Syllabus for MECH 4326: Applied Finite Element Analysis
Fall 2016

Overview
This 3 credit hour class is intended to provide the students with an introduction to the theory, skills, and nomenclature to confidently 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 and ANSYS. This is not a class to teach you how to use a particular software.

Course Information Instructor:
Dr. Vinod Kumar
Email: vkumar@utep.edu
Office Hours: M 9-10am or by appointment.
Office: A106

TA: Shaikh Tanveer Hossain
Email: shossain3@miners.utep.edu
Office hour: 9am-10am (Monday)

Prerequisites: Mechanical Design, MECH 3334
Meeting Times: TR 3-4:20am
LART 318

Software: You are expected to have access to the following software: Matlab and ANSYS (available on ETC FTP see http://etc.utep.edu/software/repository.htm for installation instructions). 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:
1. Formulate assemble and solve simple finite element problems by hand
2. Understand the finite element interpolation and how it is used to model elasticity problems
3. Understand the formulation of the special type of elements, e.g., bar, beam, & shell elements
4. Understand how various finite elements converge and how to test for the convergence
5. Understand the basic elasticity partial differential equations and the 2D simplifications of plane stress, plane strain and axisymmetric
6. How to choose appropriate boundary conditions
7. Modeling errors and basic element deficiencies
8. Modal and dynamic response analysis
9. Heat conduction
10.Fluid Mechanics

Course Policies
Grading: The grade in this class will be based on
1) three exams, and a few unannounced quizzes during the semester, 40 percent
2) a final project and on 30 percent
3) homework assignments 30 percent

Any outstanding grading issues must be resolved within two weeks after the graded work has been returned. There is no curve, dropping of exams, or room for negotiation on this part.

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

- 90 ≤ A
- 80 ≤ B < 90
- 70 ≤ C < 80
- 60 ≤ D < 70
- F < 60

Exams: The exams will be announced at least one week in advance in the class so that there is no excuse for missing an exam. There will be no make-up exams given!

Homework: Homework will be assigned in the class and due at the next lecture. 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. Also, homework is expected to be neatly done. I reserve the right not to grade any homework that I am not able to follow.

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.

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 those outside of class. I try to lecture so that I supplement the text.

Supplemental materials:
I will provide supplemental materials through Youtube videos and text files 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.

Attendance: Attendance is expected and required. We will sometimes take attendance, and you do run the risk of missing a quiz if you are absent or late. If you are attending a conference or academic competition you need to see me first for approval. Typically, if you are not presenting any work or directly participating in the competition I will not accept this as a valid excuse or missing class.

Academic Dishonesty: If any academic dishonesty is suspected, the student will be referred to the Office of Student Life. This includes copying during an exam, receiving outside help, etc. as well as copying Matlab input files. If you are unsure about what constitutes academic dishonesty
please consult the following site: http://studentaffairs.utep.edu/Default.aspx?tabid=4386

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 CASS office located at Union East Room 106 or contact them at (915) 747-5148 or at cass@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
• Structural dynamics and time-dependent problems In addition, you will learn the following computational skills:
• Programming and solving simple finite element problems in Matlab
• 2D problem with ANSYS