Syllabus for
MECH 4326: Applied Finite Element Analysis
Spring 2020

Overview

This 3 credit hour class is intended to provide the students with an introduction to the theory, skills, and nomenclature to confidently, and intelligently perform linear elastic and basic dynamic finite element analysis for mechanical engineering systems and structures. This will be done with exposure to the basic theory of finite element analysis with hands-on applications solved using Matlab, MSC. Nastran. This is not a class to teach you how to use particular software.

Course Information

CRN:26510

Instructor: Dr. Methaq Abed

Email: msabed@utep.edu

Office Hours:Virtual office hours will be conducted through blackboard from 2:30 to 4:30 pm TR, you are welcome anytime to send your questions via email and allow me 24 to 48 hrs to reply. Please enter your name and your class name like (MECH 4326) when you enter the online session.

Office: Engineering Annex, A104

Textbook: "A First Course in the Finite Element Method", 6th edition, by Daryl L. Logan

Prerequisites: MECH 3334& MECH 2351

Location: Online

Meeting Time: 12:00 to 1:20 pm TR

Software: You are expected to have access to the following software: MATLAB, MSC.Nastran, and Altair HyperWorks (available on ETC FTP site http://etc.utep.edu/software/repository.htm installation instructions are here as well). You should not use MyDesktop or some other virtual connection. These are typically unreliable. Issues with MyDesktop will not be considered a valid excuse for not completing homework,

Course Objectives

At the end of this class, the typical students should be well prepared in the following areas:

- Formulate assemble and solve simple finite element problems by hand
- Understand the finite element interpolation and how it is used to model elasticity problems
- Understand the formulation of the following finite elements: bar, truss, beam, CST, LST and Quad4 2D elements, solid and shell elements
- Understand how various finite elements converge and how to test for the convergence

- Understand the basic elasticity partial differential equations and the 2D simplifications of plane stress, plane strain and axisymmetric
- How to choose appropriate boundary conditions
- Modeling errors and basic element deficiencies

Course Policies

Grading:

1) Three exams will be given during the semester.
2) Final project
3) Homework assignments will be randomly collected and graded. A few unannounced quizzes during the semester
4) Attendance will be taken through Top Hat/ Participation through blackboard discussion.

The grade will be computed as follows:

Final Score = 60% Exams+ 20% Project+ 10% Homework + 10% (Attendance and class Assignment)

The lowest test grade will be dropped.

To comply with the University's new rules due to coronavirus that hits the nation now, exam 3 will be given online through the blackboard. I will be using the lockdown browser with a webcam for the online exam.

Expected Date for Test #3: Tuesday, May 5th

Drop/Withdrawal Deadline: Friday, April 3rd, 2020.

Project Due Date: Thursday, May 7th.
The submission for the project will be online. There will be one submission per group. If anyone is hard for him/ her to communicate with the team, then he/she can submit the project as individual.

The letter grade that will be assigned is given as follows:

$$88 \le A \le 100$$
$$75 \le B < 88$$
$$62 \le C < 75$$
$$50 \le D < 62$$
$$F < 50$$

Exams: The exams will be announced at least one week in advance so that there is no excuse for missing an exam. ***There will be no make-up exams given!*** If you miss an exam with reasonable justification, your grade will be based on three exams. Also, if you show up for an exam after the exam has started, you ***will not be allowed to take the exam.***

Projects: There will be a group project given in the semester. This project is of such a scope that it will take a few weeks to complete. Typically, they will involve using FEA as a design tool and then involve design iteration.

Homework and quizzes: Homework will be assigned at the end of each chapter. I will not grade every homework, but I will randomly ask to grade some homework assignments. That means you need to bring the homework to class in a manner that is acceptable to be handed in at the beginning of the lecture that is due. Please do not come in late to class to hand them in – they will not be accepted. ***Also, homework is expected to be neatly done. I reserve the right not to grade any homework that I am not able to follow***.

Also, there will occasionally be an in-class quiz based on the homework. Very possibly exactly a problem or part of a problem from the homework. Also, as discussed in the next section, there will be problems that you will solve in class that will be graded through Top Hat ® and count to your grade.

Top Hat: We will be using the Top Hat (www.tophat.com) classroom response system in class. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or via text message (SMS).

You can visit http://tinyurl.com/THStudentRegistration for the Student Quick Start Guide, which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system. An email invitation will also be sent to your email account (if you don't receive this email, you can register by visiting our direct Top Hat course URL: https://app.tophat.com/e/745492

Course ID: 745492

Top Hat will require a subscription. There are three options to choose from:
- $24 for 4 months of unlimited access
- $36 for 12 months of unlimited access
- $72 for lifetime student access

Computational Assignments*:* Several homework problems will involve using computer programs in the solution. I will post an example of how to hand these types of problems in. Again I will not grade computational homework that is not in an appropriate form. The most important part of a computational assignment is the analysis done on the results or the post-processing. I do not want to just see the print out from Nastran! Typically, these assignments should be typed up.

Nastran input files will be checked to see that they execute and give results. Also, some of the in-class exercises will involve using Nastran. It is essential that you gain some experience in using this type of finite element program in a finite element class.

Readings: I do not explicitly cover everything that is in the text, but that does not mean you are not responsible for the material. Each lecture, I will state what sections I am covering, and you are to read that outside of class. I try to lecture so that I supplement the text, not simply recite it.

YouTube*:** I have posted several videos of solutions to problems on YouTube as well as additional lecture material that are meant to supplement your understanding of the material in this class or to fill in any background that might be missing. This material is not optional; it is assumed that you will go through this as well.***

Students with Special Needs: Students with disabilities or special needs, including both permanent disabilities (including learning disabilities, Attention Deficit Disorder, visual, mobility and hearing impairments, psychological disabilities, and chronic systemic disorders) as well as some temporary medical conditions (e.g., a broken arm), are encouraged to see the UTEP Disabled Student Services Office (DSSO) located at Union East Room 106 or contact them at (915) 747-5148 or at dss@utep.edu.

Topics covered:
- The general finite element approach
- Displacement method
- Energy method

· 1D spring, rod elements
· 2D and 3D truss elements
· 1D beam and 2D and 3D frame elements
· Plane stress and plane strain elements
· Isoparametric elements
· 3D stress elements
· Plate and shell elements
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In addition, you will learn the following computational skills:
· Programming and solving simple finite element problems in Matlab
· Writing ASCII input files for Nastran
· Use and formulation of various Nastran

ACES & Tutoring Center

Please note there are tutoring services available in the ACES center. Tutoring is free to you; the Department pays them. If tutors are not used, the Department may stop funding them. Check the schedule of the tutors and make use of the services. For more details, visit the

ME Advising Blackboard -> cc mech acadav: MECH Academic Advising -> Tutoring & Resources

At the link you can find tutor schedules, location of the ACES center and the list of tutors available. For more information, send email to METutors@utep.edu

Harassment Policy

The department has a zero-tolerance policy for harassment. Engagement in any behavior considered harassment would be reported to the proper authorities. In addition to generally understood forms of harassment, the department also treats the following behavior as harassment:

- Repeated emails and/or calls regarding subjects that have already been addressed. Once a decision has been made or a question answered, a student who continues to ask the same question will be given a warning by the recipient of the email/call. If the student continues, the behavior will be reported. Questions that seek understanding of course material are not harassment, but repeated questions about a grade or an administrative decision are.
- Grades are NOT negotiable, ever. If you believe a grading mistake has been made, you must follow the process described in the UTEP catalog. Any request for a grade elevation that is NOT based on a mistake is considered harassment and will be reported immediately.