ME 320 – Heat Transfer (Fall 2024)

Principles and applications of heat transfer by conduction, convection, and thermal radiation. This four-credit-hour course consists of three hours of lecture and one hour of laboratory exercise. Professor Smith's lecture section for this course (AL2) meets MWF at 10:00 AM in LuMEB 4100.

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Office Hours: My office hours will be held every week for one hour at a time to be determined via a class poll. If some aspect of the course material is unclear to you after attending lectures and studying the textbook, it is your responsibility to seek assistance. You are welcome to discuss with me regarding your challenges with problem solving, heat transfer concepts, and other topics relevant to ME320.

Required Textbook: Bergman and Lavine, *Fundamentals of Heat and Mass Transfer*, 8th Ed., Wiley, 2017. A copy of the textbook is required. Either a hard copy (recommended) or an electronic version will suffice.

Prerequisites: This course must be preceded by ME 200 and ME 310 (or TAM 335). The subject matter covered in these courses, Thermodynamics and Fluid Mechanics, lays a foundation for heat transfer in general. Analysis learned in ME 320 uses differential equations to predict the temperature distribution within fluids and solids, for which reason MATH 285, 286, or 441 are prerequisites. I recommend reviewing that subject matter, as appropriate, throughout the duration of ME 320.

Course Objectives: The objectives for the lecture portion of this course include:

- Establishing proficiency to analyze practical problems in heat transfer through the application of energy and mass balance principles together with rate laws for the various heat and mass transfer modes. An important aspect of this class is the analytical method: when confronted with a complex thermal problem, you should be able to diagram it, simplify it, analyze it, and make a judgment as to the physical meaning and application of your results.
- Establishing qualitative understanding of the modes of heat transfer and the theoretical and empirical basis for calculating conduction, convection, and radiation heat transfer rates;
- Acquisition of judgement to qualify simplifying assumptions made in the analysis of thermal systems and to explain the limitations of the particular analytical approach used. You should acquire a "feel" for this part of your discipline, so that you are able to apply judgment to the evaluation of thermal designs and systems.

Class Meetings: You are expected to attend all official course meetings but may be excused for an illness or emergency, according to the policy described later. You will be held responsible for all material delivered during lectures, lab meetings, and reading for this class. I plan to make lecture recordings available when possible through a Mediaspace channel (https://mediaspace.illinois.edu/channel/channelid/352574132), but all students are expected to attend and participate in lecture.

Homework: Working out your understanding of heat transfer through practical problem solving is essential to becoming an engineer who practices heat-transfer analysis. Homework will thus be assigned in sync with lectures and based on that lecture's assigned reading, as indicated on the *Course Schedule* on the ME 320 Canvas site. Though homework constitutes a small fraction of the course grade, experience shows that students who master homework usually do well on exams. Accordingly, homework will play an important role in your individual growth in this course. While it is acceptable to share your thoughts concerning homework problem-solving strategies with classmates, *your homework* is expected to be *your work* in every sense.

Homework problem sets assigned for lectures during the preceding week must be submitted as a single PDF file on Canvas each Friday before 11:59 pm, unless otherwise specified. Homework assignments submitted late but within one hour of the associated deadline will receive an automatic reduction in grade of 50%. Homework assignments submitted more than one hour late will receive 0%. It is your responsibility to confirm that your assignment has been submitted correctly: navigate back to your assignment on Canvas after you have submitted it to confirm the submission time and that the PDF is uploaded correctly. Each problem set for a given lecture will be graded according to the following scheme:

- 3 points for a complete set;
- 7 points for one randomly selected problem from the set;
    - 2/7 for correct format,
    - 4/7 for a valid technical approach, and
    - 1/7 for proceeding to a correct solution.

This scheme may not apply to some assigned problems, and the Course Grader may adopt common-sense variations in the scoring system. Points will be awarded not only for the correct answer, but also for the correct format and a valid technical approach. An example of the proper problem format is given in the attachments. You must present your solution in the required format to receive full credit. This includes the use of appropriately labeled and annotated control volumes: remember that control volumes are to thermal analysis as free body diagrams are to mechanical analysis. The analysis that follows from your schematic with appropriate control volumes should show all intermediate steps explicitly, though textbook solutions often fail to do so.

Exams: There will be two evening exams as indicated on the Course Schedule, the particular time, duration, and mode of which will be determined at least two weeks prior to the exam date. There will be a final exam at a time and place to be determined. Absolutely no make-up exams will be given, except in the case of an excused absence or excused conflict. Letters of Accommodation from the Disability Resources and Educational Services (DRES) office should be given to Professor Smith within the first two weeks of class.

Laboratory: This course has a laboratory, which has its own policies for grading and attendance. If you need help with the laboratory or need to resolve a laboratory-related issue, please try to resolve it with the lab instructor (Professor Blake Johnson) before approaching the course instructor. If you need help with the course material, please resolve it with the course instructor before approaching the laboratory instructor.

Grades: Course grades will be based on homework, exam, and laboratory grades, according to the following weighting scheme (as a percentage of total points available in the class):

Laboratory Grade	25%
Lecture Grade	75%

Your laboratory grade will be based on lab reports as described in handouts made available to during your first laboratory section meeting. Your lecture grade will be based on:

-10% Homework
-55% Midterm exams (27.5% each)
-35% Final exam

Final grades will be assigned using the following scale. At my discretion, I may reduce the minimum score to earn a certain letter grade, but I will not raise it.

A+	98-100%
A	93-97%

A-	90-92%
B+	88-90%
B	83-87%
B-	80-82%
C+	78-80%
C	73-77%
C-	70-72%
D+	68-70%
D	63-67%
D-	60-62%
F	<60%

Regrade Policy: If you received the correct number of points on each problem and they were added incorrectly, bring the graded assignment to my attention through email on the same day that its grade was released to you. I will fix it right away.

If you think that you were awarded an incorrect number of points, you will be given a formal opportunity to request a regrade for midterm exams. This should include justification of why your answer is correct or otherwise equivalent to the instructor's solution. In order to make your case, you may need to use equations and calculations. The goal here is to make sure you understand what you are asking for and why. The memo may be hand-written or typed. I must be able to understand it. When regrading a midterm exam, I may increase or decrease the number of points. If I awarded too many points on the first try, the review will result in fewer points. If I awarded too few points on the first try, the review will result in more points.

Device Policy: Electronic devices may only be used for note taking during in-person lectures. All other uses are prohibited, as they are distracting to other students in the class and to the instructor. If students do not follow this rule, the use of electronic devices will be prohibited altogether.

Excused Absences: Should you be unable to attend an official meeting due to a death, other serious family emergency, or a personal health issue, you must email me prior to the conflict and provide appropriate written documentation. Absences due to university-sanctioned travel should be submitted during the first two weeks of class.

Unethical Conduct: Any academic integrity violation (see the UIUC Student Code, Article 1, Part 4) in the lecture or laboratory portion of the course will be dealt with firmly, with the recommended penalty being failure of the course, separation from the Grainger College of Engineering, or separation from the university. This includes representing the work of other humans or of artificial intelligence (e.g., ChatGPT) as your own, including on homework, exams, and laboratory assignments, as well as the facilitation of others to do such.