**Western University**
***Department of Mechanical & Materials Engineering***

# MME 2273B – INTRODUCTION TO FLUID MECHANICS AND HEAT TRANSFER

**COURSE OUTLINE – 2025-2026**

***CALENDAR DESCRIPTION:*** An introduction to fluid mechanics and heat transfer. The fluid mechanics part covers fluid properties, fluid statics including buoyancy and stability, one-dimensional fluid dynamics including conservation of mass and energy and losses in pipe networks. Heat transfer covers development of the general energy equation for three dimensions and steady-state conduction in one and two dimensions.

***COURSE INFORMATION:***

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| Instructor: | Dr. Rex Sherratt |
| Email: | asherra@uwo.ca |
| Lectures/tutorials/labs: | See Draft My Schedule |

***CONSULTATION HOURS:*** By appointment

***PREREQUISITES:*** NMM 2270A/B or the former Applied Mathematics 2270A/B

***ANTIREQUISITES:*** MSE 2273A/B

***ACCREDITATION UNITS:*** Science = 50%, Engineering Science = 50%.

***TOPICS:***

- Fluid Statics
- Fluid Dynamics
- Introduction to heat transfer modes
- Steady state conduction

***GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES)***

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

Notation*: where x be I: Introductory, D: Intermediate, A: Advanced, or empty*. I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e.g. no review).

***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. **Fluid Statics**
    a. Identify the fluid properties required to solve a problem and determined their magnitude (KB2)
    b. Determine the pressure at a point in a static fluid from a measurement taken at another point (KB2, PA2)
    c. Quantify hydrostatic forces and moments acting on a system (KB3, PA2)
    d. Determine whether a partially submerged body will float and whether it will be stable (KB2, PA2)
2. **Fluid Dynamics**
    a. Apply the mass and energy conservation (Bernoulli) equations to solve idealized fluid flow problems (KB2, KB3)
    b. Determine flow rates and or pressure losses in a realistic pipe system (KB2, KB3, PA2)
    c. Successfully conduct and report laboratory measurements taken on a pipe flow system (I2, I3)
3. **Introduction to Heat Transfer Modes**
    a. Identify the modes of heat transfer associated with a given heat transfer problem (KB2)
    b. Calculate heat transfer rates and/or material/fluid temperatures for simple problems involving two or three heat transfer modes (KB3)
4. **Steady state conduction**
    a. Apply the heat diffusion equation to solve 1-D conduction

problems in Cartesian, cylindrical, and spherical co-ordinate systems (KB3, PA2)

b. Successfully conduct and report on laboratory measurements of linear conduction heat transfer (I2, I3)
c. Determine the heat transfer characteristics of a finned surface
d. Use shape factors to solve simple multi-dimensional heat transfer problems (KB3, PA2)

***CONTACT HOURS:*** 3 lecture hours, 2 tutorial hours, 0.5 laboratory hours per week (laboratory hours occur in two 3-hour sessions), 0.5 course.

***TEXTBOOK:***

**For Fluid Mechanics:** *Fluid Mechanics,* White F and Xue H, 9th Edition, McGraw Hill

**For Heat Transfer:** *Fundamentals of Heat and Mass Transfer*, Bergman T L, Lavine A S, 8th Edition, John Wiley and Sons

Both textbooks for this course (and alternative formats) can be found using the following link:
https://bookstore.uwo.ca/textbook-search?campus=UWO&term=W2025B&courses%5B0%5D=001_UW/MME2273B

Please note: Students may use different editions or copies of the textbook(s). As problem numbering can vary between editions, it is the students' responsibility to identify the equivalent problem in their copy.

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

***EVALUATION:***

**Overall:**

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| In-tutorial Questions | 8% (1.6% each) |
| Quizzes/midterms | 27% (13.50% each) |
| Laboratory | 5% (2.5% each) |
| Final Examination | 60% |

**Tentative Schedule:**

**In-tutorial Questions:**
In-tutorial Question #1: Thursday 22nd January 2026
In-tutorial Question #2: Thursday 29th January 2026
In-tutorial Question #3: Thursday 13th February 2026
In-tutorial Question #4: Thursday 26th February 2026
In-tutorial Question #5: Thursday 12th March 2026
In-tutorial Question #6: Thursday 19th March 2026
In-tutorial Question #7: Thursday 26th March 2026

**Quizzes:**
Quiz #1 (Designated Assessment): Thursday 5th February 2025 (week 5), 1:40 pm – 3:10 pm
Quiz #2: Thursday 5th March 2025 (week 8), 1:40 pm – 3:10 pm

**Laboratories:**
Laboratory experiment 1: Losses in pipe networks (Weeks 10 – 11)
Laboratory experiment 2: Linear heat conduction (Weeks 11 – 12)

**Final Examination:**
The final examination will take place during the regular examination period.

***COURSE POLICIES:*** The following course-specific policies will be strictly enforced throughout the course:

**General:** Students are responsible for regularly checking their Western e-mail and the Brightspace course website (https://wts.uwo.ca/owl/) in order to make themselves aware of any information that is posted about the course. If a student fails to act on information that has been posted on the Brightspace course website and does so without a legitimate explanation (i.e. those covered under the illness/compassionate form), then there are no grounds for an appeal.

**Quizzes (midterms):** Both Quizzes will be closed-book and an equation sheet will be provided in the exam. Only non-programmable calculators will be allowed. Students arriving more than 30 minutes late for an in-person Quiz will not be allowed to write the Quiz and will receive zero marks. If a student is excused from writing a Quiz by academic consideration (e.g. due to illness), the weighting of that Quiz will be placed onto the Final Exam. If a student is going to miss, or require accommodations for, a Quiz for religious reasons, they must inform the instructor in writing within 1 week of the start of the term or they will be required to write the Quiz. Even with academic consideration (see above) a student must attend and submit work for at least 1 of the 2 Quizzes to meet the minimum coursework requirements (see Summary of Minimum Coursework Requirements Policies below). **The first quiz is Designated Assessment for this course.** There will be no makeup quizzes.

**Weekly In-tutorial Questions:** The in-tutorial questions are open-book and students must work in a group of 4 students, submitting a single solution for marking with all the group members' names and ID numbers on it. Individual students must also submit their own work on the problem; failure to complete both steps may result in a grade of zero. Students arriving more than 30 minutes late for an in-tutorial question will not be allowed to be included on a submitted solution and will receive zero marks. Even with any academic considerations (see above), a student must attend and submit work for a minimum of 5 out of the 7 in-tutorial questions to meet the minimum coursework requirements (see Summary of Minimum Coursework Requirements Policies below). The total course grade for in-tutorial questions is based on the student's best five submissions.

**Laboratories:** Laboratory reports are to be submitted during the same laboratory class in which the experiment is completed. Attendance at both of the designated laboratory sessions is compulsory (even with academic consideration). Failure to attend and complete both laboratory sessions will mean that the student will not meet the minimum coursework requirements (see Summary of Minimum Coursework Requirements Policies below). If a laboratory is missed without academic consideration, there is no guarantee of a make-up laboratory session. Under extenuating circumstances, as determined by the instructor, an alternative lab format may be used. If at-home labs are assigned with a week or more between the date they are assigned and the date they are due, students who receive academic consideration for the date the lab is due must submit their lab within forty-eight hours of the original deadline. Late labs will not be accepted.

**Final Exam:** The final exam will be closed-book and an equation sheet will be provided. Only non-programmable calculators will be allowed. If a minimum mark of 50% is not obtained on the final exam the student cannot receive a final course mark greater than 48%. Students arriving more than 30 minutes late for an in-person exam will not be allowed to write the exam and will receive zero marks.

**Summary of Minimum Coursework Requirements Policies:** Even taking into account any academic considerations, a student must:

(1) Attend and submit solutions for at least 5 of the 7 In-tutorial questions;

(2) Attend and submit work for at least 1 of the 2 Quizzes and

(3) Attend and submit work for both of the laboratory sessions.

**Any student not meeting these requirements may not receive a grade higher than 48% in the course.** In the absence of academic consideration, it is necessary to submit

work for 5 in-tutorial questions and sit both quizzes to have the opportunity to gain full marks in those categories. Late assessments will not be accepted, and the student will receive a zero on assessments that are not submitted unless the student has academic consideration. There will be no makeup quizzes.

**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.

Students are required to behave professionally during all class meetings. Failure to comply may result in the student receiving a grade of zero on any associated grades or assessments occurring at the time of the infraction.

**Use of Electronic Devices:** Only a non-programmable calculator may be used in the Quizzes and in the Final Exam.

**Policy on Repeating All Components of a 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.

***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.

***Important Links***

- **WESTERN ACADEMIC CALENDAR**
- **ACADEMIC RIGHTS AND RESPONSIBILITIES**
- **ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS**
- **UNIVERSITY STUDENTS' COUNCIL (USC) - SERVICES**
- **IMPORTANT DATES AND DEADLINES**
- **ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS**
- **ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS**
- **SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS**
- **STUDENT FORMS**
- **OFFICE OF THE REGISTRAR**
- **RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES (SYLLABI)**
- **ACADEMIC APPEALS**
- **STUDENT ABSENCE PORTAL**

***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:***

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| First term half course (i.e. "A" or "F") | September 13, 2024 |
| Full courses and full-year half course (i.e. "E", "Y" or no suffix) | September 13, 2024 |
| Second term half course (i.e. "B" or "G") | January 14, 2025 |

***Drop Deadlines*:**

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|---|---|
| First term half course without penalty (i.e. "A" or "F") | November 12, 2024 |
| Full courses and full-year half courses without penalty (i.e. "E","Y" or no suffix) | December 2, 2024 |
| Second term half or second term full course without penalty (i.e. "B" or "G") | March 7, 2025 |

***Contact Information:***

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|---|---|
| Undergraduate Services Office: | SEB 2097 |
| Phone: 519-661-2130 | E-mail: engugrad@uwo.ca |
| Mechanical Engineering: | SEB 3002 |
| Phone: 519-661-4122 | E-mail: mmeundergraduate@uwo.ca |
| Chemical & Green Process Engineering: | TEB 477 |
| Phone: 519-661-2131 | E-mail: cbeugrad@uwo.ca |
| Civil Engineering: | SEB 3005 |
| Phone: 519-661-2139 | E-mail: civil@uwo.ca |
| Computer, Electrical, Mechatronic Systems & Software Engineering | TEB 279 |
| Phone: 519-661-3758 | E-mail: eceugrad@uwo.ca |
| Integrated Engineering | ACEB 2410 |
| Phone: 519-661-6725 | E-mail: engceli@uwo.ca |
| Office of the Registrar/Student Central | WSSB 1120 |
| Phone: 519-661-2100 | |