. Lubin.G,Von.Nostrand, "Advanced Plastics and Fibre Glass", Reinhold Co.New York,1989.

VI. REFERENCE BOOKS:

1. Gupta.L, "Advanced Composite Materials, Himalayan Books, New Delhi, 1998.
2. Jones.R.M, "Mechanics of Composite Materials, McGraw Hill Koga kushal td.Tokyo.
3. Reddy.J.N, "Mechanics of Composite Materials.

VII. WEB REFERENCES:

1. http://onlinelibrary.wiley.com/book.
2. https://www.asme.org/products/courses/design-analysis-fabrication-composite-structures.
3. http://as.wiley.com/WileyCDA/WileyTitle/productCd-1118401603.html

VIII. E-TEXT BOOKS:

1. https://www.bookshout.com/ebooks/design-and-analysis-of-composite-structures
2. https://www.overdrive.com/media/1303069/design-and-analysis-of-composite-structures
3. http://www.lehmanns.de/technik/25035754-9781119957065-design-and-analysis-of-composite-structures