



Heat Transfer

The University of Toledo
Department of Mechanical, Industrial, and Manufacturing Engineering
MIME 3440

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Prerequisite:	MIME 3430	TA Email:	Javier.Salazar@rockets.utoledo.edu

COURSE/CATALOG DESCRIPTION

A comprehensive study of conduction, convection and radiation. Derivation and solution of differential equations related to heat transfer. Analysis of forced and free convection and design of heat exchangers. Dimensional analysis related to heat transfer.

COURSE OVERVIEW

Chapter	(approx)	Chapter Topic
1	1	Introduction
2	4	Introduction to Conduction
3	3	1-D, Steady Conduction
4	3	2-D, Steady Conduction
5	3	Unsteady Conduction
	-	Examination I
6	3	Introduction to Convection
7	5	External Flow
8	4	Internal Flow
9	3	Free Convection
	-	Examination II
11	3	Heat Exchangers
12	4	Radiation Properties and Processes
13	3	Radiation Exchange Between Surfaces
	-	Examination III (10 classes)



STUDENT LEARNING OUTCOMES

At the end of this course students will be able to:

- 1) Use numerical and analytical methods to predict steady-state heat transfer rates and temperature profiles in solids;*
- 2) Use the lumped-capacitance model to predict transient heat transfer to/from solids;*
- 3) Use dimensionless parameters to predict rates of convection;*
- 4) Perform thermal analyses of heat exchangers to determine the size and heat transfer rates;*
- 5) Perform simple analyses of systems with radiation heat transfer;*
- 6) Understand the need for life-long learning based on additional material to be learned;*

TEACHING/LEARNING STRATEGIES

- 1) Recitations will focus on reviewing analytical and to some extent numerical methods used in heat transfer and applying them to solve representative heat transfer problems on the white board.*
- 2) Before each class: read the pages from the textbook on the material to be presented – it will help you to focus on the lecture and to better understand the concepts.*
- 3) Come to the lecture and focus on what is being presented; take notes; ask questions if needed; raise your hand and respond to the questions asked in class.*
- 4) After each class:*
 - a) Read the relevant pages from the textbook.*
 - b) Read your notes and handouts; redo, on your own, the problems solved in class.*
 - c) Solve, on your own, the examples from the textbook; compare your results to the provided solutions.*
 - d) Do the assigned homework alone; **keep a copy**.*
 - e) If you do not know how to do a homework problem, ask for help (instructor, colleague, tutor).*
- 5) Before a test: make sure you go again through all homework problems, class problems, and examples from the textbook; ask for help if needed.*

PREREQUISITES AND COREQUISITES

Prerequisite: MIME 3430 Fluid Mechanics

Corequisite: MIME 3450 Energy Laboratory

SUGGESTED TEXTS AND ANCILLARY MATERIALS

Suggested: "Introduction to Heat Transfer", 6th Edition, Bergman, Lavine, Incropera, and DeWitt, 2011 John Wiley & Sons, ISBN 978-0470-50196-2



TECHNOLOGY REQUIREMENTS

Use computer software to calculate results for numerical simulations and to generate graphs, if needed (such as Excel, Mathcad, or Matlab).

Web assist: Blackboard <https://blackboard.utdl.edu>

Blackboard will be used to post course materials, announcements, and homework/examination solutions.

UNIVERSITY POLICIES

Policy Statement on Non-Discrimination on the basis of Disability (ADA)

The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance](#).

Academic Accommodations

The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the [Student Disability Services Office](#).

ACADEMIC POLICIES

The University of Toledo and the College of Engineering academic dishonesty and missed class policies will be applied. Please refer to the MIME Undergraduate Student Handbook, Appendices 1, 2, and 3 for more information. You can find this document online at

http://www.eng.utoledo.edu/mime/undergraduate/handbook/MIME_Handbook_Fall_2012.pdf

Academic dishonesty OF ANY SORT will result in FAILING THE COURSE & REPORTING to the College of Engineering Undergraduate Office. Please note that in case of excused absence, any missed work must be completed and written documentation of the circumstance (such as a doctor's note) must be provided to be kept on file.

COURSE EXPECTATIONS

A professional attitude is expected at all times.

Any behavior that negatively influencing the learning of other students, such as conversation that can be heard from a few rows away, or cell phone ringing/vibrating, will not be allowed. Cell phones and other similar devices must be turned off (not just in silent mode) during lectures and during examinations.

If you do not understand something, there is a good chance that others have the same problem. Never be embarrassed to ask for help if you find something confusing.

I will assign homework problems in most lectures to help you understand the material covered and to prepare you for examinations.

It is planned that the examinations will be closed book and closed notes. All required formula/charts/figs will be provided as handouts; you can use these during the quizzes/exams. You will also need a calculator for all tests and quizzes.

Examinations:

All exams will be closed book and closed notes, unless notified. Examination problems will come from 3 sources:

1. Chapter Example Problems



2. A set of 10 or fewer problems per chapter will be selected from the problems at the end of each chapter. Answers to all identified problems will be provided.
3. Problems similar to those worked out in class.

Homework will not be collected and will not be graded. But it is highly recommend to solve the HW problems and review the solutions that are posted in the blackboard.

There will be 3 Exams

Exam I:	Chapters 1 -5	Conduction (30 % of the final grade)
Exam II:	Chapters 6 -9	Convection (30 % of the final grade)
Exam III:	Chapters 11 -13	Radiation and Heat Exchangers (30 % of the final grade)

Pop Quiz

There will be several pop quizzes. The quiz with the lowest grade will be dropped. (10 % of the final grade)

GRADING

The final grade will be determined using a straight scale as follows.

Numerical Average	Grade
≥ 93.00	A
89.33 – 92.99	A–
85.67 – 89.32	B+
82.00 – 85.66	B
78.33 – 81.99	B–
74.67 – 78.32	C+
71.00 – 74.66	C
67.33 – 70.99	C–
63.67 – 67.32	D+
60.00 – 63.66	D
< 60.00	F

COMMUNICATION GUIDELINES

For other than in-person discussion, please use email to communicate with me. Please refrain from asking through email detailed explanations on solutions or other course problems. Use the office hours for these issues.

STUDENT SUPPORT SERVICES

The university offers tutoring and student support service work to enhance your academic journey. Use these resources for additional support. <https://www.utoledo.edu/success/>

Final Thoughts

1. Regular class attendance is VERY important.
2. Come prepared to learn.
3. If you are confused by something in class or in the book, ask a question.
4. The examination system has been developed to reduce stress on you and to provide the best opportunity for you to demonstrate your mastery of this subject.