COURSE: ENGR 5420    4 Credits

INSTRUCTOR: Dr. Weidong Wu

Office: EMCS 440B
Phone: (423) 425-5822
E-Mail: Weidong-Wu@utc.edu
Webpage: http://www.utc.edu/faculty/weidong-wu

MEETING TIME: TBD

MEETING ROOM: TBD

OFFICE HOURS: Open door policy or by appointment

ADA STATEMENT: Attention: If you are a student with a disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) and think that you might need special assistance or a special accommodation in this class or any other class, call the Disability Resource Center (DRC) at 425-4006 or come by the office, 102 Frist Hall.

If you find that personal problems, career indecision, study and time management difficulties, etc. are adversely affecting your successful progress at UTC, please contact the Counseling and Career Planning Center at 425-4438 or http://www.utc.edu/Administration/CounselingAndCareerPlanning/.

DESCRIPTIONS:

This class teaches the fundamentals of FEM with hands-on experience in numerical implementation and applications.

OBJECTIVES

• The students should understand the mathematical and physical principles underlying the FEA.
• Be able to identify and solve relatively complex engineering problems using commercial FEA code such as Abaqus
• To provide students with basic skills of FEA programming using Matlab
• Be able to write FEA technical report to clearly show his/her work

LEARNING OUTCOMES

At the conclusion of this course, students should be able to

• demonstrate a basic understanding of the concepts, mathematical formulation and numerical implementation
• underlying the FEA as applied to solid mechanics;
• create his/her own FEA computer programs using Matlab to solve simple engineering problems;
• analyze more complex problems using commercial FEA software ABAQUS;
• demonstrate the ability to invoke appropriate assumptions, select proper elements and develop FEA models that adequately and efficiently represent physical systems;
• demonstrate the ability to deliver a professional FEA report of their work and give a well organized presentation.

HOMEWORK:

Most homework assignments should include both hand calculations and computer modeling verification using Abaqus, or Ansys. Simple Matlab programming of FEA may also be assigned. All HWs need to be typed (will accept scanned copies of nicely AND neatly handwritten materials) and submitted electronically to my email with subject: Your first and last name_HW#

TEXTBOOKS:

All the following books are optional:

1. Jacob Fish, Ted Belytschko, A First Course in Finite Elements, Wiley 2007

SOFTWARE:

Abaqus and Matlab

GRADING POLICY:

A final grade will be assigned based on the following percentages:

Mid-term exam: 15%

Final take-home exam: 15%

Course projects: 40%

Homework: 30%

The final score will also be based on the student’s overall performance

PROJECTS AND HOMEWORK

There will be two course projects. The students are expected to identify their own problems to solve by both hand calculations and computer simulation, a detailed report should be submitted to instructor by deadline. The students will need present his work in the class.

Generally homework problems should be solved by hand calculations and verified by running FEA software or Matlab code. The homework can be typed and nice and neat hand written homework is acceptable, computer simulation results should be printed out and attached to the homework.
HONOR CODE:

OFFENSES: Cheating on any exam, quiz, work to be completed in class; cheating on final examination; theft or attempted theft of exam questions or possession of exam questions prior to the time of the examination shall all be offenses subject to appropriate penalties. • PENALTIES: The penalty for commission of any offense set out above is failure in the course and, subject to the approval of the Chancellor, dismissal or suspension from the University.

TENTATIVE TOPICS (Subject to change)

1. Introduction to FEA and FEA procedures
2. Fundamentals of mechanics and essential mathematics
3. Introduction to Abaqus and Matlab
4. Direct Approach for discrete systems
5. Strong and weak forms for 1D and 2D problems
6. Formulation of finite elements
   a. FEA in one dimension
   b. The 2-D triangular element
   c. The 2-D quadrilateral element
   d. Isoparametric 2-D elements
   e. The 3-D element
   f. Beam element
   g. Plate bending element
7. Computer implementation of FEA using Matlab

USEFUL LINKS

FEA @ MIT