

MME 3303a - Fluid Mechanics II

COURSE OUTLINE – 2024-2025

CALENDAR DESCRIPTION:	Conservation of mass and linear momentum, differential analysis of the flow, centrifugal pumps, dimensional analysis, laminar and turbulent boundary layers, drag and lift forces on objects, description of turbulence
COURSE INFORMATION:	Instructor: Mohammad Zakir Hossain, Ph.D., P.Eng. E-mail: mhossa7@uwo.ca Lectures/Tutorials/Labs: See Draft My Schedule
PREREQUISITES:	MME 2273A/B
ACCREDITATION UNITS:	Engineering Science = 100%
TOPICS:	<ol style="list-style-type: none">1. Introduction2. Differential relations for fluid flow<ul style="list-style-type: none">• Conservation of mass• Conservation of momentum• Navier-Stokes equations3. Dimensional analysis<ul style="list-style-type: none">• Dimensionless parameters• Buckingham Pi theorem• Relationship between model and full-scale flows4. Flow past immersed bodies<ul style="list-style-type: none">• Boundary layer flows• Drag and lift on immersed bodies5. Turbomachinery<ul style="list-style-type: none">• Pumps• Pump performance curves• System characteristics and pump selection6. Introduction to turbulence<ul style="list-style-type: none">• Reynolds decomposition• Physical nature of turbulent flows
LEARNING OUTCOMES	<p>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.</p> <ol style="list-style-type: none">1. Relate fluid mechanics fundamentals to a wide range of real-world engineering applications (KB2, KB3, KB4, LL1)2. Solve governing equations of fluid mechanics for various geometrical configurations (PA1, PA2, PA3)3. Develop non-dimensional parameters for generalized parametric analysis (PA1, PA2, PA3)4. Predict the performance of a full-scale prototype based on model testing (PA2, PA3, I2, I3)5. Compute drag and lift forces on a wide range of objects (PA2)6. Interpret pump characteristic curves and evaluate pump's performance (PA2, PA3)

7. Analyze and interpret data from lab experiments in relation to theoretical/empirical predictions (IN3)
8. Participate in teamwork and evaluate self/peer performance in team (ITW3)

CONTACT HOURS: 3 lecture hours and 2 tutorial hour per week, 0.5 laboratory hours per week, half course

TEXT: *Fluid Mechanics*, Frank White, Eighth or Ninth edition, McGraw Hill.

REFERENCES: *Fundamentals of Fluid Mechanics*. Munson, Young and Okiishi, Wiley.

UNITS: Both SI and Imperial units.

EVALUATION: The final course grade will be determined according to the following weighting scheme:

In-class participation (iClicker assessment):	10%
Weekly in-tutorial assignments:	10%
Laboratory data analysis and report:	20%
Term test 1 (2 hours, closed book):	15%
Term test 2 (2 hours, closed book):	15%
Final exam (3 hours, closed book):	30%

Tests, tutorial assignments, class participation and laboratories will be carried out according to the following *tentative* schedule:

Evaluation Format	Weight	Effort Type	Assigned	Due
Class participation	10%	Individual	Weekly	During the lecture (5% for correct answers and 5% for participation)
In-tutorial assignments	10%	Individual	Weekly	End of tutorial hour in which it is assigned
Term test 1	15%	Individual	See Course site on Brightspace	Room: TBD
Term test 2	15%	Individual	See Course site on Brightspace	Room: TBD
Lab 1	5%	Team	See Course site on Brightspace	One week from the date of your lab
Lab 2	5%	Team	See Course site on Brightspace	One week from the date of your lab
Lab 3	5%	Team	See Course site on Brightspace	One week from the date of your lab
Lab 4	5%	Team	See Course site on Brightspace	One week from the date of your lab

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

Laboratory sessions

- All students are to attend the laboratory section to which they signed up.
- Lab schedule will be posted 2-3 weeks before the beginning of labs.
- Failure to pass the laboratory component of the course will attract automatic course failure.
- Passing of the laboratory component is equivalent with obtaining more than 50% on the laboratory component of the course.
- A make-up session will be offered to students who have missed a laboratory session **with** academic consideration.
- Missing of a laboratory session **without** academic consideration will translate into a mark of zero for that laboratory session.
- When academic consideration has been obtained for a particular laboratory session, it is the student's responsibility to contact the instructor of the course in a *timely* fashion in order to seek alternate arrangements for the missed laboratory session (*i.e.*, within maximum three days after consideration has been obtained from the Engineering Undergraduate Services Office).
- Missing more than one lab without academic consideration will result in the course failure.
- 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.
- For each lab, an online quiz regarding lab content will be conducted during tutorial, after all lab groups have completed that lab (*i.e.* 4 quizzes for 4 labs). The date of each lab quiz will be announced in advance. **No extra marks for lab quizzes** but failure to get at least 50% correct answers in a quiz will reduce the mark for that lab by 50%.

Term Tests

- Term tests will be closed book (formula sheet will be provided. Standard scientific calculators are permitted).
- Each of the two term tests will be two hours long.
- **No** make-up term test option will be offered regardless of the circumstances for which the term test was missed.
- Missing of a term test **without** academic consideration will translate into a mark of zero for that term test.
- Missing the term test **with** academic consideration will automatically shift the weight of the missed term test into the final exam.
- Students are required to contact the instructor of the course for any other circumstances that appear not to be covered by the non-exhaustive list above.

In-Tutorial Assignments

- In-tutorial assignments will take place during the second hour of the tutorials (dates to be specified in Brightspace) where the first hour will consist of help session and practice problem solving conducted by the course instructor and/or the teaching assistant.
- The in-tutorial assignment will be based on problem solving **individually** and must be completed online within the tutorial classroom. Any student who attempts to complete the online assignment outside the tutorial classroom will get zero mark.
- No make-up sessions will be offered for those missing the in-tutorial assignment (irrespective of the reason).
- The grading for in-tutorial assignments will be based on the **best $n-2$** of n in-tutorial assignments scheduled during the course.
- If the in-tutorial assignment is missed **with** academic consideration, then its weight will be shifted into the final exam.

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- If the in-tutorial assignment is missed **without** academic consideration, then the mark for the missed exercise will be zero.
 - Since flexibility in tutorial attendance is already included in this course, academic consideration may be denied for students missing more than two tutorial assignments.
 - Unlike term tests or final exams that require the approval of the Engineering Undergraduate Services, for in-tutorial assignments, academic consideration should be obtained from the MME Undergraduate Coordinator.
 - 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.

Term work

- If a minimum of 50% is not obtained on term work (class participation, term tests, in-tutorial assignments, and laboratory sessions), the student will fail the course irrespective of the mark obtained in the final examination.

Final examination

- The exam will take place during the December examination period.
- The exam will be closed book (formula sheet will be provided. Standard scientific calculators are permitted).
- The length of the final exam will be three hours.
- If a minimum of 50% is not obtained on the final examination, the student will be assigned a grade of no greater than 48% for the course.
- If you miss the Final Exam, please contact the Academic Counselling office in the Engineering Undergraduate Services as soon as you are able to do so. They will assess your eligibility to write the Special Examination.
- 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.

Submissions

- In-tutorial assignments are due at the end of the tutorial hour in which they were assigned. No late submissions will be accepted.
- Lab reports will be due one week after the date on which the lab was performed. No late submissions will be accepted.

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.

**CONSULTATION
HOURS:**

By appointment. Email the instructor to schedule a consultation.

**USE OF
TECHNOLOGY:**

iClicker will be used for class participation. Students need to provide answers to the questions shared during the lecture. Students must complete the iClicker assessments in the classroom. Each student must complete and submit their own assessments. The grading will be based on the **best $n-2$ of n** iClicker assessments. The data gathered from iClicker will only be accessed and used by the instructor to evaluate students' participation and class presence.

General Faculty / University Policies

In the event of contradictions between course-specific policies above and general Faculty / University policies described below, please contact your course instructor for clarification.

- Attendance** Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Associate Dean Academic (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Associate Dean Academic, the student will be debarred from taking the regular examination in the course.
- Missed/Late Accommodation Policy**
1. Students missing a test/assignment/lab or examination you will report the absence by submitting an Academic Consideration Request form through [STUDENT ABSENCE PORTAL](#).
 2. **Documentation must be provided as soon as possible.**
- Exam Accommodation**
1. If you are unable to write a final examination, report your absence using the Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).
 2. Be prepared to provide the Undergraduate Services Office with supporting documentation (below 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 submit an Academic Consideration Request Form through [STUDENT ABSENCE PORTAL](#).
- PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.*
- 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 submit the Academic Consideration Request Form and provide documentation if requested by the instructor (see below 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. Some courses may have built-in flexibility for assignment deadlines or the total number of assignments that will be graded. See course-specific policies for details.
 5. 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.

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

Medical Accommodation

1. The Academic Consideration Request Form is available through the [STUDENT ABSENCE PORTAL](#).
2. Requests for academic consideration must include the following components:
 - a. Indication of the course(s) and assessment(s) affected by the request
 - b. Medical note, and
 - c. Additional supporting documentation as relevant
3. Requests for academic consideration without a medical note or other supporting documentation may be accepted once per term, per course.
4. Undocumented absences cannot be used for examinations scheduled by the Office of the Registrar during official examination periods (including take-home final exams and December mid-year exams for full courses) and practical laboratory and performance tests typically scheduled in the last week of the term. Undocumented absences also cannot be used for the “designated assessment” in each course. When flexibility in assessment exists and is clearly stated on the course outline, both undocumented absences and academic consideration requests with documentation may be denied.
5. **Students must request academic consideration as soon as possible and no later than 48 hours after the missed assessment.**
6. Once the request and supporting documents have been received and reviewed, appropriate academic consideration, if granted, shall be determined by the instructor in consultation with the academic advisor, in a manner consistent with the course outline.

Academic consideration may include extension of deadlines, waiver of attendance requirements for classes/labs/tutorials, or re-weighting of course requirements. Some forms of academic consideration, such as arranging Special Examinations, assigning a grade of Incomplete, or granting late withdrawals without academic penalty, may only be granted by the Academic Advising office of the Faculty of Registration.

7. An instructor may deny academic consideration for any assessment that is not required in the calculation of the final grade (e.g., “8 of 10 quizzes”). Assessment flexibility must be indicated on the course outline.
8. An instructor may deny academic consideration relating to the timeframe submission of work where there is already flexibility in the submission timeframe (e.g., 72-hour submission window). This assessment flexibility must be indicated on the course outline.

Religious Accommodation

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

Academic Integrity	In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.
	Please visit Academic Integrity Western Engineering for more information
Academic Offences	Plagiarism means using another’s work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work and a repeat offence will earn you zero on the course. A third offence may lead to expulsion from the university. Scholastic Discipline for Undergraduate Students & Cheating, Plagiarism and Unauthorized Collaboration: What Students Need to Know
	Students must write their reports, 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
Faculty of Engineering AI Policy	The use of generative Artificial intelligence (GenAI) tools won’t be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can’t hide from the use of GenAI tools to contribute to the understanding of the course materials. However, the use of GenAI tools in any assignment or contribution during the course will have to be disclosed, as a resource.
	GenAI tools use won’t be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.
Use of English Policy	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 for the 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.
Accessibility	Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide

the best experience to all members of the campus community, please visit the [Accessibility Western University](#) for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit [Academic Support & Engagement -Academic Accommodation](#).

Inclusivity, Diversity, and Respect

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the [Office of Equity, Diversity and Inclusion](#).

Health and Well-Being

- [Health & Wellness Services – Students](#) - Offers appointment-based medical clinic for all registered part-time and full-time students.
- [Mental Health Support](#) - Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- [Crisis Support](#) - For immediate assistance, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am - 4:30 pm. For after-hours crisis support, click [here](#).
- [Gender-Based Violence and Survivor Support](#) - Western [is committed to reducing incidents of gender-based and sexual violence](#) and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced gender-based or sexual violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts, [here](#). To connect with a case manager or set up an appointment, please contact support@uwo.ca.

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:

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:

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:

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	