



ENGG*4470 Finite Element Analysis

Fall 2018

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - September 06, 2018

1 Course Details

1.1 Calendar 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.

Pre-Requisite(s): ENGG*2160, MATH*2130, MATH*2270

1.2 Timetable

Lectures:

Day	Time	Location
Monday	8:30am - 9:20am	ALEX 100
Wednesday	8:30am - 9:20am	ALEX 100
Friday	8:30am - 9:20am	ALEX 100

Labs:

Day	Time	Location	Section(s)
Monday	12:30pm - 2:20pm	THRN 2313	01
Wednesday	11:30am - 1:20pm	THRN 2313	02
Tuesday	12:30pm - 2:20pm	THRN 2313	03

1.3 Final Exam

Wednesday, December 12, 7:00pm - 9:00pm

Room TBA

2 Instructional Support

2.1 Instructor(s)

Alexander Bardelcik

Email: abardelc@uoguelph.ca
Telephone: +1-519-824-4120 x53228
Office: THRN 2501
Office Hours: Thursday 1:00PM - 2:00PM

2.2 Teaching Assistant(s)

Teaching Assistant: Siyu Wu
Email: swu09@uoguelph.ca
Office: THRN 2129 - Office Hour Location
Office Hours: TBD

Teaching Assistant: Mohamed Elhamahmy
Email: malhamah@uoguelph.ca
Office: THRN 2129 - Office Hour Location
Office Hours: TBD

Teaching Assistant: Tejas Mavani
Email: tmavani@uoguelph.ca
Office: THRN 2129 - Office Hour Location
Office Hours: TBD

2.3 Lab Technician

SOE IT Help (soeithelp@uoguelph.ca) Phone: Ex. 54113

3 Learning Resources

3.1 Required Resource(s)

Course Website (Website)

<http://courselink.uoguelph.ca>

Course material, news, announcements, and grades will be regularly posted to the ENGG*4470 CourseLink site. You are responsible for checking the site regularly.

Kim and Sankar Introduction to Finite Element Analysis and Design Wiley, 2008 (Textbook)

3.2 Recommended Resource(s)

Reddy, J.N, An Introduction to the Finite Element Method, 2nd Edition, New York ; Montreal McGraw-Hill, 1984. (Textbook)

3.3 Additional Resource(s)

Lecture Information: (Other)

The lecture powerpoint slides will be posted on the course website (CourseLink) throughout the semester. You will be granted access to the website when you register for the course.

Miscellaneous Information: (Other)

Lectures are the main source of material which includes important discussions and worked examples that might not be found elsewhere. Other information related to this course will also be posted on CourseLink.

PDF Handouts (Notes)

A set of PDF worksheet handouts (for long derivations/examples) will be posted on CourseLink. You are responsible to print these work sheets (full Letter size, 8.5'X11") and bring them to lectures as we will be filling them out together throughout the semester.

Assignments: (Other)

The assignments will be posted on CourseLink. All the solutions will be posted as indicated.

4 Learning Outcomes

This course aims at: (1) equipping the students with an understanding of theory and practice of the finite element method, (2) developing the ability to analyze and design using a commercial FEA software package.

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Utilize approximate numerical methods in solving structural problems such as the Ritz and the Galerkin methods.
2. Derivation of expressions describing the stiffness matrices and equivalent nodal load vectors for simple linear truss, beam and plane finite elements.
3. Apply principles of the isoparametric element formulation.
4. Use a commercial finite element software package (ANSYS) to solve engineering problems in solid mechanics.
5. Assess the accuracy and reliability of finite element solutions and troubleshoot problems arising from errors in a given finite element analysis.
6. Develop finite element formulations of engineering problems from a variety of application areas.
7. Demonstrate their ability to communicate their analysis and design ideas through technical reporting and presentation.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome Set Name	Course Learning Outcome
1	Knowledge Base	1, 2, 3
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1, 2, 3
1.3	Recall, describe and apply fundamental engineering principles and concepts	3

#	Outcome Set Name	Course Learning Outcome
1.4	Recall, describe and apply program-specific engineering principles and concepts	1, 2
5	Use of Engineering Tools	4, 5
5.2	Demonstrate proficiency in the application of selected engineering tools	4
5.3	Recognize limitations of selected engineering tools	5
6	Individual & Teamwork	7
6.3	Execute and adapt individual role to promote team success through, for example, timeliness, respect, positive attitude	7

5 Teaching and Learning Activities

5.1 Lecture

Topic(s): Math Preliminaries

Reference(s): Chapter 0

Topic(s): Stress-strain analysis

Reference(s): Chapter 1

Topic(s): Uniaxial bar and truss elements – direct method

Reference(s): Chapter 2

Topic(s): Weighted residual & energy methods

Reference(s): Chapter 3

Topic(s): Finite element analysis of beams and frames

Reference(s): Chapter 4

Topic(s): Finite elements for plane solids

Reference(s): Chapter 6

Topic(s): Finite element procedure and modeling

Reference(s): Chapter 7

Topic(s): Structural design using finite elements

Reference(s): Chapter 8

5.2 Lab

Mon, Sep 3 - Fri, Sep 7

Topic(s): No Labs

Mon, Sep 10 - Fri, Sep 14

Topic(s):	No Labs
Mon, Sep 17 - Fri, Sep 21	
Topic(s):	Lab 1 - MATLAB Introduction + Assignment 0 (using MATLAB)
Mon, Sep 24 - Fri, Sep 28	
Topic(s):	Lab 2 - Assignment 1
Mon, Oct 1 - Fri, Oct 5	
Topic(s):	Lab 3 - Assignment 2
Mon, Oct 8 - Fri, Oct 12	
Topic(s):	No Labs
Mon, Oct 15 - Fri, Oct 19	
Topic(s):	Lab 4 - ANSYS Workbench Introduction I
Mon, Oct 22 - Fri, Oct 26	
Topic(s):	Lab 5 - ANSYS Workbench Introduction II
Mon, Oct 29 - Fri, Nov 2	
Topic(s):	Lab 6 - Assignment 3
Mon, Nov 5 - Fri, Nov 9	
Topic(s):	Lab 7 - Assignment 4
Mon, Nov 12 - Fri, Nov 16	
Topic(s):	Lab 8 - Assignment 5
Mon, Nov 19 - Fri, Nov 23	
Topic(s):	Lab 9 - ANSYS Project Help

5.3 Important Dates

Thursday, September 6: First day of classes
Monday, October 8: Thanksgiving Holiday (no classes)
Tuesday, October 9: Fall Study Break
Friday, November 2: drop date - 40th class
Wednesday, November 28: last day of class
Thursday, December 12: Final exam for this course

6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
6 unmarked assignments	0
Project	30
Midterm Exam (1 & 2)	30
Final Exam	40
Total	100

6.2 Assessment Details

6 unmarked assignments (0%)

Project (30%)

Midterm Exam 1 (15%)

Date: Wed, Oct 3, ALEX 100
Regular lecture time

Midterm Exam 2 (15%)

Date: Wed, Oct 10, ALEX 100
Regular lecture time

Final Exam (40%)

Date: Wed, Dec 12, TBD

7 Course Statements

7.1 Communication and Email Policy

Please use lectures and tutorials as your main opportunity to ask questions about the course. Electronic communication should be limited to the course forum, however topics of a personal and confidential nature (e.g. marks) should be emailed to the instructor: abardelc@uoguelph.ca. Please note that all email communication must be made through your University of Guelph email account.

7.2 Academic Consideration

If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:
<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

7.3 Accommodation of Religious Obligations

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements.

See the undergraduate calendar for information on regulations and procedures for Academic Consideration of Religious Obligations:
<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

7.4 Passing Grade

The exams account for 70% of the total mark of the course. The project portion accounts for 30% of the total mark of the course. In order to pass the course, you must meet the following two criteria:

- Score 35% or higher out of the 70% allocated to the exam portion of the course.
- Score 15% or higher out of the 30% allocated to the project portion of the course.

Failure to meet any of the two criteria will result in a failure grade.

7.5 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
<http://www.academicintegrity.uoguelph.ca>

Please also review the section on Academic Misconduct in your Engineering Program Guide. The School of Engineering has adopted a Code of Ethics that can be found at:
<http://www.uoguelph.ca/engineering/undergrad-counselling-ethics>

8 School of Engineering Statements

8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on CourseLink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The regulations and procedures for [Academic Consideration](#) are detailed in the Undergraduate Calendar.

9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate Calendar.

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: www.uoguelph.ca/sas

9.6 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The [Academic Misconduct Policy](#) is detailed in the Undergraduate Calendar.

9.7 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.
