

# MME 3360b – Finite Element Methods for Mechanical Engineering

## COURSE OUTLINE – 2024-2025

**CALENDAR DESCRIPTION:** This course is an 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 multi-physics problems. Methods and applications of optimization and support of engineering design are also introduced.

**COURSE INFORMATION:** Instructor: Dr. Ben Hamilton  
Email: ben.hamilton@uwo.ca  
Lectures: See [Draft My Schedule](#)  
Tutorials/Labs: See [Draft My Schedule](#)

**CONSULTATION HOURS:** By appointment  
Office: SEB 2057A

**PREREQUISITES:** Engineering Science 1036A/B or Computer Science 1026A/B, NMM 2270A/B or the former Applied Mathematics 2270A/B, MME 2202A/B or CEE 2202A/B, MME 2204A/B, MME 2259A/B or MSE 2202A/B.

**ANTIREQUISITES:** CEE 3384A/B, MSE 3360A/B

**ACCREDITATION UNITS:** Engineering Science 80%, Engineering Design 20%.

**TOPICS/LEARNING OUTCOMES:** The Mechanical and Materials Engineering Program has been accredited by Canadian Engineering Accreditation Board (CEAB) of Engineers Canada. Accredited programs provide the academic requirements for licensure as a professional engineer in Canada. Western Engineering has defined indicators of the 12 Graduate Attributes (GAs) that the CEAB expects graduating engineering students to demonstrate. The connections between course learning outcomes and [Western Engineering’s GA Indicators](#) are identified below.

Course Topics and Specific Learning Outcomes	CEAB Graduate Attribute Indicators
<p><b>1. General steps in the FEM</b> At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> <li>a. Identify steps and associated errors common to any FEM project</li> <li>b. Verify and validate FEM results</li> </ul>	PA3, IN3, ET2
<p><b>2. Direct stiffness method</b> At the end of this section, students will be able to:</p> <ul style="list-style-type: none"> <li>a. Formulate and solve FEM equations for assembly of spring, truss, and beam elements</li> <li>b. Apply applicable FEM modeling techniques</li> </ul>	PA3

<p><b>3. Applications of solid, shell beam and 2D elements</b>  At the end of this section, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Use a commercial FEM program to select elements as required by the analyzed geometry</li> <li>b. Define analysis type and implement correct modeling techniques</li> </ol>	IN3, ET2
<p><b>4. Types of analyses: static linear, static nonlinear, thermal stress, modal, linear buckling, thermal</b>  At the end of this section, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Select the correct type of analysis as required by the analyzed problem</li> <li>b. Interface between different types of analysis to solve multi-physics problems</li> </ol>	PA3, ET2
<p><b>5. Using a commercial FEM program to analyze design problems</b>  At the end of this section, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Implement FEM in a design process</li> <li>b. Use FEM as a design tool</li> </ol>	PA3, ET2, D4

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).

**CONTACT HOURS:** 3 lecture hours, 2 tutorial hours (per request), 2 laboratory hours/week (12 laboratories in total), half course

**TEXTBOOK:** Suggested: Engineering Analysis with SOLIDWORKS Simulation 2023, P. Kurowski, SDC Publications, ISBN: 978-1-63057-552-6.

**UNITS:** S.I. will be used primarily; however, Imperial may also be used.

**EVALUATION:**

Course Component	Weight	Date
Three assignments (5% each)	15%	Jan. 31, Feb. 14, Mar. 28
Midterm Examination	20%	Mar. 7
SolidWorks CSWA-S exam	15%	Week of Mar. 16
Final Examination	50%	TBA

**Laboratory:** Laboratories take place every week. Students will work on assignment problems assisted by Teaching Assistants and/or by the Course Instructor. The CSWA-S exam will also be challenged during the laboratory.

**Midterm Examination:** Closed book examination.

**Final Examination:** Closed book examination. 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.

**Note:** If deadlines for assignments are not met, a two-day grace period will be allowed without penalty. A delay of more than two days will result in a mark of zero. Please note that because the submission deadline for these assignments already includes flexibility in the form of a 48-hour submission window, the instructor reserves the right to deny academic consideration for assignments which are submitted following the end of the period of flexibility.

**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 a student misses the midterm exam without consideration, the midterm exam's mark will be zero. Please note that this assessment is considered to be central to the learning objectives for this course. Accordingly, students seeking academic consideration for this assessment will be required to provide formal supporting documentation.

If technical issues prevent a student from successfully completing and submitting the midterm examination, at the instructor's discretion the weight of the examination may be shifted to the final exam. No make-up midterm examination will be offered in this

case.

If technical issues prevent a student from successfully completing and submitting the final examination, the official guidelines from the Associate Dean's Office, Undergraduate Affairs will be followed. Options to be considered will include, but without being limited to, an oral examination or a make-up examination in the special examination period.

If there is legitimate cause for suspicion of cheating during tests, the midterm exam or final exam exists, 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 quiz. 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 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.