Western University
Department of Mechanical & Materials Engineering

MME 4437A – Advanced CAE: Simulation

COURSE OUTLINE – 2025-2026

CALENDAR DESCRIPTION: Nonlinear structural analysis, vibration of discrete and distributed systems, kinematic and dynamic analysis, flexible mechanism analysis, nonlinear thermal analysis, fluid flow analysis, thermal fluids, multi-physics simulation, interfacing between structural, thermal and mechanism analyses.

COURSE INFORMATION:

Instructor: Ben Hamilton, PhD

Email: ben.hamilton@uwo.ca

Lectures/tutorials/labs: See Draft My Schedule

CONSULTATION HOURS: By appointment

PREREQUISITES: MME3307A/B, MME3360A/B, MME3380A/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 in the event that you are dropped from a course for failing to have the necessary prerequisites.

ANTIREQUISITES: None

ACCREDITATION UNITS: Engineering Science = 75%, Engineering Design = 25%

TOPICS: Selected advanced topics of Computer Aided Engineering (CAE)

1. Nonlinear structural problems
2. Nonlinear material models
3. Linear and nonlinear vibration of discrete and distributed systems
4. Kinematics and dynamics of flexible mechanisms
5. Computational Fluid Dynamics
6. Thermal fluid problems
7. Topology Optimization

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.

Upon successful completion of this course, students will be able to:

1. Formulate and solve advanced engineering analysis problems not covered in introductory courses. (KB3, PA2, D4)
2. Interface between different computer aided engineering tools. (ET2)
3. Use different computer aided engineering tools to analyze complex system behavior analysis tools. (KB3, PA2)

4. Perform advanced types of finite element analysis, finite volume analysis and topology optimization. (KB4, CS3, LL2)
5. Specify the latest engineering tools. (ET2)
6. Use latest local and cloud computing analysis tools. (ET2)

CONTACT HOURS: 3 lecture hours, 2 hours of supervised lab time per week for assignment/project help, half course

TEXTBOOK: The following textbooks are recommended:

"Thermal Analysis with SolidWorks Simulation 2022 and Flow Simulation 2022", P. Kurowski, SDC Publications, ISBN: 978-7-63057-490-1.

"Vibration Analysis with SolidWorks Simulation 2022", P. Kurowski, SDC Publications, ISBN: 978-1-63057-488-8.

"Engineering Analysis with SolidWorks Simulation 2025", P. Kurowski, SDC Publications, ISBN: 978-1-63057-702-5.

Other references will be provided during lectures

UNITS: SI will be used; however, English units may be introduced through examples as required.

EVALUATION:

Assessment Type	Assigned	Due Date	Weight
Assignment 1	Sep. 8	Sep. 23	5%
Assignment 2	Oct. 20	Nov. 25	5%
CSWP-S Exam (closed book)	N/A	Oct. 6	10%
CSWP-Flow Exam (closed book)	N/A	Nov. 17	10%
Project	Sept. 4	Dec. 1	20%
Final Exam (closed book)	During the examination period		50%

COURSE POLICIES: If deadlines for assignments and projects are not met, a three-day grace period will be allowed without penalty. A delay of more than three 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 72-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.

CSW Exams: If technical issues prevent a student from successfully completing or submitting a CSW exam, the instructor will decide whether a second attempt is permitted. If approved, a makeup exam will be scheduled at a later date.

The CSWP-S Exam 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 (designated assessment).

Final Examination: 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.

Generative AI: The use of generative artificial intelligence (AI) tools (i.e., ChatGPT, Google Gemini, Microsoft Copilot, image or code generation tools, etc.) is not permitted for any assessed work in this course, including exams, assignments, and projects. All submitted work must be produced by the student without the aid of generative AI technologies.

If you are unsure whether a particular tool or approach is permitted, please consult the instructor before using it.

If a student is suspected of cheating on a course assessment, the student will be

notified, and an investigation will be completed by the Associate Chair - Undergraduate (MME). If it is determined that a scholastic offence has taken place, the Associate Chair - Undergraduate may apply a grade penalty, up to and including course failure. Further disciplinary actions may be imposed by the Associate Dean for Undergraduate Studies (Engineering).

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.

General Faculty / University Policies

The Faculty of Engineering and Western University have overarching policies that prescribe how undergraduate courses should run. The course-specific policies described above should be considered *in addition to* those overarching policies, or as course-specific interpretations of them. In the event of contradictions or confusion between course-specific policies above and general Faculty / University policies, please contact your course instructor for clarification.

Western Engineering's undergraduate polices can be found by navigating to:
https://www.eng.uwo.ca/undergraduate/academic-support-and-accommodations/policies.html

and then clicking the "*Engineering Undergraduate Policies framework*" link.