MEMS 1052: Heat and Mass Transfer
Section 2, Fall 2021

Instructor

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Meeting Time & Location

Thursday 13:50-16:25 at RM 3-102
Zoom meeting for first a couple of weeks
(Zoom link: https://us06web.zoom.us/j/81022075805?pwd=WmdrTGdRVlRiWFpVN05iMW1FQ2x4dz09)

Office Hour

Thursday 10:00-12:00, or by appointment

TA Information

Junjie Wu: 1348619079@qq.com
WeChat group for Q&A, sending notices, …
Scan the code in Blackboard to join the group.

Textbook

F.P. Incropera, D.P. DeWitt, T.L. Bergman, A.S. Lavine, *Incropera's Principles of Heat and Mass Transfer*, Global Edition, John Wiley and Sons.

Course Description

This course provides an in-depth treatment of the modes of heat transfer: conduction, convection, and radiation. Course topics include steady and unsteady-state conduction, heat sink applications, thermal resistance network, forced and free convection, heat exchangers and the fundamental principles of radiation.

Course Objectives

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

1. Provide an understanding and appreciation of the physical mechanisms of heat transfer.
2. Develop the ability to properly use the analytical and empirical descriptions of heat transfer mechanisms.
3. Apply these descriptions to the analysis of thermal systems.

Prerequisite

MSE 0048: Thermodynamics of Materials

Grading

Homework	20%
Midterm Exam	30%
Term Project	15%
Final Exam	35%

Grade Policy

A: 90 – 100	A−: 85 – 90	B+: 80 – 84	B: 76 – 80	B−: 73 – 76
C+: 70 – 73	C: 66 – 70	C−: 63 – 66	D: 60 – 63	F: < 60

Course Topics

1. Introduction
2. Introduction to conduction
3. 1D steady-state conduction
4. 2D steady-state conduction
5. Transient conduction
6. Introduction to convection
7. External flow
8. Internal flow
9. Free convection
10. Boiling and condensation
11. Heat exchangers
12. Radiation: processes and properties
13. Radiation exchange between surfaces
14. Diffusion mass transfer

Course Policies

1. Show up on time.
2. It is OK to discuss homework assignments with your classmates, but all submissions must be your own work.
3. It is expected that you will work on assignments consistently from the day they are made available.

Evaluation Policy

Partial credit will be awarded to recognize that some portion of the work is correct. However, partial credit grading is only practical if the work is clearly developed, with clear and well-marked diagrams when fitting, with the appropriate equations prominently displayed, where the substitutions into the equations are quite clear, and the assumptions used are obvious to the grader. That is, it is the student's responsibility to present her/his work so clearly that the grader can quickly ascertain the location and nature of the error(s) and can follow the subsequent work through. If this is not clear on the work submitted, credit cannot be given (then or later). ***Partial credit is assigned at the discretion of the grader.*** It is therefore always in your best interest to practice clarity and completeness in your solutions when working homework problems. This is applicable to exam problems as well.

Copyrights

The handouts used in this course are copyrighted. By "handouts" we mean all materials generated for this class, which include but are not limited to syllabi, in-class materials, videos, slides, and problem sets. Because these materials are copyrighted, you do not have the right to copy or distribute the handouts, unless the author expressly grants permission.

Academic Integrity

All students are expected to adhere to the standards of academic honesty. Any student engaged in cheating, plagiarism, or other acts of academic dishonesty would be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include but is not limited to the confiscation of the examination of any individual suspected of violating the University Policy.

Term Project

What

Use what you learn from this course to thoroughly analyze a heat-transfer thermal system in your daily life that most interests you. A written report for this mini research project is required.

Why

To reinforce your learning in heat transfer and to promote your creativity. Finding a problem is more valuable than just solving a problem.

How

Use whatever technique you want to solve your problem. The techniques include but are not limited to direct calculation (like textbook examples), numerical calculation (like finite-difference method), software simulation (like ANYSYS), and simple experimental measurements.

Example

Choose your own interested thermal systems. The topics could be from the grand universe to a small cup of tea. In fact, any object could be a thermal system and hence heat transfer exists everywhere, such as human body, cell phone, heater, air conditioner, microwave oven, wall, earth, hot pot, and so on.

Format

1. Introduction (Clearly state why you want to investigate your chosen heat-transfer system, your motivation, or the significance of your choice.)
2. Method (Usually, you may need to simplify the problem by giving necessary assumptions. In this case, a schematic diagram is really helpful. Clearly state your assumptions for this simplified model. Also provide the details of the code, software, or experimental instrument if any.)
3. Results and discussion (Present your detailed solution or analysis in this section. In-depth analysis and discussion are always welcome. It is OK if no solution is obtained, but the discussion must be required. After all, not every problem can have a solution, even though you have made as many assumptions as you can.)
4. Conclusion (Briefly summarize your main findings.)
5. Reference (List all your references cited in your report if any.)

Other

The deadline of the written report will be near the end of this semester. If time allows, I hope everyone can give a short oral presentation. We will see.