

ME 2240 A Heat Transfer

Semester	Spring 2024
Classroom	Votey 105
Meeting time	8:30–9:45
Instruction	Yves Dubief, ydubief@uvm.edu Office hours: W 9-11 Votey 201C
TA(s)	TBA Office hours: T-Th 12-2:00 Perkins 211A
Prerequisites	ME 2230, Python
Note:	Heat transfer problem are mostly solved in python. You should always bring the laptop or tablet that runs python to class. You should be familiar with your local file system and One Drive. You should set up a directory (folder) where you will store your assignments and data. You should know how to load new modules in python.
Credit hours	3
Textbook	Fundamentals of Heat and Mass Transfer, 8th Edition, ISBN-13: 978-1119582786 Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt
Software	Python 3 with jupyter notebook https://github.com/yvesdubief/UVM-ME144-Heat-Transfer

Course description

One- and two-dimensional steady and unsteady thermal conduction; natural and forced internal and external convection; thermal radiation; heat exchangers; boiling and condensation heat transfer

Course objectives

- To demonstrate the ability to understand and identify relevant modes of heat transfer in physical problems and to demonstrate the ability to apply conservation of energy in heat transfer problem.
- To demonstrate the ability to analyze 1D and solve multi-dimensional steady-state heat conduction in bodies with various thermal boundary conditions and multiple component materials.
- To demonstrate the ability to model and simulate unsteady simplified heat transfer problems with appropriate boundary conditions including phase change.
- To demonstrate the ability to understand the mechanisms of convective and radiative heat transfers and to demonstrate the ability to utilize analytical and empirical relations for the solution of engineering heat transfer problems.
- To demonstrate the ability to design a heat transfer system based on many factors (e.g. historical or forecasted weather data) and many constraints such as optimization of costs, minimization of environmental and/or health impacts.
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

- g) Students will understand major implications of climate change on human habitat, including their historic and contemporary interconnections and the differential effects of human organizations and actions.
- h) Students will be able to plan, discern, and evaluate appropriate complex solutions to the challenges posed by climate change using multiple disciplinary scientific perspectives .

Grade distribution and assessment

Weekly assignments	40 %
In-class exams	30 %
Project	30 %

Letter grade distribution

100.0--93.00	A	73.00--76.99	C
90.00--92.99	A-	70.00--72.99	C-
87.00--89.99	B+	67.00--69.99	D+
83.00--86.99	B	63.00--66.99	D
80.00--82.99	B-	60.00--62.99	D-
77.00--79.99	C+	59.99--00.00	F

Policies

Classroom Environment Expectations

- Working in groups is encouraged at the beginning of the semester. If so, please enter the names of students in your study group at the beginning of the notebook.
- You are expected to follow the Code of Academic Integrity of the University of Vermont and expectations written in Our Common Ground. Any act plagiarism will result in no more than one warning. Further violation of the academic integrity contract will result in a report to the Center for Student Conduct and a grade of zero for the assignment.
- Office hours will be conducted both online and in person, simultaneously. Be courteous and productive. Post any question regarding the course and its content on MT general conversation. Instructors and TAs will answer your question posted on the days of office hours within 24 hours.
-

Working in groups is encouraged at the beginning of the semester. If so, please enter the names of students in your study group at the beginning of the notebook. You are expected to follow the Code of Academic Integrity of the University of Vermont and expectations written in Our Common Ground. Any act plagiarism will result in no more than one warning. Further violation of the academic integrity contract will result in a report to the Center for Student Conduct and a grade of zero for the assignment. Office hours will be conducted both online and in person, simultaneously. Be courteous and productive. Post any question regarding the course and its content on MT general conversation. Instructors and TAs will answer your question within 24 hours. Students are expected to use blackboard for forums and download and upload of course documents, and read emails sent by instructors.

Late assignment

Assignments are expected to be uploaded on blackboard in the requested format by the deadline set by the instructor. Late assignment will result in a loss of 10/100 points. With sufficient justification, you may ask

for an extension no later than 48 hours before the deadline. Please contact the instructor as soon as you can in case of an emergency.

Tentative schedule

Week	Content
1	Thermodynamics, Modes of heat transfer, heat transfer coefficients
2	Conduction, Fourier's law, thermal properties of matter, heat equation, boundary conditions, temperature distribution
3	1D Conduction, Planar system thermal resistance, composite wall, contact resistance, thermal energy generation
4	1D conduction, Radial systems, extended surfaces
5	Exam, 2D conduction, Finite volume
6	2D conduction + Transient conduction, Linear Algebra and time-stepping methods, Analytical solutions
7	Conduction wrap up
8	Convection, Review of fluid mechanics, intro to convection, External flows
9	Convection, External flows (cont'd)
10	Exam (in class), Convection, Internal flows
11	Convection, Internal flows, Free and forced convection
12	Free convection, Boiling and Condensation
13	Boiling and condensation, Radiation
14	Radiation

Relationship to ABET Student Outcomes

Level of instruction 0-Little or none 1-moderate 2-strong	Student Outcome indicator (1-7)	Student Outcome
2	1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
2	3	an ability to communicate effectively with a range of audiences
2	4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
2	5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
2	6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
1	7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Statement about Academic Integrity

<https://www.uvm.edu/policies/student/acadintegrity.pdf>

Statement on Alcohol and Cannabis in the Academic Environment

As a faculty member, I want you to get the most you can out of this course. You play a crucial role in your education and in your readiness to learn and fully engage with the course material. It is important to note that alcohol and cannabis have no place in an academic environment. They can seriously impair your ability to learn and retain information not only in the moment you may be using, but up to 48 hours or more afterwards. In addition, alcohol and cannabis can:

- Cause issues with attention, memory and concentration
- Negatively impact the quality of how information is processed and ultimately stored
- Affect sleep patterns, which interferes with long-term memory formation

It is my expectation that you will do everything you can to optimize your learning and to fully participate in this course.

Statement on Students with Disabilities

In keeping with University policy, any student with a documented disability interested in utilizing accommodations should contact SAS, the office of Disability Services on campus. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. A student's accommodation letter lists those accommodations that will not be implemented until the student meets with their faculty to create a plan. Contact SAS: A170 Living/Learning Center; 802-656-7753; access@uvm.edu; or www.uvm.edu/access

Statement on Religious Holidays
Students have the right to practice the religion of their choice. Each semester students should submit in writing to their instructors by the end of the second full week of classes their documented religious holiday schedule for the semester. An arrangement can then be made to make up the missed work.

Statement on Student Athletes

In order to be excused from classes, student athletes should submit appropriate documentation to the Professor in advance of all scheduling conflicts within the first two weeks of class. Those missing class are expected to submit make-up assignments within a reasonable time period.