

# GUJARAT TECHNOLOGICAL UNIVERSITY

## B. E. SEMESTER: V

### AERONAUTICAL ENGINEERING

Subject Name: **Composite Materials and Smart Structures (Institute Elective - II)**

Subject Code: **150106**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Internal Assessment (I)
4	0	2	6	70	30	50

#### UNIT - I Composite Material

Sr. No.	Course Content
1.	Composite materials: Classification of composites, Advantages of fibre-reinforced laminates, Methods of manufacture, Macromechanics of a lamina, Anisotropic Elasticity, Stress - Strain relations in material coordinates, Transformation to geometric axes, Strength concepts, Biaxial strength theories, Maximum stress, Maximum strain, Tsai-Wu, Introduction to micromechanics: Mechanics of materials approach to determine Young's modulus, Shear modulus and Poisson's ratio, Brief mention of elasticity approach and Halpin-Tsai equations, Laminate analysis : Introduction to classical plate theory, Classical lamination theory, Special cases of single-layer, symmetric, antisymmetric and unsymmetric configurations with cross-ply and angle-ply layups, Deflection analysis of laminated plates, Analysis of laminated beams and columns,. Shear deformation theories for composite laminates, Manufacturing of composites, Finite element method of analysis, Analysis of sandwich structures.

#### UNIT - II Smart Materials

Sr. No.	Course Content
1.	Introduction to smart material and its construction, Different types of smart materials and their specific properties and applications, Introduction to MEMs. and different smart materials (Piezoelectric materials, Optical Fiber, Shape Memory Alloy (SMA), Electroreological fluid, Magnetoreological fluid, Magnetostrictive materials, etc.)

## **Reference Books:**

1. Composite Materials for Aircraft structures: Alan Baker, Stuart Dutton, Donald Kelly.
2. Aircraft Materials and Processes: George F Titterton.
3. Aerospace Materials Vol. IV & V: Balaram Gupta.
4. Advanced Composite Materials: Lalit Gupta.
5. Mechanics of Aircraft Structures: C. T. Sun.
6. Health monitoring of Aerospace structures: Wieslaw Staszewski, Christian Boller, Geof Tomlison.