Course Description: Introduction to the finite element method and its applications in engineering mechanics, mechanical engineering, civil engineering and materials science.

Text: No official textbook. Reference books are on reserve in the library. Some notes and handouts will be provided.

Time: 9:10 – 10:00 a.m., Monday, Wednesday and Friday
Room: 3400 Engineering Building

Web Page: http://www.egr.msu.edu/classes/me424/averillr

Instructor: R.C. Averill, Department of Mechanical Engineering
Office: 2461 Engineering Building
Phone: 353-7188
Fax: 353-1750
Email: averillr@egr.msu.edu

Office Hours: Mondays and Wednesdays: 8:00 a.m. – 9:00 a.m., 10:15 a.m. – 11:15 a.m. Other times by appointment.

Grading: Laboratory Reports: 30% (approximately 6-8 reports)
 Theory Homework: 20% (approximately 8-10 assignments)
 Midterm 20%
 Final Exam 30%

Tentative Outline: 1. Introduction to the Finite Element Method
 2. Analysis Classifications, Element Types, and Model Validation
 3. Review of Fundamental Concepts and Procedures in Linear Algebra
 4. FEA of One-Dimensional Problems in Structures and Heat Transfer
 5. Interpolation Theory in 1D, 2D and 3D
 6. Formulation of Finite Element Equations by Minimization of Potential Energy
 7. Accuracy and Post-Processing of the Solution
 8. Element Behavior and Modeling Issues
Late Policy:
Unless prior approval of the instructor is obtained, a laboratory report or theory homework assignment submitted after the given deadline will be assessed a 10% penalty for each day it is late.

Make-Ups:
Make-up exams are strongly discouraged. The instructor must approve the need for a make-up exam prior to the date of the class exam to be missed.

Attendance:
Strongly recommended, but not used in grade determination.

Academic Honesty:
Article 2.3.3 of the Academic Freedom Report states that "the student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." In addition, the ME Department adheres to the policies on academic honesty as specified in General Student Regulations 1.0, Protection of Scholarship and Grades, and in the all-University Policy on Integrity of Scholarship and Grades, which are included in Spartan Life: 1999 Student Handbook and Resource Guide. Students who plagiarize may receive a 0.0 on the assignment or fail the course or receive more severe sanctions. See the plagiarism policy below.

Disabilities:
Students with disabilities should contact the Resource Center for People with Disabilities to develop reasonable accommodations. For an appointment with a counselor, call 353-9642 (voice) or 355-1293 (TTY).

Dropping the Course:
The last day to drop this course with a 100 percent refund and no grade reported is February __, 2005. The last day to drop this course with no refund and no grade reported is March __, 2005. You should immediately make a copy of your amended schedule to verify that you have dropped this course.

Religious Observance:
If you wish to be absent from class to observe a religious holiday, you should make arrangements in advance with the instructor.

Assignment 1:
Verify that your computer account from the Division of Engineering Computing Services (DECS) is operational and become familiarized with very basic command using the UNIX operating system.
Plagiarism Policy
Department of Mechanical Engineering

Plagiarism is not tolerated in the Department of Mechanical Engineering. It shall be punished according to the student conduct code of the University. Integrity and honesty are essential to maintain society's trust in the engineering profession. This policy is intended to reinforce these values.

For the purpose of this policy, plagiarism means presenting, as one's own, without proper citation, the words, work or opinions of someone else.

A. You commit plagiarism if you submit as your own work:

1. Part or all of an assignment copied from another person's assignment, including reports, drawings, web sites, computer files, or hardware.

2. Part or all of an assignment copied or paraphrased from a source, such as a book, magazine, pamphlet, web site, or web posting, without proper citation

3. The sequence of ideas, arrangement of material, pattern or thought of someone else, even though you express them in your own words. Plagiarism occurs when such a sequence of ideas is transferred from a source to a paper without the process of digestion, integration and reorganization in the writer's mind, and without acknowledgement in the paper.

B. You are an accomplice in plagiarism and equally guilty if you:

1. Knowingly allow your work, in preliminary or finished form, to be copied and submitted as the work of another.

2. Prepare an assignment for another student, and allow it to be submitted as his or her own work.

3. Keep or contribute to a file of assignments with the clear intent that these assignments will be copied and submitted as the work of anyone other than the originator of the assignment. (The student who knows that his or her work is being copied is presumed to consent to its being copied.)

(based upon the MSU English Department's policy on plagiarism at: http://www.msu.edu/unit/engdept/undergrad/plagiarism.html)
Measurable objectives examined in students taking ME 424

Successful completion of the course means that the student is able to:

1) Describe the "essence" of the finite element method: to approximate the solution to differential equations by replacing them with a set of easily solvable algebraic equations based on subdomain (element) approximations.
2) Formulate finite element equations and derive interpolation functions for one-, two-, and three-dimensional finite elements.
3) Obtain finite element solutions by hand calculations for problems consisting of a small number of unknown primary degrees of freedom.
4) Identify appropriate governing differential equations and corresponding finite element types for a wide variety of solid and structural mechanics analysis problems.
5) Explain the benefits/drawbacks of certain types of elements.
6) Build effective finite element models of real structures and perform a finite element analysis to determine deflections, strains, stresses, and natural vibration frequencies.
7) Demonstrate numerical convergence of a finite element solution.
8) Explain the importance of and be able to perform validation of computational models.
9) Write reports detailing finite element analysis results, including assumptions, type of model, and significant findings.