

**Western University**  
**Faculty of Engineering**  
**Department of Mechanical and Materials Engineering**

**MME3360B Finite Element Methods for Mechanical Engineering**  
**Course Outline 2021-2022**

**Description:** Overview of the finite element method (FEM) and its use to solve general problems in 2-D and 3-D. Applications include structural mechanics, heat transfer and multi-physics problems. Methods and applications of optimization and support of engineering design are also introduced.

**Instructor:** Dr. Paul M. Kurowski; Ph.D., P.Eng.  
Room: SEB2057A  
Email: [pkurows@uwo.ca](mailto:pkurows@uwo.ca)  
Office hours: by appointment

**Academic Calendar Copy:**

Overview of the finite element method (FEM) and its use to solve general problems in 1-D, 2-D and 3-D. Applications include structural mechanics, heat transfer and thermal stress. Methods and applications of commercial FEM programs in support of engineering design and analysis are introduced.

**Contact Hours:** 3 lecture hours, 2 laboratory hours (12 laboratories per semester)  
2 tutorial hours (per request), 0.5 course.

**Anti-requisites:** CEE 3384A/B, MSE 3360A/B

**Pre-requisites:** ES 1036A/B or Computer Science 1026A/B, Numerical and Mathematical Methods 2270A/B, MME 2202A/B or MSE 2212A/B, MME 2204A/B or MSE 2214A/B, MSE 2202A/B.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees if you are dropped from a course for failing to have the necessary prerequisites.

**CEAB Academic Units:** Engineering Science 80%, Engineering Design 20%.

**Required Textbook:** “Engineering Analysis with SOLIDWORKS Simulation 2021”  
P. Kurowski, SDC Publications, ISBN: 978-1-63057-383-6

**Required Software:** SOLIDWORKS 2021

Available in computer labs and for installation on students' computers.

### General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base	I	Use of Engineering Tools	D	Impact on Society and the Environment	
Problem Analysis	I	Individual and Teamwork		Ethics and Equity	
Investigation	I	Communication Skills		Economics and Project Management	
Design		Professionalism		Life-Long Learning	

Notation:  $x$  represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

### Topics and Specific Learning Objectives

#### 1. General steps in the FEM

At the end of this section, students will be able to:

- a. Identify steps and associated errors common to any FEM project
- b. Verify and validate FEM results

#### 2. Direct stiffness method

At the end of this section, students will be able to:

- a. Formulate and solve FEM equations for assembly of spring, truss, and beam elements.
- b. Apply applicable FEM modeling techniques

#### 3. Applications of solid, shell beam and 2D elements

At the end of this section, students will be able to:

- a. Use commercial FEM program to select element as required by the analyzed geometry
- b. Define analysis type and implement correct modeling techniques.

**4. Types of analyses: static linear, static nonlinear, thermal stress, modal, linear buckling, thermal**

At the end of this section, students will be able to:

- a. Select the correct type of analysis as required by the analyzed problem
- b. Interface between different types of analysis to solve multi-physics problems.

**5. Using a commercial FEM program to analyze design problems**

At the end of this section, students will be able to:

- a. Implement FEM in a design process
- b. Use FEM as a design tool.

**Evaluation**

Course Component	Weight
Three homework assignments 5% each	15%
SOLIDWORKS Simulation certification test	15%
Midterm Examination	20%
Final Examination	50%

**Assignments:** Three individual assignments due on: 4<sup>th</sup> week, 6<sup>th</sup> week, 11<sup>th</sup> week. Assignments will be submitted on-line to assignment drop box in course OWL

**Certification test:** On-line SOLIDWORKS Simulation certification test CSWA-S during the last week of March 2022.

**Laboratory:** Laboratories take place every week. students will work on assignment problems assisted by Teaching Assistants and/or by the Course Instructor.

**Tutorial:** as required, by appointment

**Midterm Examination:** Scheduled during the first week of March 2022; 2h long, open book examination.

**Final Examination:** The final examination, 3h long, open book examination. It will take place during the regular examination period. To obtain a passing grade in the course, a mark of 50% or more must be achieved on the final examination. A final examination mark < 50% will result in a final course grade of 48% or less.

**Course policies:** If a student misses the midterm exam with consideration, the weight of the midterm exam will be applied to the final exam. If student misses the midterm exam without consideration, the midterm exam's mark will be zero.

If deadlines for assignments are not being met, two days grace period will be allowed with 5% penalty per day. Delay of more than two days will result in mark zero.

If cheating during the midterm or the final examination is suspected, the student will be required to participate in a one-on-one oral examination with the instructor. The mark obtained in the oral examination will supersede the one obtained during the written examination. If the student refuses his/her participation in the oral examination, the examination will be automatically graded with zero and further academic penalties for scholastic offences will be applied.

Students who have failed an Engineering course (i.e. < 50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment, or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

Students are required to contact the instructor of the course for any other circumstances that appear to not be covered by the non-exhaustive list above.

**Use of English:** In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work (except final examination) may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

**Attendance:** Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

**Absence Due to Illness or Other Circumstances:** Students should immediately consult with the instructor or department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see the attached “Instructions for Students Unable to Write Tests or Examinations or Submit Assignments as Scheduled”). The student should seek advice from the instructor or department Chair regarding how best to deal with the problem. Failure to notify the instructor or department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, see the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_medical.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf)

For more information concerning accommodations for religious holidays, see the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_religious.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf)

**Cheating and Plagiarism:** Students must write their essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their

debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Scholastic offences are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

**Policy on Repeating All Components of the Course:** Students who are required to repeat an Engineering course must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment, or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted by the student for grading in subsequent years.

**Internet and Electronic Mail:** Students are responsible for regularly checking their Western e-mail and the course web site (<https://owl.uwo.ca/portal/>) and making themselves aware of any information that is posted about the course.

**Accessibility:** Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2111 ext. 82147 for any specific question regarding an accommodation.

**Support Services:** Office of the Registrar, <http://www.registrar.uwo.ca/>  
Student Development Centre, <http://www.sdc.uwo.ca/>  
Eng.Undergraduate Services, <http://www.eng.uwo.ca/undergraduate/>  
USC Student Support Services, <http://westernusc.ca/services/>

Students who are in emotional/mental distress should refer to Mental Health @ Western, [http://www.health.uwo.ca/mental\\_health/](http://www.health.uwo.ca/mental_health/), for a complete list of options about how to obtain help.

**Copy Rights:** Lecture notes and online lecture videos are copyrighted to the instructor and hence they are legally protected. As such, the unauthorized posting and sharing of the copyrighted course content could be subjected to legal actions. Along the same lines, the recording of the live/synchronous sessions of the course is strictly prohibited.

## **Course delivery with respect to the COVID-19 pandemic**

Although the intent is for this course to be delivered in-person, the changing COVID-19 landscape may necessitate some or all of the course to be delivered online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any assessments affected will be conducted online as determined by the course instructor.

**When deemed necessary**, tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: <https://remoteproctoring.uwo.ca>.

**INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED**

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

**NEW: Requests for Academic Consideration using the Self-Reported Absence Form**

If you experience an unexpected illness or injury or an extenuating circumstance (48 hours or less) that is sufficiently severe to temporarily render you unable to meet academic requirements (e.g., attending lectures or labs, writing tests or midterm exams, completing and submitting assignments, participating in presentations) you should self-declare using the online Self-Reported Absence portal. This option should be used in situations where you expect to resume academic responsibilities within 48 hours or less.

Each student will be allowed a maximum of two self-reported absences between September and April and one self-reported absence between May and August. Self-reporting may not be used for final exams or assessments (e.g. midterm exams, tests, reports, presentations, or essays) worth more than 30% of any given course.

For full instructions about the Self-Reporting System refer to the Academic Calendar link [here](#).

**A. GENERAL REGULATIONS & PROCEDURES (other than self-reported absences)**

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination that is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If your course work is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

**B. TERM/MIDTERM TESTS (other than self-reported absences)**

1. If you are in first year and you are unable to write a midterm/term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a midterm/term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief.
3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair or the Undergraduate Services Office is required when rescheduling midterm/term tests.

**C. FINAL EXAMINATIONS (cannot be self-reported)**

1. If you are unable to write a final examination, contact the Undergraduate Services Office **PRIOR TO THE SCHEDULED EXAMINATION TIME** to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department **and** the Associate Dean and in order to apply you must sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

**PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.**

**D. LATE ASSIGNMENTS**

1. Advise the instructor if you are having problems completing the assignment on time (**prior** to the due date of the assignment).
2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).
3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4.
  - i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.
  - ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

**E. SHORT ABSENCES**

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

**F. EXTENDED ABSENCES**

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You are strongly encouraged to seek advice from your Academic Counsellor in the Undergraduate Services Office.

**G. DOCUMENTATION**

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, **you must provide the doctor with a Student Medical Certificate** to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.**

**In Case of Serious Illness of a Family Member:** Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

**In Case of a Death:** Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

**For Other Extenuating Circumstances:** If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

**Note:** Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).



## H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).
2. **You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.**
3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your Academic Counsellor.

**Calendar References:** Check these regulations in your 2021 Western Academic Calendar available at [www.westerncalendar.uwo.ca](http://www.westerncalendar.uwo.ca).

[Self-Reporting Absences](#)  
[Absences Due to Illness](#)  
[Academic Accommodations for Students with Disabilities](#)  
[Academic Accommodations for Religious or Holy Days](#)  
[Course Withdrawals](#)  
[Examinations](#)  
[Scheduling of Term Assignments](#)  
[Scholastic Offences](#)  
[Student Medical Certificate](#)  
[Engineering Academic Regulations](#)

**Note:** These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

### **Add Deadlines:**

First term half course (i.e. “A” or “F”)	September 16, 2021
Full courses and full-year half course (i.e. “E”, “Y” or no suffix)	September 16, 2021
Second term half course (i.e. “B” or “G”)	January 11, 2022

### **Drop Deadlines:**

First term half course (i.e. “A” or “F”)	November 12, 2021
Full courses and full-year half courses (i.e. “E”, “Y” or no suffix)	November 30, 2021
Second term half or second term full course (i.e. “B” or “G”)	March 7, 2022

### **Contact Information:**

Undergraduate Services Office	SEB 2097 Phone: 519-661-2130	E-mail: <a href="mailto:engugrad@uwo.ca">engugrad@uwo.ca</a>
Chemical & Green Process Engineering	TEB 477 Phone: 519-661-2131	E-mail: <a href="mailto:cbeugrad@uwo.ca">cbeugrad@uwo.ca</a>
Civil Engineering:	SEB 3005 Phone: 519-661-2139	E-mail: <a href="mailto:civil@uwo.ca">civil@uwo.ca</a>
Computer, Electrical, Mechatronic Systems & Software Engineering	TEB 279 Phone: 519-661-3758	E-mail: <a href="mailto:eceugrad@uwo.ca">eceugrad@uwo.ca</a>
Integrated Engineering	ACEB 2410 Phone: 519-661-6725	E-mail: <a href="mailto:engceli@uwo.ca">engceli@uwo.ca</a>
Mechanical Engineering	SEB 3002 Phone: 519-661-4122	E-mail: <a href="mailto:mmeundergraduate@uwo.ca">mmeundergraduate@uwo.ca</a>

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