AE 4132–Finite Element Analysis

HOURS: 3-0-3

CATALOG DESCRIPTION:

An introduction to classical approximation techniques and the fundamentals of the finite element-method applied to structures and structural dynamics with aerospace applications

PREREQUISITES:

COE 3001

TEXTBOOK:

A First Course in the Finite-Element Method, Daryl L. Logan, 5th ed., 2012.

COURSE OBJECTIVES:

1) To convey the fundamental concepts of the finite-element method and its application to structural and structural dynamics problems

2) To develop an understanding of the computational aspects of the finite-element method and its application in realistic aerospace applications

LEARNING OUTCOMES:

At a mastery level, students will be able to:

1. Understand the basic theory of finite-element method
2. Formulate, develop and apply the governing equations for basic finite-elements including bars, beams, frames and plane-stress elements

At a basic understanding level, students will be able to:

3. Apply the finite-element method to transient problems in structural dynamics

At an exposure level, students will be aware of:

4. Isoparametric formulation of finite-element problems for plane-stress and 3D problems

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 Office of Disability Services. (http://disabilityservices.gatech.edu).

ACADEMIC INTEGRITY:

Academic dishonesty is not tolerated. This includes cheating, lying about course matters, plagiarism, or helping others commit a violation of the Honor Code. Plagiarism includes reproducing the words or visual/graphical expressions of others without clear attribution and citation. Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code, available online at http://osi.gatech.edu/content/honor-code.

TOPICAL OUTLINE:

Topic	Lecture Hours
I. Review of basic mechanics and overview of the finite-element method	**3**
II. Virtual work and energy methods in mechanics	**2**
A. Virtual work	
B. Principle of minimum total potential energy	
III. Classical approximation techniques	**8**
A. Method of Galerkin	
B. Method of Ritz	
IV. Applications of the finite-element method	**13**
A. 1D and planar bar elements	
B. Beam elements	
C. Frame and grid elements	
D. Constant strain triangle for plane stress	
V. Isoparametric elements and numerical quadrature/cubature	**6**
A. Isoparametric formulation for plane stress elements	
B. Numerical quadrature and cubature rules	
C. Development of quadrilateral plane stress elements	
VI. Applications of the finite-element method to structural dynamics	**7**
A. Modal methods for structural dynamics	
B. Numerical time-integration techniques: Newmark's method	
Tests/Exams/Reviews	**3**
Total	**42**