**AE 6121 –** **Fundamentals of Aerospace Structural Analysis**

**Hours:** 3-0-3

**Catalog Description (25 words or fewer):**

Overview and fundamentals of aerospace structural analysis, including virtual work and energy methods, buckling and advanced structural theories.

**Prerequisites:**

COE 3001

**textbooks:**

*Structural Analysis* by O.A. Bauchau and J. I. Craig, Springer 2009

**Course Objectives:**

Fundamentals of structural analysis with emphasis on virtual work and energy principles; application of these principles to the formulation of advanced structural theories; understanding of structural buckling and the determination of critical loads.

**Learning Outcomes:**

Students will be able to:

1. Solve for the stresses and displacements in a structure, which may be either determinate or indeterminate and loaded under a combination of axial, shearing, bending and torsional loads.
2. Construct advanced structural theories (e.g. composite or sandwich structures).
3. Derive critical loads and study the nature of buckling in a structure loaded in compression.

**Grading:**

Midterm Exams(2): 60%

Final Exam: 40%

**Learning Accommodations:**

If needed, we will make classroom accommodations for students with documented disabilities. These accommodations must be arranged in advance and in accordance with the ADAPTS office (http://www.adapts.gatech.edu).

**Topical Outline:**

| **Topic** | **Lecture Hours** |
| --- | --- |
| **I. Course Overview and Background** | **1** |
| **II. Virtual Work Principles** | **8** |
| * 1. Principle of Virtual Displacements | 3 |
| * 1. Principle of Virtual Forces | 2.5 |
| * 1. Unit Load Method | 2.5 |
| **III. Energy Principles** | **8** |
| 1. Potential and Strain Energy | 3 |
| 1. Complementary Potential | 2.5 |
| 1. Castigliano’s theorem | 2.5 |
| **IV. Technical Theory of Beams and Advanced beam Theories** | **7** |
| 1. Derivation of the Technical Theory of Beams | 3 |
| 1. Timoshenko Beam Theory | 4 |
| **V. Structural Buckling** | **10** |
| 1. Fundamental Concepts of Structural Buckling | 3 |
| 1. Column Buckling (Euler Load) | 4 |
| 1. Buckling of Frames | 1.5 |
| 1. Post-Buckling and Elastica Theory | 1.5 |
| **V. Thin-Walled Structures** | **8** |
| 1. Shear Flow in Thin-Walled Beams | 3 |
| 1. Torsion of Thin-Walled Beams | 3 |
| 1. Multi-Cell Thin-Walled Sections | 2 |
|  |  |
| **Tests/Exams/Reviews** | **3** |
| **Total** | **45** |