University of Guelph
School of Engineering
ENGG*4470 Finite Element Analysis

Instructor

Instructor: Marwan Hassan, PhD, PEng email: mahassan@uoguelph.ca
Phone: ext 52429
Office: Rm 2405 Office Hours: Tu Thu 1:30-2:30
Lectures times: Mon, Wed, Fri 9:30-10:20 Lecture room: MACK, Room 224

Teaching Assistants

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Textbooks

Introduction to Finite Element Analysis and Design, By: Kim and Sankar

Course Description

Catalogue Description The theory of finite element analysis is presented including element derivation and solution procedures. Students use a finite element package to solve problems based on static and dynamic applications in mechanical systems. Examples are chosen from classical machines as well as biological systems.

Required Background It is expected that the student taking this course have a good background and problem solving skills in: calculus, engineering mechanics, material, strength of materials, and design.

Course Objectives This is course is designed

- Understand how and why the finite element technique works
- Learn how the finite element method is implemented (both algorithmically and numerically) by developing simple finite element computer code
- Develop finite element formulations of engineering problems from a variety of application areas including stress, heat transfer, and vibration analysis

- Learn to use a commercial finite element software
- Understand how to use finite element analysis in design

Specific Learning Outcome Course Outcomes in terms of CEAB attributes

A knowledge base for engineering The knowledge of analytical equations for finite element formulations .

Problem analysis The ability to use given load and/or geometry information to determine stresses in components. Employ industry-standard software for interactive FE model generation, analysis and the post-processing of results. Interpret the output from the software critically and intelligently in order to yield the required information. The ability to demonstrate the validity of the results.

Design An open-ended design problem is assigned to each student in order to develop their ability to:

- Devise solutions for complex open-ended engineering problem.
- Design mechanical linkage system including individual components that meet specified needs.

Use of engineering tools The students are required to demonstrate the ability to apply modern engineering tools to analyze and develop their ideas. These tools include:

1. CAD software.
2. Matlab programming.
3. Using ADINA to perform stress, thermal, and modal analysis

Individual and team work The class is divided into groups of 3 students working together as a team in:

1. Devising the solution.
2. Analyzing the ideas.
3. Presenting the progress.
4. Discussing alternatives with the instructor.
5. Finalizing the design.
6. Preparing the final report.
7. Delivering the final presentation.

Communication skills The students are required to submit two individual project reports which are used to developed their ability to communicate complex engineering concepts through writing. In addition two formal presentation are also required (progress and final presentations) which are intended to develop the student ability to use verbal and visual medium for effect communication.

Lecture Schedule

1. Mathematical Preliminaries
2. Stress-Strain Analysis
3. Uniaxial Bar and Truss Elements - Direct Method
4. Weighted Residual and Energy Methods for One Dimensional Problems
5. Finite Element Analysis of Beams and Frames
6. Finite Elements for Heat Transfer Problems
7. Finite Elements for Plane Solids
8. Finite Element Procedure and Modeling
9. Structural Design Using Finite Elements

Evaluation

Assignments (approximately 9)	0%
project	30%
Term tests (*)	40%
Final (*)	30%

Class tests are tentatively scheduled (TBA).
Passing the term and the final tests is a prerequisite to passing the course.

Miscellaneous

Assignments Assigned problems are for practice with no marks. You are required to attempt solving them on your own. Partial solution outlining the main steps will posted at least a week later.

In-class tests The in-class tests will be held during lecture period, and will be announced at least one week in advance. Please note that other university policies specified in University Undergraduate Calendar apply. Please see the following website for details.
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Mark adjustments Requests for mark adjustments must be put forward within one week of the documents being returned to the students (no exceptions). The documents include quizzes, and exams. The document must be taken to the TA that marked it. Any paper that is re-marked will be re-marked entirely. Therefore, it is strongly suggested that you thoroughly

review your entire document BEFORE making a re-marking request. Pencil-written works will not be remarked.

Attendance All students are expected to attend all classes. Important discussions will be held in class that may not be found elsewhere. Students questions and comments are highly valued.

Classroom Protocol Students should demonstrate their understanding of engineering as a profession and its responsibility to society. You should treat this class as if it were professional employment. This lecture and lab experience is intended to simulate real life. Students are expected to arrive in the classroom on time. You are responsible for all information, announcements, and course material presented in class. Professional behaviour reflecting the engineering profession is expected at all times. Cell phones are to be turned off during the class session. The use of laptops or tablets in class is not allowed. Students may not use a cell phone as a calculator when calculators are needed for this course. If you have questions for the instructor you should set up a meeting with the instructor as if it was your supervisor. Prepare for the meeting by knowing what you want to accomplish and consolidate your questions in a short time period.

University Policy on Academic Misconduct: Academic misconduct, such as plagiarism, is a serious offence at the University of Guelph. Please consult the Undergraduate Calendar 2008-2009 and School of Engineering programs guide, for offences, penalties and procedures relating to academic misconduct.
http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Disclaimer: The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to the University of Guelph Academic Regulations.