Classical and Statistical Thermodynamics

EML 5104 Section CAMP, 1FE2, 2FED
Class Periods: Period 3 (9:35 AM ~ 10:25 AM)
Location: NEB 0102 / EDGE Online
Academic Term: Fall 2025

Instructor:
Jing Pan
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352-294-6869
Office Hours: W/F, after class ~ noon, In-person (Wertheim RM475) or ZOOM

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
TBD

Course Description
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.

Course Pre-Requisites / Co-Requisites
There are no pre-requisites for this class. Some background in the following areas will be helpful:
- Undergraduate Thermodynamics
- Basic knowledge on Python programming

Course Objectives
Review classical thermodynamics; Introduce core concepts in statistical thermodynamics; Develop problem-solving skills for thermodynamics systems and applications.

Materials and Supply Fees
None

Recommended Textbooks and Software
The primary course materials will be drawn from the following textbooks and resources. Supplementary lecture notes will be provided for topics not covered in these sources.
Classical Thermodynamics:
- Fundamentals of Thermodynamics, Borgnakke and Sonntag, Wiley 8-10th Edition
- Fundamentals of Engineering Thermodynamics, Moran and Shapiro, Wiley 8-9th Edition.

Statistical Thermodynamics:
- Molecular Driving Forces – Statistical Thermodynamics in Chemistry and Biology, Dill and Bromberg, Garland Science
- David Tong: Lectures on Statistical Physics, https://www.damtp.cam.ac.uk/user/tong/statphys.html
- Statistical Thermodynamics: Fundamentals and Applications, Normand M. Laurendeau, Cambridge University

Other 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/

Required Computer

Recommended Computer Specifications: https://it.ufl.edu/get-help/student-computer-recommendations/
HWCOE Computer Requirements: https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/

Course Outline

- Module 1: Classical Thermodynamics (Review)
  CH1&2 – Laws of Thermodynamics, Mechanical Work, Properties of Pure Substances
  Ch3&4 - First Law, Energy, Enthalpy, Specific Heats, Control Volumes
  CH5&6&7 - Second Law, Entropy
  CH8 - Exergy
  CH11 - Gas Mixtures
  CH12 - Thermodynamic Relations

- Module 2: Statistical Thermodynamics
  CH1&2 - Probability, Equilibrium
  CH3 - Heat, Work, Energy
  CH5&6 - Entropy, Boltzmann Law
  CH8&9&10 - Free Energies, Maxwell's Relations, Boltzmann Distribution
  CH11&12 - Gas Mixtures, Properties of Substances
  CH13 - Chemical Equilibria

Homework

A series of small homework problems sets will be provided most weeks. Solutions will be posted with the problem sets. Homework problems will not be graded. The purpose for the homework problems is for you to develop problem-solving skills. You are encouraged to complete the problems by yourself first before checking the provided solutions.

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%. Mid-term exams will be conducted in-class/using Honor Lock (Edge students). All exams will be graded based on the correctness of final answers, but partial credit will be given.
Make-up Policy: Make-up exams will not be granted except in cases of emergency and will be handled on a case-by-case basis. You must contact the instructor prior to the exam and obtain approval for make-up exam.
Final Exam: 12/10/2025 10AM – 12PM NEB 0102

Evaluation of Grades

Assignment	Percentage of Final Grade
Participation	5%
Midterm 1	25%
Midterm 2	25%
Final Exam	30%
Class Paper/Project	15%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00

80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Positive 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.

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 Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu