ENME 470 Finite Element Analysis  
Summer 2016

Catalog Description
Basic concepts of the theory of the finite element method. Applications in solid mechanics and heat transfer. 3 credits.

Prerequisite:  
Senior Standing

Class Information:  
TuTh 12:00 - 3:30pm

Room:  
KEB1200 for the first week; KEB 2111 on all other days

Course Instructor:  
Dr. Chandrasekhar Thamire  
Office: EGR 3133; Phone: (301) 405-7329; Email: ethamire@umd.edu

Office Hours:  
TuTh: 10:30 am – 12:00 noon, and by appointment

Textbook:  
Engineering Analysis with Pro/Mechanica and ANSYS, Guangming Zhang, College House Enterprises LLC, 2011
ISBN: 978-1-935673-03-3

References:  
Finite Element Analysis, K. J. Bathe, Prentice Hall, 1996

Course Description This course introduces you to the theory and targeted applications of the finite element methods. Emphasis will be on applications in solid mechanics and heat transfer. We will be learning the underlying numerical method initially and then applying the method to solve design problems in engineering industry using FEA software. Creo and Matlab will be the primary software systems used. Time permitting, ANSYS and other FEA software may also be used. The course will enable you to gain a good understanding of science-based computational modeling methodology and learn the skills essential to obtain numerical solutions to a variety of engineering problems.

Goals: The main objectives of this course are to provide students with a conceptual understanding of (1) the principles of finite element analysis (FEA), (2) implementation of FEA principles using commercial software, and (3) design optimization. The main software system used in teaching/learning will be Creo Simulation, and other software systems may be introduced depending on the learning pace of the class. ABET-specific goals for this course are:

1. Ability to apply knowledge of mathematics, science, and engineering.
2. Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
3. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
4. Recognition of the need for, and an ability to engage in life-long learning.

Topics Covered:

- Introduction to Finite Element Analysis
- Concept of Constitutive Equations and Stiffness Matrices
- Material Properties and Basic Types of Elements
- Structural Idealizations: Beams (trusses) and Shells
- Modeling using 3D Elements and Mesh Generation
- Error Analysis and Criteria for Convergence
- Modeling of Constraints and Loads
• FEA with Components and Assemblies
• Buckling, Vibration, and Thermal Analysis
• Simulation-Driven Design Optimization

Grading Policy: Participation: 5%
Homework Assignments: 25%
Mini Design Project (Team Project): 15%
Mid-Term Exam: 25%
Final Exam: 30%

Attendance:

Attendance and active participation are essential to learning in this course. The students are expected to attend the entirety of each class. Attendance will be taken randomly in each class, and participation in class will be counted as 5% of the grade.

Textbook and Homework Assignments

To understand the concepts of engineering analyses and the concepts of FEA methods, reading the material presented in the textbook is important. Many of the homework problems will be taken from the textbook. Therefore, you should bring your textbooks with you when coming to class. Occasionally problems that are not from the textbook may be given. Lecture notes to assist you in completing them will be distributed or posted on elms.

Homework and Project

Only hard copies of results (typically FEA plots prepared by the software used) and hand-written work, as appropriate, are accepted for homework. Email submissions will be awarded only 50% of the credit, unless accompanied by a documented medical emergency. Late homework is not accepted and to account for emergencies, the lowest homework grade will be dropped. Topics and details of the mini project will be provided mid-way through the semester.

Important Dates

07/14/16 First day of classes
07/17/16 Last day (for undergraduates) to drop a single course without a "W"
08/04/16 Mid-term Exam, 10:00 am – 11:30 am
08/07/16 Last day (for undergraduates) to drop a single course with a "W"
08/20/16 Final examination, Thursday, 10:00 am – noon; Project reports due

Academic Integrity:

The University is an academic community. Its fundamental purpose is the pursuit of knowledge. Like all other communities, the University can function properly only if its members adhere to clearly established goals and values. Essential to the fundamental purpose of the University is the commitment to the principles of truth and academic honesty. Accordingly, The Code of Academic Integrity is designed to ensure that the principle of academic honesty is upheld. While all members of the University share this responsibility, The Code of Academic Integrity is designed so that special responsibility for upholding the principle of academic honesty lies with the students. Read the detailed information on Academic Integrity on the university home page.