DESCRIPTION: The course is focused on basic fundamental aspects and advanced concepts in fluid mechanics. The course objective is to provide review of some fundamental topics from undergraduate curriculum that include conservation laws, dynamic similarity and introduction to boundary layer flows. The course then focuses on advanced topics that include detailed boundary layer analysis, jets, turbulence, aerodynamics, airfoils and compressible flows.

PREREQUISITES: Graduate student standing or permission from the instructor

ANTIREQUISITES: None

TOPICS: Module 1 (Weeks 1-6)
- Conservation Laws
  - Mass (Continuity)
  - Momentum (Navier-Stokes)
  - Energy
- Dynamic Similarity
  - Dimensional analysis
  - Similarity laws

Module 2 (Weeks 7-11)
- Boundary layers
  - Flat plate (Laminar and turbulent boundary layers)
  - Curved surfaces (Flow past cylinder and sphere)
  - Two-dimensional jets
- Turbulence
  - Statistical description of turbulent flows
  - Energy cascade and spectra

Module 3 (Weeks 12-13)
- Aerodynamics
  - Airfoils (geometry and lift/drag characteristics)

VIRTUAL CONTACT HOURS: 3 lecture hours per week, 2 tutorial hours per week, half course


EVALUATION: Term test 1: 20% (Tentative: September 28, 2020)
Term test 2: 20% (Tentative: October 26, 2020)
Final exam: 60% (Tentative: November 30, 2020)

INSTRUCTOR: Professor Roger Khayat
Office: SEB 3086, Tel. 519-661-2111, ext. 88253
Email: rkhayat@uwo.ca
Virtual Office Hours: To be announced

COURSE CONTENT
The lecture notes and online lecture videos are copyrighted to the instructor and legally protected. Do not post these videos and lecture notes on any other website or online forums. The recording of the live/synchronous sessions of the course without the permission from the instructor is prohibited. The illegal posting and sharing of the copyrighted course content could be subjected to legal actions.

CHEATING, PLAGIARISM/ACADEMIC OFFENCES
Academic integrity is an essential component of learning activities. Students must have a clear understanding of the course activities in which they are expected to work alone (and what working alone implies) and the activities in which they can collaborate or seek help; see information above under “Assessments” and ask instructor for clarification if needed. Any unauthorized forms of help-seeking or collaboration will be considered an academic offense. University policy states that cheating is an academic offence. If you are caught cheating, there will be no second warning. Students must write their essays and assignments in their own words. Whenever students take an idea or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence. Academic offences are taken seriously and attended by academic penalties which may include expulsion from the program. Students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence (see Western's scholastic discipline regulations for graduate students).

SYNCHRONOUS LEARNING ACTIVITIES
Students are expected to participate in synchronous learning activities as outlined in the course syllabus and/or described by the instructor. If you have issues that will impede your ability to participate in synchronous activities, please discuss with the course instructor at the beginning of the course.

CONDUCT
Students are expected to follow proper etiquette during synchronous and asynchronous activities to maintain an appropriate and respectful academic environment. Any student who, in the opinion of the instructor, is not appropriately participating in the synchronous and asynchronous learning activities and/or is not following the rules and responsibilities associated with the online learning activities, will be reported to the Associate Dean (Graduate) (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Associate Dean (Graduate), the student could be debarred from completing the assessment activities in the course as appropriate.

HEALTH/WELLNESS
As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several health and wellness related services (remotely accessible) to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. Information regarding health- and wellness-related services available to students may be found at http://www.health.uwo.ca/.

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html https://www.uwo.ca/health/psych/index.html

SICKNESS
Students should immediately consult with the Instructor (for a particular course) or Associate Chair (Graduate) (for a range of courses) if they have problems that could affect their performance. The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or the Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal. Obtaining appropriate documentation (e.g., a note from the doctor) is valuable when asking for accommodation due to illness.

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 Accessible Education at 661-2111 x 82147 or http://academicsupport.uwo.ca/accessible_education/index.html, for any specific question regarding an accommodation.
## Learning Outcomes (MME 9604)

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<th>Degree Level Expectation</th>
<th>Weight</th>
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<th>Outcomes</th>
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| Depth and breadth of knowledge | 70% | • Term tests | • Understands advanced concepts and theories  
• Aware of important current problems in the field of study  
• Understands computational and/or empirical methodologies to solve related problems |
| Research & scholarship | | • | • Able to conduct critical evaluation of current advancements in the field of specialization  
• Able to conduct coherent and thorough analyses of complex problems using established techniques/principles and judgment |
| Application of knowledge | 30% | • Term tests | • Able to apply knowledge in a rational way to analyze a particular problem  
• Able to use coherent approach to design a particular engineering system using existing design tools |
| Professional capacity / autonomy | | • | • Aware of academic integrity  
• Implements established procedures and practices in the coursework  
• Defends own ideas and conclusions  
• Integrates reflection into his/her learning process |
| Communication skills | | • | • Communicates (oral and/or written) ideas, issues, results and conclusions clearly and effectively |
| Awareness of limits of knowledge | | • | • Aware of the need of assumptions in complex scientific analyses and their consequences  
• Understands the difference between theoretical and empirical approaches  
• Acknowledges analytical limitation due to complexity of practical problems |