Elements of Thermodynamics and Heat Transfer

EML 3007 Sections 12810, 12835
Class Periods: M, W, F | Period 4 (10:40 AM – 11:30 AM)
Location: NEB 100
Academic Term: Fall 2023

Instructor:
Philip B. Jackson, Ph.D.
philipbjackson@ufl.edu
Office: (352) 392 – 4521
Office Hours: See Canvas for up-to-date office hours schedule

Peer Mentor
Please contact through the Canvas website

- See Canvas for up-to-date office hours schedule and contact information

Course Description
Credits: 3
Applications of the first and second laws of thermodynamics to closed and open systems. Steady one-dimensional conduction, lumped parameter analysis, convection, radiation. Intended for non-mechanical engineering students.

Course Pre-Requisites / Co-Requisites
CHM 2045, *MAC 2313*, and *PHY 2048*
While undergraduate calculus, chemistry and physics are required pre-requisite, this course will briefly re-introduce all relevant topics from these subjects as they become necessary.

Course Objectives
This course provides undergraduate coverage of basic thermodynamic processes. The course emphasizes the fundamental principles of control volume analysis to both open and closed systems, the application of conservation of energy and conservation of mass, the concept of entropy and thermodynamic losses, and the general calculation of various state properties. Students will learn to apply these concepts through exposure to numerous practical engineering problems. Upon completion of the course, students are expected to have developed a thorough understanding of the fundamentals of thermodynamics and problem-solving techniques applicable to heat and fluid transfer systems.

Materials and Supply Fees
None

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
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	Low
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the	Low

impact of engineering solutions in global, economic, environmental, and societal contexts	
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	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	High

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

Lecture videos and course notes (developed by the instructor), all available on Canvas, comprise the required course materials.

The free CATT3 thermodynamics software, available on Canvas, is required during the second half of the course.

Recommended Materials

- Fundamentals of Thermal-Fluid Sciences
- Yunus Cengel, John Cimbala, and Afshin Ghajar
- 2022, 6th Edition
- **ISBN10:** 1266360190 **| ISBN13:** 9781266360190

While the textbook above is the official text for the course, its newest version is prohibitively expensive. Students are advised to purchase/acquire an earlier edition (4th, 5th, or 6th editions are all equally acceptable) or a used copy of the text. Contact Peer Mentors for the most economical options for acquiring the text.

You can find a copy of the textbook's appendices and thermodynamic data on the course Canvas site: Files/Tech Resources/Appendix.pdf. (Duplicated by permission from McGraw-Hill)

Course Schedule

Week 1: Introduction, Laws, Basic Definitions, Units, Thermodynamic Properties
Week 2: Properties of pure simple substances, Thermodynamic Processes
Week 3: Work and Heat
Week 4: First Law, Enthalpy, Internal Energy, Specific Heat, Conservation of Mass
Week 5: First Law Analysis for a Closed System
Week 6: First Law Analysis for an Open System
Week 7: Common Open Systems
Week 8: Forward and Reverse Heat Engines, Reversibility
Week 9: Entropy and Entropy Generation
Week 10: Second Law of Thermodynamics for Closed Systems
Week 11: Second Law Analysis of Open Systems
Week 12: Power and Refrigeration Cycles
Week 13: Steady-State Heat Conduction
Week 14: Convection Heat Transfer
Week 15: Thermal Radiation

See Canvas for a more detailed weekly and daily breakdown of course modules.

Attendance Policy, Class Expectations, and Make-Up Policy

Class attendance is optional. Those who have no scheduling conflicts with the recording of live lectures are encouraged to attend but doing so is not mandatory. Students may attend the live class regardless of the section for which you are enrolled. Students enrolled in the web section may attend the live recording of class, likewise students enrolled in the live section may choose to view lectures solely online.

All homework and quizzes will be administered and submitted electronically through Canvas. The midterm exam and the final exam will all be administered in-person in a classroom during the evening assembly exam periods (8:20 PM to 10:20 PM). Make-up exams for excused absences are scheduled on a case-by-case basis. See Canvas for the up-to-date exam schedule and contact the instructor if you have a conflict.

Students are required to watch all posted videos and read all posted content but your consumption of course materials will not be monitored by the instructor. We will use Zoom as our primary means of communication for office hours and homework help. Face-to-face meetings are also available on request. Students are encouraged to contact the instructor through email or text at any time (I can always make myself available for a chat if you need help or have any concerns!).

Generally, late assignments are not accepted, however a 15-minute grace period after an assignment is due is allowed before it is counted as late. If you have extenuating circumstances, it does not hurt to ask for an extension.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:
https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (9)	100 each	30%
Quizzes (5)	100 each	20%
Midterm Exam	100	25%
Final Exam	100	25%
		100%

Extra credit assignments are also offered periodically throughout the semester. All extra credit points are applied only at the end of the semester during the calculation of final course grades. See Canvas for more details about individual assignment scoring, overall grade calculations, and extra credit.

Grading Policy

Percent	Grade	Grade Points
90.0 - 100	A	4.00
89.0 - 89.9	A-	3.67
88.0 - 88.9	B+	3.33
80.0 - 87.9	B	3.00
79.0 - 79.9	B-	2.67
78.0 - 78.9	C+	2.33
70.0 - 77.9	C	2.00
69.0 - 69.9	C-	1.67
68.0 - 68.9	D+	1.33
60.0 - 67.9	D	1.00
59.0 - 59.0	D-	0.67
0 - 58.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination.

It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator
• HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
• Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
• Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*:* https://distance.ufl.edu/getting-help/; *https://distance.ufl.edu/state-authorization-status/#student-complaint*.