EMEC 405: FINITE ELEMENT ANALYSIS
Montana State University
Department of Mechanical Engineering

Lecture: MWF 8:00-8:50 am Roberts Hall 208
Recitation: M 12:00-12:50 pm EPS 134

Instructors

Dr. Erick Johnson (lecture)
201E Roberts Hall
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Dr. Michael Edens (recitation/lab)
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994-2633

Please use these email addresses rather than the D2L email. Also, the subject line should begin with EMEC405.

OFFICE HOURS: See schedule posted on D2L
Any time we’re in our offices.
If you can’t meet during scheduled office hours or can’t find one of us in our offices try email or phone to discuss the issue or setup an appointment.

Course Website

https://ecat.montana.edu select EMEC 405

Catalog Description

Introduction to the finite element method emphasizing the fundamental principles of FEA. Various finite element formulations for applications to structural analysis, thermal/fluids analysis, and design. Practical computational experience using a commercial finite element computer code. 4 cr. (LEC 3 RCT 1)

Prerequisite: EMEC 326 or instructor approval.
Corequisite: Concurrent enrollment in or prior completion of EMEC 342.

Textbook

Course Objectives

- Introduce the basic concepts and theory of the finite element method
- Provide knowledge and experience in the formulation and applications of FEA
- How to interpret solutions, results, and critique the quality of the mesh used
- Acquire experience with the use of a commercial finite element computer codes

Assessment and Evaluation

Student evaluation will be based upon the following body of work

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homework/Recitation</td>
<td>20%</td>
</tr>
<tr>
<td>In-Class Exercises</td>
<td>10%</td>
</tr>
<tr>
<td>Mini Projects</td>
<td>20%</td>
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<tr>
<td>Term exams: (2x 12.5%)</td>
<td>25%</td>
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<tr>
<td>Final Project</td>
<td>25%</td>
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Final grades will be assigned based upon the following:

- A- 90% to 92%
- A >92%
- B- 80% to 82%
- B >82% to <88%
- B+ 88% to <90%
- C- 70% to 72%
- C >72% to <78%
- C+ 78% to <80%
- D 60% to <68%
- D+ 68% to <70%
- F <60%

HOMEWORK

Several homework problems will be assigned each week from the textbooks. Problems assigned from Hutton will be used to reinforce concepts and prepare for exams. Some of these problems will need to be done using only pencil, paper, and a calculator, while others can be solved using Mathcad, MATLAB (recommended), or your favorite such software. Problems assigned from Lee (recitation) will reinforce lecture material and its application to FEA as well as improve your working knowledge of FEA packages.

Homework will be graded on a 3-point scale. Homework assigned during lecture will be due by 12pm (noon) on the following Wednesday, unless otherwise specified.

RECITATION

Recitation will focus primarily on learning the basics of the commercial FEA software package, ANSYS. You will be required to complete a number of tutorials out of Lee. These problems will all require use of your favorite CAD software or ANSYS workbench CAD along with ANSYS FEA. Recitation will also cover use of ANSYS classic and other FEA packages. There is no textbook for this material. Learning ANSYS classic will improve your FEA skills and show a more direct tie between ANSYS and application of lecture material. We will focus heavily on how to create code files to perform analyses. We will drop one of the lowest scores.

IN-CLASS EXERCISES

Throughout the semester in-class exercises will be given. These will need to be completed during class time. The exercises will be worked in small groups. One submission per group will be required (everyone in the group will have their name listed). No make up for these will be given. I will drop two of the lowest scores.
MINI PROJECTS
During the semester there will be several class projects. These are group based and will involve writing your own FEA code (e.g. a 1D beam model in MATLAB) or be extensions of your recitation homework. Groups will be changed for each project. More details will be presented during class.

TERM EXAMS
There will be two in class exams during the semester. These will cover problem solving and concepts. Dates will be provided in class and on the D2L calendar.

Unexcused exams will be assigned a score of 0. To be excused you must contact myself or the department prior to the time of the exam. Official documentation will be required in support of any excused absence.

FINAL PROJECT
The project is where you will tie everything in the class together and demonstrate that you have at least a basic understanding of FEA. Groups will consist of 3-4 people. Each group will be responsible for selecting and formulating their project, subject to instructor approval. Your grade will be based upon a final report and an in-class presentation.

Behavioral Expectations
Montana State University expects all students to conduct themselves as honest, responsible and law-abiding members of the academic community and to respect the rights of other students, members of the faculty and staff and the public to use, enjoy and participate in the University programs and facilities. For additional information reference see (http://www2.montana.edu/policy/student_conduct/student_conduct-code_2008-2009.htm)

COLLABORATION
University policy states that, unless otherwise specified, students may not collaborate on graded material. Any exceptions to this policy will be stated explicitly for individual assignments. If you have any questions about the limits of collaboration, you are expected to ask for clarification.

PLAGIARISM
Paraphrasing or quoting another’s work without citing the source is a form of academic misconduct. Even inadvertent or unintentional misuse or appropriation of another's work (such as relying heavily on source material that is not expressly acknowledged) is considered plagiarism. If you have any questions about using and citing sources, you are expected to ask for clarification.

ACADEMIC MISCONDUCT
Section 420 of the Student Conduct Code describes academic misconduct as including but not limited to plagiarism, cheating, multiple submissions, or facilitating others’ misconduct. Possible sanctions for academic misconduct range from an oral reprimand to expulsion from the university.

ACADEMIC EXPECTATIONS
Section 310.00 in the MSU Conduct Guidelines states that students must:

A. be prompt and regular in attending classes;
B. be well prepared for classes;

C. submit required assignments in a timely manner;

D. take exams when scheduled;

E. act in a respectful manner toward other students and the instructor and in a way that does not detract from the learning experience; and

F. make and keep appointments when necessary to meet with the instructor.

In addition to the above items, students are expected to meet any additional course and behavioral standards as defined by the instructor.

STUDENTS WITH DISABILITIES

If you have a documented disability for which you are or may be requesting an accommodation(s), you are encouraged to contact your instructor and Disabled Student Services as soon as possible.

STUDENT EDUCATIONAL RECORDS

All records related to this course are confidential and will not be shared with anyone, including parents, without a signed, written release. If you wish to have information from your records shared with others, you must provide written request/authorization to the office/department. Before giving such authorization, you should understand the purpose of the release and to whom and for how long the information is authorized for release.