

MME 3303a - Fluid Mechanics II

COURSE OUTLINE – 2021-2022

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: Kamran Siddiqui
Room SEB 2078
E-mail: ksiddiq@uwo.ca

Lectures: Tu, 12:30-1:30 (SEB-2202)
W, 11:30-12:30 (SEB-2202)
Th, 8:30-9:30 (WSC-55)

Tutorials: Th, 9:30-11:30 (WSC-55)

Labs: **003** – Tu, 9:30-12:30 (SEB-1072)
004 – M, 8:30-11:30 (SEB-1072)
005 – Th, 1:30-4:30 (SEB-1072)
006 – M, 2:30-5:30 (SEB-1072)
007 – W, 8:30-11:30 (SEB-1072)

PREREQUISITES: MME 2273A/B

COREQUISITES: Applied Mathematics 3413A/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

ACCREDITATION UNITS: Engineering Science = 100%

TOPICS:

1. Fundamental concepts
2. Differential relations for fluid flow
 - Conservation of mass
 - Conservation of momentum
 - Navier-Stokes equations
3. Dimensional analysis
 - Dimensionless parameters
 - Buckingham Pi theorem
 - Relationship between model and full-scale flows
4. Flow past immersed bodies
 - Boundary layer flows
 - Drag and lift on immersed bodies
5. Turbomachinery
 - Pumps
 - Pump performance curves
 - System characteristics and pump selection
6. Introduction to turbulence
 - Reynolds decomposition
 - Physical nature of turbulent flows

**LEARNING
OUTCOMES**

- Students successfully completing this course will be able to,
1. Relate fluid mechanics fundamentals to a wide range of real-world engineering applications
 2. Develop non-dimensional parameters for generalized parametric analysis
 3. Predict the performance of a full-scale prototype based on model testing
 4. Compute drag and lift forces on a wide range of objects
 5. Interpret pump characteristic curves and evaluate pump's performance
 6. Describe the fundamental characteristics of turbulent flows
 7. Participate in teamwork and evaluate self/peer performance in team

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 (closed book):	15%
Term test 2 (closed book):	15%
Final exam (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
In-tutorial assignments	10%	Team	Weekly except Sept. 9, Sept. 16, and Nov. 4	End of tutorial hour in which it is assigned
Term test 1	15%	Individual	TBA (Week of Oct. 18)	TBA
Term test 2	15%	Individual	TBA (Week of Nov. 15)	TBA
Lab 1	5%	Team	Weeks of Oct. 12 th and Oct. 18 th	One week from the date of your lab
Lab 2	5%	Team	Weeks of Oct. 25 th and Nov. 8 th	One week from the date of your lab
Lab 3	5%	Team	Weeks of Nov. 15 th and Nov. 22 nd	One week from the date of your lab
Lab 4	5%	Team	Week of Nov. 29 th	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.

Term Tests

- Term tests will be closed book (formula sheet will be provided).
- 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 specified above) 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 consist of problems to be solved by the team formed by the course instructor.
- No make-up sessions will be offered for those missing the in-tutorial assignment (irrespective of the reason).
- If the in-tutorial assignment is missed **with** academic consideration, then its weight will be equally distributed into the rest of in-tutorial assignments.
- If the in-tutorial assignment is missed **without** academic consideration, then the mark for the missed exercise will be zero.

-
- 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).
- The length of the final exam will be three hours.
- 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:

Wednesdays 4:00-5:00 PM in SEB 2078, or by appointment

ENGLISH:

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for the improper use of English. Additionally, poorly written work with the exception of final examinations 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.

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 Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

CHEATING:

University policy states that cheating, including plagiarism, is a scholastic offense. 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. (see Scholastic Offence Policy in the Western Academic Calendar).

SSD:

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 Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

NOTE:

Students who have failed an Engineering course (i.e. < 50%) 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 for grading by the student in subsequent years.

INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

NEW: Requests for Academic Consideration using the Self-Reported Absence Form

If you experience an unexpected illness or injury or an extenuating circumstance (48 hours or less) that is sufficiently severe to temporarily render you unable to meet academic requirements (e.g., attending lectures or labs, writing tests or midterm exams, completing and submitting assignments, participating in presentations) you should self-declare using the online Self-Reported Absence portal. This option should be used in situations where you expect to resume academic responsibilities within 48 hours or less.

Each student will be allowed a maximum of two self-reported absences between September and April and one self-reported absence between May and August. Self-reporting may not be used for final exams or assessments (e.g. midterm exams, tests, reports, presentations, or essays) worth more than 30% of any given course.

For full instructions about the Self-Reporting System refer to the Academic Calendar link [here](#).

A. GENERAL REGULATIONS & PROCEDURES (other than self-reported absences)

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination that is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If your course work is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

B. TERM/MIDTERM TESTS (other than self-reported absences)

1. If you are in first year and you are unable to write a midterm/term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a midterm/term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief.
3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair or the Undergraduate Services Office is required when rescheduling midterm/term tests.

C. FINAL EXAMINATIONS (cannot be self-reported)

1. If you are unable to write a final examination, contact the Undergraduate Services Office **PRIOR TO THE SCHEDULED EXAMINATION TIME** to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page 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 sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.

D. 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 provide documentation if requested by the instructor (see reverse side 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.
 - i) 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.
 - ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

E. SHORT ABSENCES

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

F. EXTENDED ABSENCES

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You are strongly encouraged to seek advice from your Academic Counsellor in the Undergraduate Services Office.

G. DOCUMENTATION

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, **you must provide the doctor with a Student Medical Certificate** to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.**

In Case of Serious Illness of a Family Member: Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

In Case of a Death: Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

For Other Extenuating Circumstances: If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

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

H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).
2. **You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.**
3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your Academic Counsellor.

Calendar References: Check these regulations in your 2021 Western Academic Calendar available at www.westerncalendar.uwo.ca.

[Self-Reporting Absences](#)
[Absences Due to Illness](#)
[Academic Accommodations for Students with Disabilities](#)
[Academic Accommodations for Religious or Holy Days](#)
[Course Withdrawals](#)
[Examinations](#)
[Scheduling of Term Assignments](#)
[Scholastic Offences](#)
[Student Medical Certificate](#)
[Engineering Academic Regulations](#)

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.

<u>Add Deadlines:</u>	First term half course (i.e. “A” or “F”)	September 16, 2021
	Full courses and full-year half course (i.e. “E”, “Y” or no suffix)	September 16, 2021
	Second term half course (i.e. “B” or “G”)	January 11, 2022

<u>Drop Deadlines:</u>	First term half course (i.e. “A” or “F”)	November 12, 2021
	Full courses and full-year half courses (i.e. “E”, “Y” or no suffix)	November 30, 2021
	Second term half or second term full course (i.e. “B” or “G”)	March 7, 2022

Contact Information:

Undergraduate Services Office	SEB 2097 Phone: 519-661-2130	E-mail: engugrad@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
Mechanical Engineering	SEB 3002 Phone: 519-661-4122	E-mail: mmeundergraduate@uwo.ca

Revised 08/04/21