

SYLLABUS
MENG 3234-201: Heat Transfer
(Required Course)
Spring 2021

Instructors: Dr. Salim Azzouz (lecture), and Dr. Mahmoud Elsharafi (labs)

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Office Hours: Schedule posted on D2L. Other days and times by appointment.

Course Schedule: MWF 8:00 - 8:50 AM

Lab. Schedule: T (21A), 11:00 AM - 12:50 PM, T (21B) 1:00 PM - 2:50 PM, and T (21C) 3:00 PM - 4:50 PM

Location: lecture MY 136, Labs MY 118 (McCoy Hall)

CATALOG DESCRIPTION

Fundamental laws relating to heat transfer, including steady and transient conduction, convection, and radiation. Introduction to heat exchanger design. Experimental and computational methods. Companion lab.

COURSE PREREQUISITES

MENG 3104 Fluid Mechanics

OTHER PREREQUISITES

Basic computer skills, MS Excel, hand calculator

TEXTBOOK

Heat and Mass Transfer, Fundamentals & Applications. Yunus A. Cengel, Afshin J. Ghajar, 6th edition

REFERENCES

Additional material will be posted in D2L.

TOPICS COVERED

Topics	Topics
Introduction and Basic Concepts	Internal Forced Convection
Heat Conduction Equations	Heat Exchangers
Steady Heat Conduction	Fundamentals of Thermal Radiation
Transient Heat Conduction	Radiation Heat Transfer
Numerical Methods in Heat Conduction	Mass Transfer
Fundamentals of Convection	
External Forced Convection	

COURSE LEARNING OBJECTIVES AND RELATIONSHIP TO STUDENT OUTCOMES

Outcome-Related Course Learning	1	2	3	4	5	6	7
Name the three major mechanisms of heat transfer	X		X				
Derive the conduction heat equation for different geometrical configuration	X						X
Describe the concept of steady heat conduction and thermal resistance	X					X	
Describe the concept of transient heat conduction and its applications	X					X	
Develop the finite difference formulation of differential equations in heat transfer	X						
Describe the physical mechanisms of heat convection	X						
Derive the convection differential equation	X						X
Explain the concept of heat transfer in external flow	X						
Find temperature profile and Nusselt Number in laminar flow	X	X		X			
Explain the Log mean temperature difference method – NTU method	X	X		X			
Write formal and informal engineering reports			X		X		
Work as a part of a team			X		X		

1: an ability to identify, formulate, and solve complex engineering problems by applying the principles of engineering, science, and mathematics

2: an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental, and economic factors

3: an ability to communicate effectively with a range of audiences

4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6: an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions

7: an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

CONTRIBUTION OF COURSE TO PROFESSIONAL COMPONENT

This course contributes to the engineering science component of the mechanical engineering program.

COURSE ORGANIZATION AND STUDENT PERFORMANCES ASSESSMENT

- Lecture Format

This spring 2021 semester, the heat and mass transfer lecture is designed as a hybrid lecture. It means that the lecture is offered simultaneously in two forms: 1) in person lecture (face-to face) in the classroom at the McCoy School of Engineering, and 2) online lecture through Zoom, the web-based video conferencing and meeting application. The course consists of a three 50-minutes weekly sessions. The lectures will be spent mostly explaining and discussing concepts presented in the textbook, and solving relevant case problems. The Lectures will not be used to communicate the entire textbook course content and thus, students will have to study a set of course paragraphs specified by the instructor on their own to further their understanding. Student participation in class discussions is highly recommended and rewarded. Due to the COVID-19 pandemic, students who choose to attend the in-person lecture are expressly required to wear a face mask covering the mouth and the upper nose all the time during the lecture. Students are also required to keep their social distancing (6 ft.) while sitting in the class. Please check the following university statement:

“During class, students must comply with MSU’s requirement for wearing a face covering” as mandated in the document <https://msutexas.edu/return-to-campus/assets/files/msu-texas-facial-covering-requirement.pdf>

Notice: The notes, videos, and other materials posted on D2L are the strict property of the instructor and should not be given, copied, or communicated through electronic means to a third party, or posted on digital media. Any violation of these rules will result in legal pursuit.

- Exams

There will be two regular exams plus a final one at the end of the semester. The exam will take place in room MY 136. A hand written personal single formula sheet summarizing the taught materials is allowed during the exam (+5). The exam is designed to test the students’ ability to think, analyze, and solve a set of problems. Each exam is based on the course materials developed between two consecutive exams. During the exam only your hand written notes including homework, the textbook, and the notes posted by the instructor on D2L are allowed. Any other document is considered illegal to use during the exam. The solutions of the exam should be written on engineering paper or blank sheets, organized with the appropriate questions numbering, and neatly written.

You are expected to take the exam on the scheduled date and time it is given. No make-up exam will be given. **It is strictly forbidden to use cell phones or other electronic devices with the exception of a simple calculator during the exam.** Cell phones and other electronic devices will be collected at the beginning of the exam and restituted at the end of it.

- Homework & Quizzes

Homework will be posted on D2L from a set of chosen chapters by the instructor. The students are required to upload the homework to a D2L Dropbox in PDF format. The solutions of the homework should be written using the posted homework template. Homework should be organized with the appropriate questions numbering, and neatly written. Homework should be submitted with the posted homework questions sheet as a cover page for the whole homework submission. Homework have to be turned-in on the due date specified on the homework questions sheet. The maximum grade for the submitted homework on the due date is 50%. Late homework (and the quiz) will still be accepted till the end of the semester and graded with a

maximum grade of 30%. Homework questions sheet is accompanied with quiz questions. The quiz is designed to encourage the students to study the course materials in depth. The quiz consists of questions related to the material treated in the current homework problems. The quiz should be submitted as the last part of the homework with the title "Quiz # ...". The quiz counts for 50% of the homework/quiz total grade. Each student is responsible for submitting his own individual personal homework and quiz copy, written in his own words. No dual or group homework copy is accepted unless specified by the instructor. Many homework will require the students to use the **Matlab software**.

- Lab Reports

Lab reports are based on the materials studied in class, or presented during lab sessions. Organized, neat Lab reports must be turned-in on the due date, at the beginning of class. Each group of students is responsible for submitting its own lab report in its own words. A student cannot add its name to a student lab group if absent. Labs are graded according to the content listed in the below table. Students are encouraged to finish their lab and submit it during the lab session if possible.

Arriving late to the lab will be penalized by -5 points on the lab grade. Quitting the lab session without the instructor authorization will be penalized by -10 points on the lab grade. For lab guidelines, and content, the students are referred to the labs instructor: Dr. Mahmoud Elsharafi.

Graded Items																					
Submitted/Behavior	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0
Motivation	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0
Lab Theory	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Lab Procedure	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0
Results and Discussion	30	28	26	24	22	20	18	16	14	12	10	9	8	7	6	5	4	3	2	1	0
Conclusion	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0
Ref./Org./Neatness	10	9.5	9	8.5	8	7.5	7	6.5	6	5.5	5	4.5	4	3.5	3	2.5	2	1.5	1	0.5	0

- Course Grade

The final grade for the course will be based on the scores earned in the three mandatory exams, the average score earned in the homework/quizzes, and the average score earned in lab reports. The first exam contributes 15%, the second exam contributes 25%, the third exam contributes 35%, homework/quizzes average contribute 10%, and lab reports average contributes 15% for a total of 100%. The overall average score (X) for the course is determined as follows:

$$X = 0.15 \times (\text{exam1 score}) + 0.25 \times (\text{exam 2 score}) + 0.35 \times (\text{exam 3 score}) + 0.10 \times (\text{homework/quizzes average scores}) + 0.15 \times (\text{lab report average scores}).$$

The final letter grade for the course is based on the value of X and is determined from the following grade levels:

Value of X (in %)	Letter Grade
89.5-100	A
79.5-89.4	B
69.5-79.4	C
59.5-69.4	D

Value of X (in %)	Letter Grade
< 59.4	F

CONFLICT RESOLUTION

If a misunderstanding or a conflict arises between the student and the instructor. Please follow this conflict resolution procedure:

- 1) The student should contact the instructor face to face or via e-mail if there is an issue with the course or the instructor. The faculty and the student will discuss this face to face or via email. Hopefully a resolution is reached on the issue.
- 2) The student should notify the faculty via email again if the issue still did not get resolved after the first encounter or communication.
- 3) The student can then contact the Chair of the McCoy School of Engineering, Dr. Desai, face to face or via email, (raj.desai@msutexas.edu), and discuss this issue. Dr. Desai will discuss the issue at hand with the faculty member. Dr. Desai will discuss the result of this discussion with the student. Hopefully a resolution is reached on the issue after this.
- 4) The student should notify the Chair via email if the issue still did not get resolved.
- 5) The Chair will contact the Dean and try to resolve the conflict. In case the conflict deals with the student grade, she will forward the case to the Grade Appeals Committee if necessary.

GENERAL GUIDELINES

- Plan to spend at least 6 hours outside of class to study the material and to work on homework assignments, and lab experiments. Do not wait until the last day to start working on your report, or prepare for the exam.
- Read the course material before coming to class.
- Utilize the instructor office hours throughout the semester to seek explanations from the instructor.
- Use engineering or blank paper for all homework assignments and exams. Use a systematic approach to solve problems. If a problem involves drawing a graph, use Excel, or any other graphic software tool to draw the graph. In engineering, neatness is a must, not a luxury. Be advised that you will be penalized for a lack of neatness.
- You are strongly encouraged to study in-group. Time to time a lab partner will be randomly selected for you.

UNDERGRADUATE RESEARCH INFORMATION

Research and Creative Activity Opportunities at MSU Texas

Enhancing Undergraduate Research Endeavors and Creative Activities (EURECA) is a program that provides opportunities for undergraduates to engage in high-quality research and creative activities with faculty. EURECA provides incentives and funding through a system that supports faculty and students in a cooperative research process. For more information contact the Office of

Undergraduate Research, (940) 397-6275 or by sending a message to eureca@mwsu.edu or better yet, stop by the UGR office located in the atrium of the Clark Student Center, room 161. Information and resources are available at www.msutexas.edu/eureca.

Council on Undergraduate Research (CUR)

To support undergraduate research and creative activities, Midwestern State University holds an enhanced institutional membership with the Council on Undergraduate Research (CUR). This institutional membership includes unlimited memberships for any interested faculty, staff, and students. Students may find information on benefits and resources at: www.cur.org/resources/for_students and may sign up at: members.cur.org/members_online/members/newmember.asp.

The CUR Undergraduate Resources Webpage contains:

- Research Opportunities
- Presentation Opportunities
- Undergraduate Research Journals
- CUR-Sponsored Student Events
- The Registry of Undergraduate Researchers
- and more!

Ugrow

Like EURECA, the Undergraduate Research Opportunities and Summer Workshop, Ugrow provides opportunities for students to conduct research with faculty. However, the research occurs in the summer. For five weeks, UGROW students experience the authenticity of scientific research in faculty's laboratories, in a highly interdisciplinary environment. Students work on projects of their choice and present their findings at the end of program and the MSU Undergraduate Research Forum. Faculty members publicize research projects in the spring. The application deadline for UGROW 2021 has not been established yet; however, it will be announced during the spring semester. Information and resources are available at www.msutexas.edu/ugrow.

MIDTERM PROGRESS REPORT

In order to help students keep track of their progress toward course objectives, the instructor for this class will provide a Midterm Progress Report through each student's WebWorld account for at-risk students will be reported. Midterm grades will not be reported on the students' transcript; nor will they be calculated in the cumulative GPA. They simply give students an idea of where they stand at the midpoint of the semester. Students earning below a C at the midway point should have a meeting with the professor and seek out tutoring.

CAMPUS CARRY STATEMENT

Senate Bill 11 passed by the 84th Texas Legislature allows licensed handgun holders to carry concealed handguns on campus, effective August 1, 2016. Areas excluded from concealed carry are appropriately marked, in accordance with state law. For more information regarding campus carry, please refer to the University's webpage at <http://mwsu.edu/campus-carry/rules-policies>.

GENERAL EDUCATION STATEMENT

Students in this course must demonstrate their competency in oral and written communication through written homework assignments, lab reports, quizzes, and exams. They must also demonstrate their ability to use the English language.

ACADEMIC INTEGRITY POLICY AND ETHICS

Scholastic dishonesty will not be tolerated and will be prosecuted to the fullest extent. You are expected to have read and understood the current issue of the student handbook regarding student responsibilities & rights, and the intellectual property policy information about procedures and what constitutes acceptable on-campus behavior. Any form of plagiarism will not be accepted, and will be heavily reprimanded.

DISABILITY SUPPORT SERVICES

Students registered with Disability Support Services should have a letter verifying their disability and the appropriate accommodations.

DISCLAIMER STATEMENT

Information contained in this syllabus, other than grading, and late assignments, may be subject to change with advance notice, as deemed appropriate by the instructor.

Prepared by: Dr. Salim Azzouz and Dr. Mahmoud Elsharafi, Date: 01/10/2021