MECH ENG 3R03
Heat Transfer

Undergraduate Studies
Summer 2024
Course Outline

CALENDAR/COURSE DESCRIPTION

This course introduces the application of the laws of conduction, convection, and radiation to problems in heat transfer. It also covers the fundamentals of steady and transient conduction in solids, fin analysis, laminar and turbulent convection, radiation heat transfer process, and boiling and condensation.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in any Mechanical Engineering program
Antirequisite(s): N/A

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Mohamed Yasser Abdelsalam
abdelsmy@mcmaster.ca

Office Hours:
by appointment (email or MS Teams)

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

TBD

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

http://avenue.mcmaster.ca/

- All course material: lecture notes, links to recorded lectures and assignments will be posted on A2L.
- Lectures & Tutorials will be held live and recorded on MS Teams.

COURSE INTENDED LEARNING OUTCOMES

The purpose of the course is to teach the student how to "model" realistic heat transfer problems involving conduction, convection, and radiation processes in order to be able to obtain "physically meaningful" solutions. Upon successful completion of the course, it is expected that the students will have acquired the ability to:

1. Identify the salient features of a realistic heat transfer problem for analysis.
2. Formulate a solution using the principles of conduction, convection, and radiation.
3. Solve the relevant equation(s) arising from the formulation of the problem.
4. Apply numerical techniques to obtain a meaningful answer to the problem.

MATERIALS AND FEES

Required Texts:
The main textbook for the course:
Heat and Mass Transfer: Fundamentals and Applications, 6th Edition, By Yunus Cengel and Afshin Ghajar
Recommended Additional Texts:
Fundamentals of Heat and Mass Transfer, 7th Edition, by Frank P. Incropera, David P. DeWitt, Theodore L. Bergman, Adrienne S. Lavine
Calculator:
Any calculator or laptop may be used during the Term Tests and Final Examination.

COURSE FORMAT AND EXPECTATIONS

The course is organized as follows:

- 1 x 3-hour lecture per week (Virtual on MS Teams)
- 1 x 1-hour tutorial per week (Virtual on MS Teams)
- 11 in-lecture quizzes
- 11 assignments (5%)
- 2 Midterm test (30%)
- 1 Final Exam (60%)

COURSE SCHEDULE

Date/Week	Lecture/Tutorial	Textbook Sections
Monday, May 06	Lecture 1	Chapter 1 / 2.1 / 2.2 / 2.3 / 2.4 / 2.5
Wednesday, May 08	Tutorial 1	Cartesian/Cylindrical
Monday, May 13	Lecture 2	3.1 / 3.2 / 3.3 / 3.4 / 3.5
Wednesday, May 15	Tutorial 2	Critical/Resistance
Monday, May 20	Victoria Day – No Lecture	
Wednesday, May 22	Buffer	
Monday, May 27	Lecture 3	2.6 / 3.6
Wednesday, May 29	Tutorial 3	Generation/Extended
Monday, June 03	Lecture 4	4.1
Wednesday, June 05	Tutorial 4	Lumped System Analysis
Friday, June 07	Term Test #1	
Monday, June 10	Lecture 5	4.2 / 4.3 / 4.4
Wednesday, June 12	Tutorial 5	Distributed System Analysis
Monday, June 17	Lecture 6	6.1 – 6.8 / 7.1 – 7.4
Wednesday, June 19	Tutorial 6	Convective Heat Transfer Over Surfaces
Monday, June 24	Lecture 7	8.1 – 8.6
Wednesday, June 26	Tutorial 7	Convective Heat Transfer in Tubes
Monday, July 01	Canada Day – No Lecture	
Wednesday, July 03	Revision for Term Test #2	
Monday, July 08	Lecture 8	9.1 – 9.3 / 9.5
Wednesday, July 10	Tutorial 8	Natural Convection Heat Transfer
Friday, July 12	Term Test #2	
Monday, July 15	Lecture 9	12.1 – 12.6
Wednesday, July 17	Tutorial 9	Radiation Concepts
Monday, July 22	Lecture 10	13.1 – 13.6

Wednesday, July 24	Tutorial 10	Black And Gray Body Radiation
Monday, July 29	Lecture 11	10.1 – 10.7
Wednesday, July 31	Tutorial 11	Boiling And Condensation
Friday, August 02	Final Exam Review	
Monday, August 05	Civic Day – No Lecture	
Wednesday, August 07	Final Exam	

ASSESSMENT

Component	Weight
Quizzes	5%
Assignments	5%
Mid-term Exam	30%
Final Exam	60%
Total	100%

EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs to this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Engineering Physics is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the Equity and Inclusion Office.

MENTAL HEALTH & WELLNESS

For a list of McMaster University's resources, please refer to the Student Wellness Centre.
Talkspot is a non-crisis mental health resource specifically for students in the Faculty of Engineering.

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

The following illustrates only three forms of academic dishonesty:
1. plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. improper collaboration in group work.
3. copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

1. It is the students' responsibility to regularly check the course webpage (ex. Avenue to Learn) for updates and announcements.

2. Late assignment submissions will not be accepted without proper justification (e.g., a doctor's note).
3. The weight of all MSAF'd assignments and/or midterm exam will be transferred to the final exam.

SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:**

    - Use the McMaster Student Absence Form (MSAF) on-line self-reporting tool. No further documentation is required.
    - Students may submit requests for relief using the MSAF once per term.
    - An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
    - The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
    - The MSAF cannot be used for academic work that has already been completed attempted.
    - An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
    - The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

2. **For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**

    - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
    - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.