

## Classical/Statistical Thermodynamics - EML 5104



### Fall 2020 Syllabus

MWF Period 6 (12:50 PM –1:40 PM)

**Course Location:** Because of social distancing guidelines due to COVID-19, class will be online and available both live MWF 12:50 PM –1:40 PM and recorded using Zoom. Links will be provided in the Canvas course shell. **Important** - For F1 visa, first year international students (only first year), you should be enrolled in a hybrid course section 13676, where we will have at least one traditional lecture at a to-be determined location. This lecture will be recorded and available via the Canvas shell for students enrolled in all other sections.

**Course Objectives:** This course provides graduate level coverage of thermodynamics. The course stresses the fundamentals with problems of relevance to a wide range of engineering disciplines. The emphasis is on mechanical and aerospace applications. Students will learn the postulates, the use of thermodynamics laws in a variety of engineering applications and analyze most common thermodynamic cycles.

**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 be virtual via Zoom with link provided in your Canvas course shell.

**Graduate TA:** Riasat Azim, Department of Mechanical and Aerospace Engineering, *Email:* [r.azim@ufl.edu](mailto:r.azim@ufl.edu)

**Textbook:** “Fundamentals of *Thermodynamics*”; Borgnakke and Sonntag; Wiley; 8-10th Edition (Recommended)

“Molecular Driving Forces – Statistical Thermodynamics in Chemistry and Biology”; Dill and Bromberg (Extra Resource Specific to Statistical Thermodynamics)

### 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/>

FactWeb - <http://www.crct.polymtl.ca/factweb.php>

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

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

### Virtual Office Hours:

Jonathan Scheffe: Tuesday 10:00 – 11:30 am, Thursday 2:00 – 3:30 pm

Riasat Azim: Monday 3:30 – 5:00 pm, Wednesday 3:30 to 5:00 pm

Links will be available in your Canvas course shell.

**Online Course Information:** Canvas

**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: 30%, Exam 1: 20%, Exam 2: 20%, 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 class on the due date, in pdf form in Canvas. 50% of the grade will be based on correctness of a randomly determined question and 50% based on overall effort. All homework must be turned with your name clearly labeled on all pages. Answers should be clearly indicated.

**Exams:** Two mid-term exams and one final exam will be given. Each mid-term examination is worth 20% 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 lowest midterm exam:

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

All exams will be performed via Proctor U or as take-home exams. No in class exams will be given. 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.

**Course Outline** (un-italicized are classical topics and italicized are statistical):

Background – Laws of Thermodynamics, Mechanical Work, Properties of Pure Substances

Chapter 3 and 4 - Application of the First Law, Enthalpy, Specific Heats, Control Volumes

*Chapter 1 and 2 (Statistical) – Principles of Probability and Extremum Principles*

*Chapter 3 (Statistical) – Heat, Work and Energy*

*Chapter 5,6 (Statistical) – Entropy, Boltzmann Law and Thermodynamic Driving Forces*

Chapter 5, 6, 7, and 8 - Entropy and the Second Law, Exergy

Chapter 11 – Gas Mixtures

*Chapter 8 and 9 (Statistical) - Free Energies and Maxwell's Relations*

*Chapter 10 (Statistical) – The Boltzmann Distribution Law*

Chapter 12 – Thermodynamic Relations

Chapter 13 and 14 – Chemical Reactions and Chemical Equilibria

**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/policies/student-honor-code-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.

**Evaluations:** “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/>.”

#### **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.

#### **Academic Resources:**

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

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling.  
<https://www.crc.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://care.dso.ufl.edu>.

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.

#### **Health and Wellness Resources:**

**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:** <http://www.counseling.ufl.edu/cwc>, 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/>.

**Online Course Recording:** Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

**Face-to-Face Lectures:** We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

You are required to wear approved face coverings at all times during class and within buildings. Following and enforcing these policies and requirements are all of our responsibility. Failure to do so will lead to a report to the Office of Student Conduct and Conflict Resolution.

This course has been assigned a physical classroom with enough capacity to maintain physical distancing (6 feet between individuals) requirements. Please utilize designated seats and maintain appropriate spacing between students. Please do not move desks or stations.

Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.

Follow your instructor's guidance on how to enter and exit the classroom. Practice physical distancing to the extent possible when entering and exiting the classroom.

If you are experiencing COVID-19 symptoms (Click here for guidance from the CDC on symptoms of coronavirus), please use the UF Health screening system and follow the instructions on whether you are able to attend class. Click here for UF Health guidance on what to do if you have been exposed to or are experiencing Covid-19 symptoms. In such a case, course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. Find more information in the university attendance policies.

**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
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.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>