Western University
Department of Mechanical & Materials Engineering

MME 2273b - Introduction to Fluid Mechanics and Heat Transfer

COURSE OUTLINE – 2018-2019

CALENDAR DESCRIPTION:

An introduction to fluid mechanics and heat transfer. The fluid mechanics 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.

PRE or COREQUISITES:

Applied Mathematics 2270A/B.

ACCREDITATION UNITS:

Science = 50%, Engineering Science = 50%

TOPICS COVERED:

FLUID MECHANICS

Section 1

- Atmospheric and hydrostatic pressure distributions
- Hydrostatic forces on flat / vertical inclined and curved surfaces for open and pressurized systems
- Buoyancy forces on submerged objects and stability of floating bodies

Section 2

- One-dimensional conservation of mass for open systems
- Derivation of Bernoulli energy conservation equation
- Pressure losses in pipe networks

HEAT TRANSFER

Section 3

- Different modes of heat transfer: conduction, convection and radiation at an introductory level
- Conservation of energy applied to heat transfer
- Three-dimensional heat diffusion equation

Section 4

- One-dimensional steady-state conduction in Cartesian, Cylindrical and Spherical geometries
- Conduction with thermal energy generation
- Heat transfer from extended surfaces
- Two-dimensional steady-state conduction
- Conduction shape factors

LEARNING OUTCOMES:

Upon successful completion of this course students will be able to:
(1) Combine and apply the concepts learned to accurately solve engineering calculation problems based on the fluid mechanics and heat transfer topics covered in the course.
(2) Conduct laboratory experiments in fluid mechanics and heat transfer, analyze the data obtained and critically evaluate the results, including a quantification of experimental uncertainty.

CONTACT HOURS:

3 lecture hours, 2 tutorial hours per week, two laboratory classes, half course
Lectures: Monday 9.30-10.30 (HSB 236), Tuesday 9.30-10.30 (SEB 2100), Friday 9.30-10.30 (HSB 35). Tutorial: Tuesday 10.30-12.30 (SEB 2100).

TEXT:

For Fluid Mechanics: *Fluid Mechanics*, White F, 8th Edition, McGraw Hill.
For Heat Transfer: *Fundamentals of Heat and Mass Transfer*, Bergman T L, Lavine A, Incropera F P, DeWitt D P, 8th Edition, John Wiley and Sons.

REFERENCES: There are many other fluid mechanics and heat transfer text books in the library and they mostly cover the same material. Hence, browse and choose those that you find most accessible. Some notes will be placed on OWL.

COMPUTING: Basic programming skills will be advantageous. Some problems may be formulated for numerical solution.

UNITS: SI

EXAMINATIONS AND QUIZZES: 2 x Quizzes (1.5 hours each), Final exam (3 hours). ***Note that any student who does not complete the mandatory minimum coursework and Quizzes (see below) will not be allowed to sit the final exam and so will not pass the course.***

EVALUATION: The course grade will be based on term work, encompassing In-tutorial questions (weekly), Quizzes and Laboratory work, together with a Final examination.

8 x In-tutorial questions (weekly)	10% (1.25% each)
2 x Quizzes	25% (12.50% each)
2 x Laboratory reports	5% (2.50% each)
Final examination	60%

Quiz #1: Tuesday 5th February 2019, 10.40 am - 12.10 pm, EC 2168A/B
Quiz #2: Tuesday 5th March 2019, 10.40 am – 12.10 pm, EC 2168A/B

Laboratory experiment 1: Losses in pipe networks (Weeks 8 – 12)
Laboratory experiment 2: Linear heat conduction (Weeks 8 – 12)
Laboratory reports to be submitted during the laboratory (schedule of the laboratories to be determined by Week 7). If a minimum mark of 50% is not obtained on the final examination the student cannot receive a final mark greater than 48%.

COURSE POLICIES: If a student is excused from writing a Quiz by academic consideration the weighting of that quiz may be placed onto the other quiz. If both Quizzes are missed with academic consideration all of the weighting of the quizzes may be place on the final examination. Students are directed to the Policy on Accommodation for Medical Illness (https://studentservices.uwo.ca/secure/index.cfm).

Attendance at both of the designated laboratory sessions is compulsory. If a laboratory is missed, without academic consideration, there is no guarantee of a make-up laboratory session.

Quizzes and Final Exam will be Closed Book, with an equation sheet that will be provided on each occasion. Only non-programmable calculators are allowed.

In order to be able to sit the Final Exam students must:
(1) Attend and submit solutions for at least 5 of the 8 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 will be forbidden to write the Final Exam and so will fail the course. In the absence of academic consideration, it is necessary to submit 8 In-tutorial questions and sit both Quizzes in order to have the opportunity to gain full marks in those categories.

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

INSTRUCTOR: Professor E. Savory
Room SEB 3085, e-mail: esavory@uwo.ca

CONSULTATION HOURS: Office Hour: Friday 11.30 – 12.30 (or by appointment)

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. Scholastic offences are taken seriously and students are directed to the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf.

NOTE: The above topics and outline are subject to adjustments and changes as needed. Students are strongly encouraged to avoid the practice of simply substituting numbers in textbook formulae. ***The emphasis in the course will be placed on solution methodology***. Assistance will be available in weekly tutorials.

Western Engineering

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Faculty of Engineering
2018-2019

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 accommodation will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services office if you are in first year) that there are compelling medical or compassionate grounds that can be documented before academic accommodation will be considered. Different regulations apply to term tests, final examinations and late assignments. Read the instructions carefully. (see the 2018 Western Academic Calendar).

A. *GENERAL REGULATIONS & PROCEDURES*

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 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 TESTS*

1. If you are in first year and you are unable to write a 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 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 term tests.

C. *FINAL EXAMINATIONS*

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 (please spell your full name).

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, 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 Associate Dean 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. 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.

E. *SHORT ABSENCES*

If you miss a class due to a minor illness or other problems, check your course outlines for information regarding attendance requirements and make sure you are not missing a test 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 may want to seek advice from the academic counsellor in your Department or the counsellors in the Undergraduate Services Office if you are in first year.

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 if you are in first year). **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 2016 Western Academic Calendar available at www.westerncalendar.uwo.ca.

Absences Due to Illness
Academic Accommodations for Students with Disabilities
Academic Accommodations for Religious Holidays
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.

Add Deadlines: First term half course (i.e. "A" or "F") September 14, 2018
Full courses and full-year half course (i.e. "E", "Y" or no suffix) September 14, 2018
Second term half course (i.e. "B" or "G") January 15, 2019

***Drop Deadlines*:** First term half course (i.e. "A" or "F"): November 12, 2018
Full courses and full-year half courses (i.e. "E", "Y" or no suffix): November 30, 2018
Second term half or second term full course (i.e. "B" or "G"): March 7, 2019

Undergraduate Services Office:	SEB	2097	Tel: (519) 661-2130	E-mail:	engugrad@uwo.ca
Dept. of Chemical and Biochemical Engineering:	TEB	477	Tel: (519) 661-2131	E-mail:	cbeugrad@uwo.ca
Dept. of Civil and Environmental Engineering:	SEB	3005	Tel: (519) 661-2139	E-mail:	civil@uwo.ca
Dept. of Electrical and Computer Engineering, Software Engineering Mechatronics Engineering	TEB	279	Tel: (519) 661-3758	E-mail:	eceugrad@uwo.ca
Dept. of Mechanical and Materials Engineering:	SEB	3002	Tel: (519) 661-4122	E-mail:	mmeundergraduate@uwo.ca

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