

# AE 3140 – Structural Analysis

**HOURS:** 3-0-3

**CATALOG DESCRIPTION:**

Application to structural analysis. Basic equations of elasticity. Bending, shearing and torsion of thin walled structures. Energy methods for structural analysis and application to finite element theory for trusses and beam structures

**PREREQUISITES:**

COE 3001 Deformable Bodies

**COURSE OBJECTIVES:**

This course is intended to introduce concepts of aerospace structural analysis with emphasis on thin walled structures. Students will apply energy methods to simple structures and be exposed to concepts of computational mechanics. Students will design aerospace components under practical loading conditions.

**LEARNING OUTCOMES:**

Students will gain mastery level understanding of:

1. Stress/Strain Relationships
2. Material Properties (Metals, Elastomers, Composites)
3. Application of the principles of work, potential energy, kinetic energy, strain energy to a deformable system
4. Beam Theory
5. Concept of buckling

Students will gain a basic level understanding of:

1. Reciprocity theorems
2. Semi-monocoque Structural Design and Sizing
3. Finite Element theory for trusses and beams

Students will gain an exposure level understanding of:

4. Variational and approximate solutions
5. Classic solution to buckling of beams
6. Relevant Applications to Aerospace Systems including stress limitations on aircraft flight envelope

**TOPICAL OUTLINE:**

<i>TOPIC</i>	<i>HOURS</i>
• Stress/Strain Relationships and Material Properties (Review)	2
• Euler Bernoulli beam theory (Review)	4
• 3D beam theory	6
• Torsion of beams	3
• Thin-walled beams	4
• Semi-monocoque Structural Design and Sizing	3
• Virtual work principles	3
• Energy methods	6
• Concept of buckling - Buckling of beams	3
• Finite Element theory for trusses and beams	4
• Relevant Applications of aerospace structures; include stress limitations on aircraft flight envelope	4