

## **ME 320 – Heat Transfer (Spring 2022)**

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 in-person lecture section for this course (AE2) meets MWF at 3:00 PM in 4100 LuMEB, except for the first two lectures of the course that will be on Zoom (see Compass for Zoom details).

**Course Instructor:** Prof. Kyle C. Smith, Ph.D.  
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**Office Hours:** My office hours will be held every week at a time **to be determined** by Prof. Smith and by appointment. If some aspect of the course material is unclear to you after independent study, it is your responsibility to seek assistance. You are welcome to discuss with me regarding your challenges with problem solving, heat/mass transfer concepts, and other topics relevant to ME320. I look forward to that time with you.

**Required Textbook:** Bergman and Lavine, *Fundamentals of Heat and Mass Transfer*, 8<sup>th</sup> Ed., Wiley, 2017. A hard copy of the textbook is not required, though it is recommended. An electronic version of the textbook is acceptable.

**Prerequisites:** This course must be preceded by ME200 and ME310. The subject matter covered in these courses, Thermodynamics and Fluid Mechanics, lays a foundation for understanding heat/mass transfer in general and the particular heat/mass transfer mode of convection. I recommend reviewing that subject matter as appropriate throughout duration of ME320.

**Course Objectives:** The primary aim of this course is that you should understand the modes of energy transfer and the theoretical and empirical basis for calculating conduction, convection, and radiation heat transfer rates, as well as the formal analogy between heat and mass (chemical) transfer. Moreover, 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. An important aspect of this class is the analytical method: when confronted with a complex thermal problem, you should be able to simplify it appropriately, analyze it, and make a judgment as to the meaning and application of your results.

**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.

**Homework:** Working out your understanding of heat transfer through practical problems is essential to becoming an engineer who practices heat transfer analysis. Homework will thus be assigned synchronously with the course material delivered in each lecture and based on that lecture's assigned reading, as indicated on the *Course Schedule*. 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 your classmates, your homework is expected to be

your work in every sense. Problem sets assigned for lectures during the preceding week must be submitted as a single PDF file on Compass **each Friday at a time to be determined** by Prof. Smith, 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 not receive credit.

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 Grader may adopt common-sense variations in the scoring system. Points will be awarded not only for the correct answer, but also the correct format and a valid technical approach. An example of the proper problem format is given in the attachments. While creative problem solutions are encouraged, 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 (such as, in-person or take-home) 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 Prof. 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 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 letter grade, but I will not raise it.

A+	98-100%
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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, please write a memo explaining why you should receive a different number of points and email it to me. 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. The memo should be stapled to the front of the exam, and this package should be turned in to me within one week of receiving the graded material. When regrading an 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.

**COVID-Related Policies:** Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community. Students are also required to follow the campus COVID-19 protocols. Students who feel ill must not come to class. In addition, students who test positive for COVID-19 or have had an exposure that requires testing and/or quarantine must not attend class. The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work. Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University.

All students, faculty, staff, and visitors are required to wear face coverings in classrooms and university spaces. This is in accordance with CDC guidance and University policy and expected in this class. Please refer to the University of Illinois Urbana-Champaign's COVID-19 website for [further information on face coverings](#). Thank you for respecting all of our well-being so we can learn and interact together productively.

In order to implement COVID-19-related guidelines and policies affecting university operations, instructional faculty members may ask students in the classroom to show their Building Access Status in the Safer Illinois app or the Boarding Pass. Staff members may ask students in university offices to show their Building Access Status in the Safer Illinois app or the Boarding Pass. If the Building Access Status says "Granted," that means the individual is compliant with the university's COVID-19 policies—either with a university-approved COVID-19 vaccine or with the on-campus COVID-19 testing program for unvaccinated students. Students are required to show only the Building Access Screen, which shows compliance without specifying whether it was through COVID-19 vaccination or regular on-campus testing. To protect personal health information, this screen does not say if a person is vaccinated or not. Students are not required to show anyone the screen that displays their vaccination status. No university official, including faculty members, may ask students why they are not vaccinated or any other questions seeking personal health information.

**Excused Absences:** Should you be unable to attend an official meeting due to a death or other serious family emergency, you must email me prior to the conflict and provide appropriate written documentation. Absences for pre-planned events (including university-sanctioned travel) should be submitted during the 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 UIUC. This includes representing the work of others as your own including on homework, exams, and laboratory assignments, as well as the facilitation of others to do such.