

Western University  
*Department of Mechanical & Materials Engineering*

## MME 3307B – Heat Transfer II

### COURSE OUTLINE – 2023-2024

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**CALENDAR DESCRIPTION:** Transient heat conduction. Forced and natural convection heat transfer. Radiation heat transfer, including surface properties and shape factor. Heat exchanger design. Applications of heat transfer in engineering systems.

**COURSE INFORMATION:** Instructor: Dr. J.M. Floryan  
Room: SEB 2051  
Email: floryan@uwo.ca  
Timetable information is available at <https://draftmyschedule.uwo.ca/>

**PREREQUISITES:** MME 2204A/B, MME 2273A/B.

**ACCREDITATION UNITS:** Science = 25%, Engineering Science = 75%

**TOPICS:**

- Conduction
  - Transient conduction
- Convection
  - Introduction to convection
  - Forced convection - external flows
  - Forced convection - internal flows
  - Free convection
- Heat exchangers
- Radiation
  - Radiation processes and properties
  - Radiation exchange between surfaces

**LEARNING OUTCOMES:**

Upon successful completion of this course, students will able to:

- identify heat transfer processes occurring in a problem of interest;
- contrast the three modes of heat transfer;
- apply the appropriate terminology used in the field, such as heat flux, thermal conductivity, energy balance, etc.;
- determine the heat flow through conduction, convection, and radiation;
- carry out heat balance analysis and predict the thermal performance of simple engineering systems;
- to recommend strategies for increasing/decreasing heat fluxes;
- to analyse and select heat exchangers;
- to conduct investigation using experiments, analysis and interpretation of data, and synthesis of information to reach valid conclusions.

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

Time  
<https://>

<b>CONTACT HOURS:</b>	3 lecture hours and 2 tutorial hours per week, 0.5 laboratory hours per week, half course.												
<b>RECOMMENDED TEXTBOOKS:</b>	Fundamentals of Heat and Mass Transfer, 8th Edition, by T.L. Bergman and A. S. Lavine, John Wiley (editions 5, 6, 7 are also acceptable; all assignments are based on edition 8).												
<b>REFERENCES:</b>	Lecture notes and the course website.												
<b>EXAMINATIONS AND QUIZZES:</b>	The term tests and final examination are <b>open-book types</b> . Only non-programmable pocket calculators are allowed.												
<b>EVALUATION:</b>	The final grade is computed as follows: <table> <tr> <td>Participation in weekly (lecture) meetings:</td> <td>10%</td> </tr> <tr> <td>Weekly in-tutorial exercises:</td> <td>10%</td> </tr> <tr> <td>Laboratory exercises:</td> <td>10%</td> </tr> <tr> <td>Term Test 1 (open book):</td> <td>15%</td> </tr> <tr> <td>Term Test 2 (open book):</td> <td>15%</td> </tr> <tr> <td>Final Examination (open book):</td> <td>40%</td> </tr> </table>	Participation in weekly (lecture) meetings:	10%	Weekly in-tutorial exercises:	10%	Laboratory exercises:	10%	Term Test 1 (open book):	15%	Term Test 2 (open book):	15%	Final Examination (open book):	40%
Participation in weekly (lecture) meetings:	10%												
Weekly in-tutorial exercises:	10%												
Laboratory exercises:	10%												
Term Test 1 (open book):	15%												
Term Test 2 (open book):	15%												
Final Examination (open book):	40%												

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

<b>Evaluation Format</b>	<b>Weight</b>	<b>Effort Type</b>	<b>Assigned</b>	<b>Due</b>
Class participation	10%	Individual	Weekly	During the lecture
In-tutorial assignments	10%	Team	Weekly except Jan.12, Jan. 19, Feb.2, March 9, April 6	End of the tutorial hour, at which it is assigned
Term test 1	15%	Individual	February 1 during tutorial time	At the end of the midterm
Term test 2	15%	Individual	March 7 during tutorial time	At the end of the midterm
Lab 1	3.33%	Team	Weeks of Jan. 22 – Feb.5.	At the end of the lab session
Lab 2	3.33%	Team	Weeks of Feb.12 – March 4	At the end of the lab session
Lab 3	3.33%	Team	Weeks of March 11 – March 25	At the end of the lab session

Problems will be assigned from the textbook weekly. These problems will not be handed in or graded but will be discussed each week during the tutorial sessions.

If a minimum mark of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.

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**COURSE  
POLICES:**

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

**Laboratory sessions**

- Students need to be familiar with the laboratory manual and the objectives of each experiment. This knowledge will be tested at the beginning of each lab session. A student who does not demonstrate proper knowledge of the material will not be allowed to experiment.
- Students need to watch a video for each experiment before coming to the laboratory session.
- All students are to attend the laboratory section to which they signed up.
- The 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 the laboratory component is equivalent to 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 a laboratory session without academic consideration will translate into a zero mark 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 to seek alternate arrangements for the missed laboratory session (*i.e.*, within a maximum of three days after consideration has been obtained from the Engineering Undergraduate Services Office).
- The MME Undergraduate Coordinator can provide academic consideration for laboratory sessions (less than 10% weight).
- Missing more than one lab without academic consideration will result in the course's failure.
- Students are required to contact the course instructor for any other circumstances that appear not to be covered by the non-exhaustive list above.

**Term Tests**

- Term tests will be open-book.
- Each of the 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 a term test without academic consideration will translate into a zero mark 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.
- Academic consideration for quizzes (greater than or equal to 10% weight) can be obtained from Engineering Undergraduate Services.
- Students are required to contact the course instructor for any other circumstances that appear not to be covered by the non-exhaustive list above.

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### **In-Tutorial Assignments**

- In-tutorial assignments will take place during the second hour of the tutorials (dates specified above), whereas the first hour will consist of a 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, its weight will be equally distributed among the rest of the assignments.
- If the in-tutorial assignment is missed **without** academic consideration, then the mark for the missed exercise will be zero.
- Students absent from more than three in-tutorial assignments (both with and without consideration) will have the weight of the in-tutorial assignments missed with consideration added to the final exam.
- The MME Undergraduate Coordinator can provide academic consideration for in-tutorial assignments (less than 10% weight).
- Please note that whenever individual contributions to the team effort are not equitably shared by the team members, individual adjustments of the marks might occur at the discretion of the instructional team of the course (*i.e.*, course instructor and teaching assistants).
- Students are required to contact the course instructor for any other circumstances that appear not to 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.
- Please note that a warning on this topic will be given whenever possible. Nonetheless, appeals on this topic will not be accepted, such that students are required to self-monitor their academic progress in the course throughout the entire term.

### **Final examination**

- If a minimum of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.
- The exam will take place during the April examination period.
- The exam will be an open book.
- The length of the final exam will be three hours.
- Students are required to contact the course instructor 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 at the end of the laboratory period. No late submissions will be accepted.

Students are required to contact the course instructor for any other circumstances that appear not to be covered by the non-exhaustive list above.

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**CONSULTATION HOURS:** Wednesdays 16:30-17:30 PM in SEB 2051 (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:  
[uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

**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:** The above topics and outline are subject to adjustments and changes as needed. Students who have failed an Engineering course (ie.<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.

#### **STATEMENT ON GENDER-BASED AND SEXUAL VIOLENCE**

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](mailto:support@uwo.ca).

#### **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.

**A. GENERAL REGULATIONS & PROCEDURES**

1. All first-year students will report to the Undergraduate Services Office by submitting the [Academic Consideration Request Form](#), for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination you will report the absence by submitting [Academic Consideration Request Form](#). Absences worth LESS THAN 10% of your mark, will be processed by your department office. If your course work is worth 10% OR MORE of your final grade, your request will be processed by the Undergraduate Services Office.
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**

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 and request relief through the [Academic Consideration Request Form](#). 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, your request for relief will be processed by your department office. If the test is worth MORE THAN 10% of your final grade your request for relief will be processed by the Undergraduate Services Office.
3. Be prepared to attach supporting documentation to the Department Chair and/or the Undergraduate Services Office through the online form (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. The approval of the Chair or the Undergraduate Services Office is required when rescheduling midterm/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 report your absence using the [Academic Consideration Request Form](#) and 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 submit an "[Application for a Special Exam](#)" form. 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 submit the [Academic Consideration Request Form](#) and 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 2023 Western Academic Calendar available at [www.westerncalendar.uwo.ca](http://www.westerncalendar.uwo.ca).

### **Absences Due to Illness:**

[https://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page\\_135](https://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_135)

### **Academic Accommodations for Students with Disabilities:**

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page\\_10](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_10)

### **Academic Accommodations for Religious or Holy Days:**

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page\\_16](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_16)



**Course Withdrawals:**

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=6&SelectedCalendar=Live&ArchiveID=#Page\\_75](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=6&SelectedCalendar=Live&ArchiveID=#Page_75)

**Examinations:**

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?PolicyCategoryID=5&command=showCategory&SelectedCalendar=Live&ArchiveID=#Page\\_75](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?PolicyCategoryID=5&command=showCategory&SelectedCalendar=Live&ArchiveID=#Page_75)

**Scheduling of Term Assignments:**

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=5&SelectedCalendar=Live&ArchiveID=#SubHeading\\_78](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=5&SelectedCalendar=Live&ArchiveID=#SubHeading_78)

**Scholastic Offences:**

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page\\_20](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=1&SelectedCalendar=Live&ArchiveID=#Page_20)

**Student Medical Certificate:**

<https://www.eng.uwo.ca/files/undergraduate/student-medical-certificate.pdf>

**Engineering Academic Regulations:**

[http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=4&SelectedCalendar=Live&ArchiveID=#Page\\_86](http://www.westerncalendar.uwo.ca/PolicyPages.cfm?Command=showCategory&PolicyCategoryID=4&SelectedCalendar=Live&ArchiveID=#Page_86)

**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”)	Sep. 15, 2023
Full courses and full-year half course (i.e. “E”, “Y” or no suffix)	Sep. 15, 2023
Second term half course (i.e. “B” or “G”)	Jan. 16, 2024

**Drop Deadlines:**

First term half course without penalty (i.e. “A” or “F”)	Nov. 13, 2023
Full courses and full-year half courses without penalty (i.e. “E”, “Y” or no suffix)	Nov. 30, 2023
Second term half or second term full course without penalty (i.e. “B” or “G”)	Mar. 7, 2024

**Contact Information:**

Undergraduate Services Office: E-mail: <a href="mailto:engugrad@uwo.ca">engugrad@uwo.ca</a>	SEB 2097	Phone: 519-661-2130
Chemical & Green Process Engineering: E-mail: <a href="mailto:cbeugrad@uwo.ca">cbeugrad@uwo.ca</a>	TEB 477	Phone: 519-661-2131
Civil Engineering: E-mail: <a href="mailto:civil@uwo.ca">civil@uwo.ca</a>	SEB 3005	Phone: 519-661-2139
Computer, Electrical, Mechatronic Systems & Software Engineering E-mail: <a href="mailto:eceugrad@uwo.ca">eceugrad@uwo.ca</a>	TEB 279	Phone: 519-661-3758
Integrated Engineering E-mail: <a href="mailto:engceli@uwo.ca">engceli@uwo.ca</a>	ACEB 2410	Phone: 519-661-6725
Mechanical Engineering: E-mail: <a href="mailto:mmeundergraduate@uwo.ca">mmeundergraduate@uwo.ca</a>	SEB 3002	Phone: 519-661-4122

**October 26<sup>th</sup> 2023**