



HEAT TRANSFER

ME 603

Instructor Info

- Prof. Nathan Laxague
- MWF 10:10 am - 11:00 am
- Nathan.Laxague@unh.edu

Lecture Info

- Prereq: MATH 527 & ME 608
- Monday, Wednesday, & Friday
- 9:10 am - 10:00 am
- Murkland 115

Recitation Info

- Tuesday
- 11:10 am - 12:30 pm
- Paul G75

TA Info

- Kaushik Bhanja
- W 2:00-3:00 pm
- F 12:30-1:30 pm
- Kaushik.Bhanja@unh.edu
- Daniel Laughlin
- M 12:30-1:30 pm
- T 2:00-3:00 pm
- Th 1:00-3:00 pm
- Daniel.Laughlin@unh.edu
- Shantanu Soumya
- T 1:00-2:00 pm
- Shantanu.Soumya@unh.edu

Overview

ME 603 is an undergraduate-level course in heat transfer. At the completion of this course, the student should be able to:

- Describe the principles of conductive, convective, and radiative heat transfer
- Apply these principles to basic heat transfer problems
- Analyze heat transfer problems using scientific computing

Material

Required Text
Bergman, Lavine, Incropera and DeWitt *Fundamentals of Heat and Mass Transfer*, 8th Ed., John Wiley and Sons, 2017, ISBN 978-1119444220.

Previous versions of this text are also acceptable. Please note, there is an electronic version of this text for a lower cost.

Other
Any other required reading materials will be provided through Canvas.

Lecture/Recitation Delivery

Students will be expected to attend lecture/recitation and take notes for themselves. If a student has a question, they may raise their hand and I will do my best to answer it succinctly. Extended questions may be addressed during scheduled office hours (see left panel).

Grading Scheme

| | | | | | |
|-----|---|--|--|--|--|
| 5% | Quizzes (x5) | | | | |
| 20% | Homework Assignments (x5, one dropped) | | | | |
| 15% | Programming Project Deliverables (5% for first, 10% for second) | | | | |
| 30% | Midterm Exams (15% per exam) | | | | |
| 30% | Final Exam | | | | |

| | A | B | C | D | F |
|---|--------|-------|-------|-------|-----|
| + | | 87-89 | 77-79 | 67-69 | |
| | 93-100 | 83-86 | 73-76 | 63-66 | <60 |
| - | 90-92 | 80-82 | 70-72 | 60-62 | |

Graded Assignments

- Homework will be assigned on Wednesdays and due (via upload through Canvas) by the end of day the following Wednesday. Late homework will be marked down 10% per day, up to two days past the due date. Homeworks submitted after 11:59 PM Friday will get a zero. *There will be no exceptions to this rule.* The lowest individual homework grade will be dropped.
- Quizzes will directly precede (and pair with) the homework assignments. You get full credit for a submitted quiz, and no credit for an unsubmitted quiz.
- Midterm examinations will be administered in person, in Parsons N108.

Quizzes, Homeworks, & Project Deliverables

“Quizzes” are in fact homework preparation, designed to be small-scale introductions to the material. They will be assigned Monday to be completed before class on Wednesday. After uploading the Quiz solution to Canvas, you will be able to watch the solution video and take a self-assessment questionnaire. Although participation in Quizzes make up a small fraction of the overall grade (5%), completing them will greatly aid your Homework efforts. Homework will be assigned at the beginning of class on Wednesdays and will be due by end of day the following Wednesday. Late homework will be marked down 10% per day, up to two days past the due date. Homeworks submitted after 11:59 PM Friday will get a zero. *There will be no exceptions to this rule.* The lowest individual homework grade will be dropped.

Homeworks will be submitted through Canvas (either written via stylus/tablet or scanned and combined into an electronic document). In order to facilitate the grading of homework assignments, please adhere to the following requirements:

1. Every page should have your name written at the top of the page. The first sheet of your work shall have this information across the top: Course No./Course Title/H.W. Set No./Name (last, first).
2. Keep problems in the order assigned and separate each problem by a heavy line across the entire sheet. Identify answers by enclosing them in an oval or box.
3. A neat, labeled sketch of the problem setup should be included. The assumptions made for each problem must be clearly stated. Label all plots completely as to title and axes, including dimension and scales.
4. Include the proper complete units associated with the quantities calculated. Use the standard nomenclature of the S.I. or English system unless others are specified.

A scientific programming project will be assigned in two phases, each deliverable with a separate due date. This will involve using MATLAB to solve a series of project-oriented problems and (finally) documenting this work in the form of a report. Late project deliverables will not be accepted. You will only have one Homework or Project Deliverable active at a given time.

Exam Scheduling

Exams will be proctored in Parsons N108 during marked exam dates/times. Individuals with an excused, officially documented reason for absence on exam day (e.g., positive COVID test) will take the exam remotely over Zoom concurrently with the in-person exam. It is my goal to create a learning experience that is as accessible as possible. If you anticipate any issues related to the testing requirements of this course or need accommodations, please either discuss them directly with me or in conjunction with the Student Accessibility Services Office within the first week of classes to explore alternative options.

All Spring 2022 final exams will follow normal practice: Monday, May 16th, 2022, 1:00 pm – 3:00 pm.

Academic Integrity

You are required to comply with all University policies regarding Academic Honesty:

<http://www.unh.edu/vpsas/handbook/academic-honesty>. Suspected violations of academic honesty are handled following Section 9.7, Procedures for Dealing with Academic Misconduct in the Student Rights, Rules, and Responsibilities Handbook, and may result in probation, deferred suspension, suspension, or expulsion. Do honest work; anything else deprives yourself of a learning opportunity that you only have for a short time.

Conduct and Respect for Peers

All participants in ME 603 (including myself, the TAs, and the students) shall treat each other with respect and collegiality. We endeavor to create a welcoming, friendly, and inclusive environment for everyone. To do otherwise marginalizes individuals who are here to learn and grow. Participation is of great importance to an intellectually vibrant class experience. To this end, in order to ensure a climate of learning for all, disruptive or inappropriate behavior (repeated outbursts, disrespect for others, etc.) may result in exclusion (removal) from this class.

Accommodations for Students with Disabilities

The University is committed to providing students with documented disabilities equal access to all university programs and facilities. If you think you have a disability requiring accommodations, please contact Student Accessibility Services (SAS) at 201 Smith Hall. If you have received an accommodation letter for this class, please contact me immediately so we can discuss the necessary arrangements. SAS may be contacted at <http://www.unh.edu/disabilityservices/clockwork>, (603) 862-2607, sas.office@unh.edu.

Class Schedule

| WEEK | DATES | TOPIC(S) | BOOK CHAPTER(S) |
|---------|---|------------------------------------|-----------------|
| Week 1 | January 26 th & 28 th | Introduction to Heat Transfer | Chap. 1 |
| Week 2 | January 31 st , February 2 nd & 4 th | Introduction to Conduction | Chap. 2 |
| Week 3 | February 7 th , 9 th , & 11 th | 1D Steady-State Conduction | Chap. 3 |
| Week 4 | February 14 nd , 16 th , & 18 th | 1D Steady-State Conduction | Chap. 3 |
| Week 5 | February 21 st , 23 rd , & 25 th | 2D Steady-State Conduction | Chap. 4 |
| Week 6 | February 28 th , March 2 nd & March 4 th | 2D Steady-State Conduction | Chap. 4 |
| Week 7 | March 7 th & 9 th | 1D Transient Conduction | Chap. 5 |
| | March 10 th | Exam 1 (Thursday Common Exam Time) | |
| | March 11 th | No Class | |
| Week 8 | March 14 th , 16 th , & 18 th | Spring Recess | |
| Week 9 | March 21 st & 23 rd | Computational Heat Transfer | |
| | March 25 th | Radiation | Chap. 12 |
| Week 10 | March 28 th & 29 th | Radiation | Chap. 12 |
| | April 1 st | Introduction to Convection | Chap. 6 |
| Week 11 | April 4 th | Introduction to Convection | Chap. 6 |
| | April 6 th & 8 th | Forced External Convection | Chap. 7 |
| Week 12 | April 11 th , 13 th , & April 15 th | Forced External Convection | Chap. 7 |
| Week 13 | April 18 th , 19 th , & 21 st | Forced Internal Convection | Chap. 8 |
| Week 14 | April 25 th & 27 th | Forced Internal Convection | Chap. 8 |
| | April 28 th | Exam 2 (Thursday Common Exam Time) | |
| | April 29 th | Heat Exchangers | Chap. 11 |
| Week 15 | May 2 nd | Heat Exchangers | Chap. 11 |
| | May 4 th & 6 th | Free Convection | Chap. 9 |
| Week 16 | May 9 th | Course wrap-up | |
| | May 16 th , 1:00 PM - 3:00 PM | COMPREHENSIVE FINAL | |

Assignment Schedule

| NAME | TOPIC | ASSIGNED | DUE |
|------------------------|----------------------------|---------------------------|---------------------------|
| Quiz 01 | General Heat Transfer | February 7 th | February 9 th |
| Homework 01 | | February 9 th | February 16 th |
| Quiz 02 | 1D Steady-State Conduction | February 14 th | February 16 th |
| Homework 02 | | February 16 th | February 23 rd |
| Quiz 03 | 2D Steady-State Conduction | February 28 th | March 2 nd |
| Homework 03 | | March 2 nd | March 9 th |
| Exam 01 | Conduction | | March 10 th |
| Project Deliverable 01 | | March 23 rd | April 6 th |
| Quiz 04 | Radiation | April 4 th | April 6 th |
| Homework 04 | | April 6 th | April 13 th |
| Quiz 05 | Forced External Convection | April 11 th | April 13 th |
| Homework 05 | | April 13 th | April 20 th |
| Exam 02 | Radiation & Convection | | April 28 th |
| Project Deliverable 02 | | April 29 th | May 13 th |
| Final Exam | E V E R Y T H I N G | | May 16 th |