

EML 5526 Finite Element Analysis and Applications

Fall 2020 syllabus

Basic Information

Catalog Information: Credits 3, Pre-requisites: None for graduate students

Instructor: Dr. Ashok V. Kumar, Associate Professor, Department of Mechanical and Aerospace Engineering, Email: akumar@ufl.edu.

Class time and location: MWF 6th period (12:50 PM -1:40 PM) Classroom: NEB-201. All instructions will be online via zoom.

Office hours: MWF 10:00-11:00 am

Teaching Assistants: TBD

Recommended Text book: "Introduction to Finite Element Analysis and Design", by N.H. Kim, B.V. Sankar, and A.V. Kumar, Wiley, 2nd Edition, ISBN: 9781119078739

Course objectives and outcomes

Catalog description: Fundamentals of finite element analysis including, discrete system analysis, static and dynamic analysis of structures, steady state and transient heat transfer analysis. Modeling, analysis and design using FEA software.

The objective of the course is to teach the fundamentals of finite element method with emphasize on the underlying theory and implementation issues as well as providing hands on experience using finite element software to model, analyze and design systems of relevance to mechanical engineers.

The outline of the course is as follows:

- I. Background
 - a) Introduction and notations
 - b) Discrete systems and direct stiffness method
 - c) Solution of linear simultaneous equations
- II. 1-D problems
 - a) Heat conduction example
 - b) Truss elements
 - c) Beam Elements
- III. 2D problems
 - a) Heat conduction
 - b) Linear elasticity (Structural Analysis)
 - i) Review of linear elasticity
 - ii) 2D models (Plane stress, Plane strain, Axi-symmetric)
 - iii) Linear and higher order 2D elements
- IV. 3D elements and modeling issues
 - a) 3D elements
 - b) Mesh generation and element selection issues
 - c) Brief introduction to: Plate and Shell elements
- V. Transient Heat transfer and Fluid flow analysis
- VI. Dynamic analysis of structures including vibrations
 - a) Newmark method for analysis of second order systems
 - b) Modal superposition method

Course assessment

Examinations: There will be three exams to be taken online using Honorlock

Graded Homework: Homework will be posted online

Final Project: The final project will represent 3-4 weeks of effort. These can involve implementation of software or application of commercial software for some detailed analysis or design.

Grading: Examinations: 50%, Homework: 35%, Final Project: 15%.

Other course information

Reference books:

- a) "A first course in the Finite Element Method", Daryl L. Logan, Thomson Publishers.
- b) "A first course in finite elements" by Fish and Belytschko, Wiley Publications.
- c) "Finite Element Procedures in Engineering Analysis", by K. J. Bathe, Prentice-Hall.

Attendance:

You should attend all classes on Zoom during class hours unless you are an EDGE or off-campus student. If you have to miss a class for legitimate reasons such as medical or university work/sports then you will be allowed to take any missed quiz or exam on a later date.

Make-up Policy:

Late assignments will receive 75% credit if submitted within the time allowed for late submission by the e-learning system and will not be graded thereafter (if submitted by email or other means). Make up exams will be given only for students with medical reasons for missing the exam. Documentation in the form of a doctor's note must be provided for make-up exams and homework.

Academic Honesty:

All students admitted to the University of Florida have signed a statement of academic honesty committing them to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action.

This statement is a reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.

Online privacy:

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

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/>.

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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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. A violation of the honor code will result in academic sanctions (typically a failing grade assigned for the course) and further disciplinary action. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use and Copyrighted Material

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use and the use of copyrighted material. 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: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.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: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

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 support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.
<https://www.crc.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://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.