Finite Element Analysis and Design

EML 4507 Section 3258 (11782)
Class Periods: MWF 3rd period (9:35 – 10:25AM)
Location: MAEA-303
Academic Term: Spring 2026

Instructor:
Ashok V. Kumar
Email: Contact via Canvas Inbox
Phone: 352-392-0816
Office Hours: MWF 10:45 – 11:45 AM

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- TBD

Course Description
Credits: 3; Stress-strain analysis and design of machine elements; finite element analysis. Fundamentals of finite element analysis including, discrete system analysis, steady-state heat transfer analysis, static analysis of structures. Modeling, analysis, and design using FEA software.

Course Pre-Requisites / Co-Requisites
EGM 3520 Mechanics of Materials, EGM 334 Introduction to Numerical Methods Engineering Analysis

Course Objectives
The objective of the course is to teach the fundamentals of the finite element method with emphasis on the underlying theory, assumption, and modeling issues as well as providing hands-on experience using finite element software to model, analyze, and design systems of mechanical and aerospace engineers.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Medium
3. An ability to communicate effectively with a range of audiences	Low
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Low
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives	

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

Required Textbooks and Software

- Title: Introduction to Finite Element Analysis and Design
  Authors: Nam-Ho Kim, Bhavani V. Sankar, and Ashok V. Kumar
  3rd Edition, Wiley. ISBN-10 1394187459; ISBN-13 978-1394187454

Course Content

- Matrix algebra
- Direct stiffness method for discrete spring-mass system.
- Bar elements and truss elements
- Beam elements
- 2D and 3D Frame elements.
- Tractions and stress at a point.
- Principal stresses, principal directions, maximum shear stress given the stress at a point.
- Principal strains and principal directions given the strain at a point.
- Stress-strain relation for linear elastic materials
- Failure of materials.
- 2D problems: plane stress, plane strain or axisymmetric.
- Triangular 3-node and quadrilateral 4-node elements.
- Equilibrium equations for heat conduction.
- Fourier's Law
- Heat conduction elements.
- Introduction to plate, shell and 3D elements.

Evaluation of Grades

Assignment	**Percentage of Final Grade**
Homework & Projects	50%
Exams	45%
Quizzes	5%
	100%

Grading Policy

Percent	**Grade**	**Grade Points**
93 - 100	A	4.00
90 - 93	A-	3.67
87 - 90	B+	3.33
83 - 87	B	3.00
80 - 83	B-	2.67
77 - 80	C+	2.33
73 - 77	C	2.00
70 - 73	C-	1.67
67 - 70	D+	1.33
63 - 67	D	1.00

60 - 63	D-	0.67
0 - 60	E	0.00

Academic Policies & Resources
The university-wide student resources to academic policies and campus resources can be found at: https://go.ufl.edu/syllabuspolicies.

Commitment to a Positive Learning Environment
The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.
If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Coordinator • HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu • Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu