

## Thermodynamics 1 - EML 3100

### Spring 2022 Syllabus



MWF Period 3 (9:35 AM –10:25 AM)

**Course Location:** MAE-A 303. Class will be available live, both in-person and via zoom MWF 9:35 AM – 10:25 AM. Recordings will be made available upon request.

**Course Description:** Application of the first and second laws of thermodynamics to closed and open systems and to cyclic heat engines. Includes the development of procedures for calculating the properties of multiphase and single-phase pure substances. *Prerequisites:* CHM 2045, MAC 2313 and PHY 2048. *Credits:* 3

**Instructor:** Prof. Jonathan Scheffe, Department of Mechanical and Aerospace Engineering, *Office:* MAE-A 208, *Email:* [jscheffe@ufl.edu](mailto:jscheffe@ufl.edu). Note that my office this semester will also be virtual via Zoom with link provided in your Canvas course shell.

#### Graduate Grader:

- Kathryn Trimm, *Email:* [ktrimm@ufl.edu](mailto:ktrimm@ufl.edu), Department of Mechanical and Aerospace Engineering

#### Undergraduate TA's:

- Curtis Lurvey, *Email:* [clurvey@ufl.edu](mailto:clurvey@ufl.edu), Department of Mechanical and Aerospace Engineering
- Benjamin Demars, *Email:* [bdemars@ufl.edu](mailto:bdemars@ufl.edu), Department of Mechanical and Aerospace Engineering
- Taylor Johnson, *Email:* [johnsontaylor@ufl.edu](mailto:johnsontaylor@ufl.edu), Department of Mechanical and Aerospace Engineering

**Textbook:** “*Thermodynamics, An Engineering Approach*”; Yunus Cengel and Michael Boles; McGraw Hill; Ninth Edition, ISBN: 978-1260048667. You can opt-in through UF all-access to obtain at a lower price.

#### Other Useful Course Related Resources:

Thermochemical Tables - <https://janaf.nist.gov/>

Thermophysical Properties - <https://webbook.nist.gov/chemistry/fluid/>

NIST Chemistry WebBook - <https://webbook.nist.gov/chemistry/>

Python and Jupyter - <https://www.anaconda.com/>

Cantera - <https://cantera.org/>

**Office Hours:** Zoom office hours for Prof. Scheffe and TA's are indicated below. Zoom links are provided in the Canvas course shell under the “Zoom Conferences” tab.

	Monday	Tuesday	Wednesday	Thursday	Friday
10:00 - 11:00		<b>Scheffe (to 11:30)</b>	<b>DeMars</b>		<b>Lurvey</b>
13:00 - 14:00				<b>Scheffe (to 14:30)</b>	
14:00 - 15:00					
15:00 - 16:00	<b>Lurvey</b>	<b>Johnson</b>	<b>DeMars</b>	<b>Johnson</b>	

**Online Course Information:** Canvas

**Course Objectives:** The objective of this course is for students to learn about energy conversion to describe physical systems relevant to today's world. Such systems include, but are not limited to, fossil fuel powered fired power plants, renewable power plants, combustion engines, Stirling engines, refrigeration, heat pumps and chemical reactors. Systems will be described applying the laws of energy and mass conservation and their application to of the Second Law of Thermodynamics. This class will provide a framework to understand the fundamentals of energy conversion from a somewhat broad and macroscopic perspective, going into fine mechanistic details of specific systems only sporadically. With the skillset obtained in this class, students will have the necessary tools to understanding and analyze a broad range energy conversion processes, a necessary prerequisite for the ultimate design and engineering of more cost effective and efficient systems in the future.

**Relevance:** All (or almost all) energy ultimately is derived from the sun. The sun's photons are converted in nature to heat, wind, biomass and rain, all of which can be further transformed into heat, work or electricity via a number of processes and thermodynamic cycles. As such, energy and energy conversion surround and sustain our daily lives, from the sunlight used to grow food, to its transportation via rail, ship or truck, to its storage in our refrigerators, to electricity provided from fossil or renewable sources. Our metabolic cycles convert the energy stored in our food to do work, analogously to the way a combustion engine converts the energy stored in gasoline to drive a car. Understanding the concept of energy and mass conservation will allow one to approach, analyze and appreciate these systems from a simplified energetic point of view to the more complex underlying mechanisms driving them.

**Course Schedule:**

Week 1 – Introductory Concepts

Week 2 – Energy Transfer and the First Law of Thermodynamics

Weeks 3 and 4 – Properties of Pure Substances

Weeks 5 and 6 – Closed System Analysis

Weeks 7 and 8 – Open System Analysis

Week 9 – Second Law of Thermodynamics

Week 10 – Spring Break

Week 11 and 12 – Entropy

Week 13 – Gas Power Cycles

Weeks 14 and 15 – Vapor and Combined Power Cycles

Week 16 – Refrigeration Cycles (time permitting)

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

**Grading Scale:** Homework: 25%, Exam 1: 15%, Exam 2: 15%, Exam 3: 15% Final Exam: 30%

**Homework:** A series of small homework questions will be provided most weeks to complete. Assignments will be given one week prior to their due date (during class and posted on Canvas), and must be turned in prior to the assigned due date. 50% of the grade will be based on correctness of a randomly determined question and 50% based on effort. All homework must be submitted electronically as a pdf that is easily legible. Answers should be clearly indicated.

**Exams:** Three mid-term exams and one final exam will be given. Each mid-term examination is worth 15% of the course grade and the final exam is worth 30%. All exams will be graded based on the correctness of final answers, but partial credit will be given. Full credit will be given for answers that are incorrect because of previously incorrect answers (i.e. cascading effects will not be possible). No examinations will be dropped, however one of the two scenarios (whichever results in a greater course average) will be used to amend your final course average:

- 1) If the final exam score is higher than any of the three midterms, the final exam score will be used in place of the lowest midterm.
- 2) The standard deviation of all midterm exam scores will be taken and added to your lowest midterm exam.

All exams will be performed in-class or via Honorlock in Canvas. If via Honorlock, you will have 90 minutes for the midterms and 150 minutes for the final exam that all occur within a flexible, larger window of time. 30 extra minutes (already built into the exam times) are provided as a buffer to allow for downloading, scanning and uploading materials. More details to follow as the semester progresses.

**Make-up Policy:** Late homework will not be accepted, except under extenuating circumstances. Make-up exams will not be granted except in cases of emergency and will be handled on a case by case basis. **If you need extra accommodations for homework or exams please reach out to the Disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/> - more information below.**

**Exam Dates:**

Midterm 1: February 9<sup>th</sup>, 2022

Midterm 2: March 4<sup>th</sup>, 2022

Midterm 3: April 11<sup>th</sup>, 2022

Final Exam: April 26<sup>th</sup> (12:30 pm – 2:30 pm), 2022

**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 Conduct 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. 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 broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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
- Jennifer Nappo, Director of Human Resources, 352-392-0904, [jpennacc@ufl.edu](mailto:jpennacc@ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto: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](mailto: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](mailto: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/>.

#### **COVID-19**

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email [covid@shcc.ufl.edu](mailto:covid@shcc.ufl.edu)) to be evaluated for testing and to receive further instructions about returning to campus.

- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

### Academic Resources

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

**Career Resource 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**: <http://www.distance.ufl.edu/student-complaint-process>.