Finite Element Analysis and Design

EML4507 Section 12838
Class Periods: MWF, 5th period, 11:45am-12:35pm
Location: TUR L005
Academic Term: Spring 2023

Instructor:

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Teaching Assistant:

- Gu, Boyang, guboyang@ufl.edu, office location, MAEB-223
- Bilgili, Emir, emir.bilgili@ufl.edu; office hours: Tuesdays 11:45 am -12:35 pm via zoom
- Corrada, Daniel A, dcorrada@ufl.edu; office hours: Thursdays 8:30-9:20 am via zoom

https://ufl.zoom.us/j/99846488411?pwd=TTczWlN6ZWZ4a1Z4WUtLdGVVcFpHUT09

Course Description

Stress-strain analysis and design of machine elements and finite element analysis

Course Pre-Requisites / Co-Requisites

EGM 3344, EGM 3520 and MAP 2302 with minimum grades of C

Course Objectives

To learn the basic concepts and methodology of the finite element method, apply the finite element method to compute stresses and strains in structures, and learn a finite element software and use the software to design mechanical components that can carry the design load without failure.

Materials and Supply Fees

None

Relation to Program Outcomes (ABET):

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

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	
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	Medium

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive 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	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Recommended Textbooks and Software

- Title: A First Course in the Finite Element Method
- Author: Daryl L. Logan
- Publication date and edition: 5 edition (January 1, 2011)
- ISBN number: ISBN-13: 978-0495668251
- MSC/NASTRAN and MSC/PATRAN https://hexagon.com/products/msc-nastran-student-edition

Recommended Materials

MSC Nastran 2021.4 - Reference Guide
https://help.hexagonmi.com/en-US/bundle/MSC_Nastran_2021.4_Reference_Guide/resource/MSC_Nastran_2021.4_Reference_Guide.pdf

Course Schedule (Tentative)

	Date	Topic
1	Jan 9	Introduction to the course
2	Jan 11	Review of matrix algebra
3	Jan 13	Direct stiffness method
4	Jan 18	Direct stiffness method (CAREER FAIR)
5	Jan 20	2D truss
6	Jan 23	3D truss
7	Jan 25	FEA Software (1) Truss Analysis HW1 due
8	Jan 27	Symmetry and Review of Chapter 1-3 and HW1
9	Jan 30	Review of Beam theory
10	Feb 1	FEA beam HW2 due
11	Feb 4	FEA beam –distributed loading
12	Feb 6	Frame and grids
13	Feb. 8	FEA Software (2) Beam Analysis HW3 due
14	Feb. 10	Chapter 4-5 and HW3 review

15	Feb 13	Practice exam review
16	Feb 15	**Exam 1**
17	Feb 17	Review of Stresses and strains (1)
18	Feb 20	Review of Stresses and strains (2)
19	Feb 22	CST
20	Feb 24	CST
21	Feb 27	CST
22	Mar 1	Q4
23	Mar 3	Q4 HW4 due
24	Mar 6	3D Tetrahedral element
25	Mar 8	FEA Software (3) Solid elements HW5 due
26	Mar 10	Review of Chapter 6, 7,11, HW5
27	Mar 20	**Exam 2**
28	Mar 22	Review of Exam 2
29	Mar 24	Modeling considerations
30	Mar 27	Modeling considerations
31	Mar 29	Modeling considerations
32	Mar 31	Failure Theory/FEA design/Final project HW6 due
33	Apr 3	FEA software (4) Solid
34	Apr 5	Isoparametric formulation
35	Apr 7	Isoparametric formulation/Quadrilateral element
36	Apr 10	Gaussian quadrature
37	Apr 12	Gaussian quadrature in 2D and 3D
38	Apr 14	3D hexahedral element
39	Apr 17	Thermal stress HW7 due
40	Apr 19	Review of continuum elements HW8 due
41	Apr 21	Review of HW7 and Practice exam
42	Apr 24	**Exam 3**
43	Apr 26	Exam 3 review Project Due

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is required. Students are responsible for knowledge of all scheduling and policy announcements made in class. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (8)	100 each	20%
Exam 1	100 each	20%
Exam 2	100	20%
Exam 3	100	20%
Design Project	100	15%
Participation		5%

- Late homework will be deducted 20% per day.
- Solutions will be posted on the E-Learning class web site

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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 Program Coordinator
• Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*: https://distance.ufl.edu/state-authorization-status/#student-complaint*.