ME 6304 A/Q (Principles of Thermodynamics) – Course Syllabus

George W. Woodruff School of Mechanical Engineering

Georgia Institute of Technology

Fall 2026, Credits: 3-0-3

Lecture: Tues, Thurs; 12:30 pm – 1:45 pm

General Information

Course Description:

Fundamentals of classical (macroscopic) thermodynamics including energy and entropy, exergy analysis, property relations, and equations of state. Fundamentals of chemical thermodynamics, including properties of mixtures, and phase and reaction equilibria. Introduction to statistical (microscopic) thermodynamics.

Pre-Requisites:

ME 3322-Thermodynamics (or equivalent)

Instructor:

Prof. Akanksha Menon, Love Building 228

Woodruff School of Mechanical Engineering

Email: amenon84@gatech.edu; Research website: https://amenonlab.me.gatech.edu/

Office Hours: After class (in-person), or by appointment (email me and join MS Teams link)

TA / Grader:

Nadia Zaleski (nzaleski6@gatech.edu)

Office Hours: Tuesdays, 9:30 – 10:30 am (MS Teams link)

Additional Resource:

Ahmed Mahfouz (amahfouz3@gatech.edu)

Office Hours: By appointment – send email to make a request (MS Teams link)

Course Materials

A comprehensive advanced thermodynamics textbook does not exist, so lecture modules will be posted on Canvas that include content from the following textbooks:

- Fundamentals of Engineering Thermodynamics, Michael J. Moran and Howard N. Shapiro (Wiley, 9th edition)
- Advanced Engineering Thermodynamics, Adrian Bejan (Wiley, 4th edition)
- An Introduction to Thermal Physics, Daniel V. Schroeder (Oxford)
- Thermodynamics and Microscale Thermophysics, Van P. Carey (Cambridge)
- Introduction to Chemical Engineering Thermodynamics, Joseph M. Smith, Hendrick C. Van Ness, Michael M. Abbott, and Mark T. Swihart (McGraw Hill, 8th edition)

Course Management:

All class materials, announcements, homework, and grades will be posted on Canvas.

Course Policies

- Classroom attendance is required, and in-class participation is strongly encouraged.
- All assignments must be submitted digitally through Canvas
- Piazza discussion board should be used for all course-related discussion (email me for personal matters).
- Cell phones should be silenced in class and may only be used for in-class assignments.
- ***How to succeed in this class:***
    - Attend every lecture; take good notes! You learn by writing things down;
    - Spend time on homework and ask for help early and often (office hours and Piazza);
    - Show all your work (step-wise) and clearly state assumptions and equations to get partial credit.
- Documented excuse: you must provide a note from the Dean of Students confirming approved Institute activities prior to missing a class (section IV.B.3 of the Student Rules and Regulations).
- Please inform me if you are unwell and need to miss a class, or if you are traveling to a conference and need to miss a class.
- ***Distance Learning (DL) students:*** Video recordings of each lecture will be posted on the same day (within five hours) to view on demand on Canvas (Media Gallery). If there is a problem with accessing the video, please email cdlops@pe.gatech.edu and copy me.

Grade Allotment

Homework: 20%
Project: 10%
Midterm: 25%
Final Exam: 40%
Participation: 5%

Grading Scale:

Your final grade will be assigned based on a normal distribution that considers the performance of the class as a whole (curved scores). However, the following scale is guaranteed: A: 90 - 100%, B: 80 - 89%, C: 70 - 79%, D: 60 - 69%, F: < 60%.

Homework

Homework is critical to learning and developing a mastery of the course material. Homework will be assigned approximately biweekly and will be due on Canvas on the date listed in the assignment. You are expected to review the lecture notes/examples and read relevant sections of the textbook before doing homework. While group discussion is encouraged on homework, you are expected to submit your own version of the assignment. Authorized aid on homework assignments includes discussing the interpretation of the problems, sharing ideas or approaches for solving the problems, and explaining concepts involved in the problems. Any other aid would (*e.g., Chegg, AI tools*) be unauthorized and considered a violation of the academic integrity policy. ***All answers must be written independently and NOT duplicated as that is a violation of the Academic Honor Code***.

- Homework must be uploaded as a PDF on Canvas before the specified deadline. Assignments submitted by email will not be accepted. Late assignments will not be accepted.
- Homework format requirements:
    - Full name at the top of the first page and page numbers at the bottom of each page.

    - Concise and legibly written solution that includes: (a) schematic, (b) given information, (c) assumptions and justification, (d) step by step analysis, and (e) the final answer with units.
    - **Submit as PDF with the file name: HW##_FirstnameLastname**
- Clearly show all work and your thought process in getting to the final answer. Your score is partially based on the soundness of your approach, not just the correct answer.
- Any requests to change the homework grade should happen within one week of when the graded assignment is returned using the "Comment" feature on Canvas. Late requests will not be considered.
- These policies also apply to DL students. Please email me to request any extensions.

Software

In lieu of thermodynamic tables available in the Moran and Shapiro textbook, you can also use the Engineering Equation Solver (EES) software for all assignments in this course. Academic licenses will only be allowed on desktop computers (fixed locations) owned by GT. Academic licenses cannot be installed on **ANY** laptops or portable computers. To access EES from a personally-owned computer or laptop, log in to VLab (https://mycloud.gatech.edu/) and select the CoE desktop.

Project

A group project and literature reviews (in lieu of homework) will be assigned during the semester. The problem statement and other details will be posted on Canvas and discussed in class at a later date. The project should be completed by a group of ~5 students (self-assigned), with the **deliverable being a written report and/or presentation** detailing the thermodynamic analysis. For equal contributions (based on peer evaluations), all members of the team will receive the same grade.

Exams

There will be one midterm exam (1 h 15 min) and a cumulative final exam (2 h 50 min). The midterm exam date is ***tentative*** and may change over the course of the semester; the final exam is scheduled on **Monday, Dec 8, from 11:20 AM - 2:10 PM** and cannot be changed. If you miss an exam without either a certified medical excuse or prior instructor approval (at least two days in advance), you will earn zero credit for that exam. Exams missed with certified medical excuses or prior instructor approval will be dealt with on an individual basis.

- Equation sheets and property tables will be provided for all exams.
- Calculators (scientific) are required for all exams.
- Partial credit will be given, so follow the same process outlined in the Homework section.
- No makeup exams will be administered unless there is a documented excuse.
- If you require accommodations through the Office of disability Services, please submit your request and notify me at the earliest.
- Check for any final exam conflicts and notify me at the earliest.
- These policies also apply to DL students. Please email me to request any extensions.

Note: All exams will be administered in-person for on campus students. For DL students, exams will use the Honorlock digital proctoring system – this system requires students to have access to a webcam, microphone, and reliable internet connection. Additional information is available at this link.

Academic Honor Code

Academic misconduct is any act that does or could improperly distort student grades or other student academic records. Students suspected of academic misconduct will be reported to the Office of Student Integrity and dealt with according to policies within the honor code (link).

Honor code violations include but are not limited to the following:

- Possessing, using, or exchanging improperly acquired (from friends, classmates, or a solutions manual) written or verbal information in the preparation of any homework, project report, examination, or other assignment included in an academic course.
- Substitution for, or unauthorized collaboration with, a student in the commission of academic requirements.
- Submission of material that is wholly or substantially identical to that created or published by another person (plagiarism).
- False claims of performance or work that has been submitted.
- Alteration or insertion of any academic grade or rating so as to obtain unearned academic credit.
- Deliberate falsification of a written or verbal statement of fact to a member of the faculty so as to obtain unearned academic credit.
- Forgery, alteration, or misuse of any Institute document relating to the academic status of the student.

Student-Faculty Expectations

At Georgia Tech, it is important to continually strive for an atmosphere of mutual respect, acknowledgement, and responsibility between the faculty member and students. For an articulation of some expectations that you can have of me, and that I have of you, please see http://www.catalog.gatech.edu/rules/. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Students with Disabilities

The Office of Disability Services serves Georgia Tech students with documented qualifying disabilities and operates under the guidelines of Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act and its amendments (ADAAA). In accordance with Georgia Tech Policy, "Reasonable accommodations are provided to ***self-identified students*** with disabilities who meet the academic and technical standards requisite to admission or participation in the program of study. Consideration may be given to the substitution or modification of certain course requirements as long as such changes do not detract from the quality of the educational experience and the changes remain within the accreditation criteria for the degree program." More information can be found here: https://disabilityservices.gatech.edu/. Self-identified students with disability should speak with Dr. Menon during the first week of classes, so that suitable arrangements can be made.

Mental Health and Wellness

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, depression, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. GT offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know is experiencing any of the issues noted above, consider utilizing the confidential mental health services available on campus. I encourage you to reach out to GT CARE (http://www.care.gatech.edu/, 404-894-3498) or the Counseling Center (www.counseling.gatech.edu, 404-894-2575) for support. An on-campus counselor or after-hours services are available to assist you. In addition, Stamps Health Services and the Dean of Students Office will offer both in-person and virtual appointments.

Resistance to Sexual Harassment

Georgia Tech is committed to a community that actively resists sexual and gender harassment. If you see or experience any of the following: sexual harassment, domestic and dating violence, sexual assault and stalking, the following resources are available:

- **Confidential VOICE Advocates** can provide support 24/7 and explore resources and options, some of which are time sensitive. Call GTPD dispatcher at 404-894-2500 and ask to speak to the On-Call VOICE Advocate. You do not need to make a report or provide any information other than your phone number for a VOICE advocate to contact you.
- Sexual violence or harassment can be reported directly to Georgia Tech's **Title IX Coordinator,** Chris Griffin (chris.griffin@gatech.edu, 404-385-5583).

Note: Faculty, Staff and TAs are mandatory reporters and are required to inform the Title IX Coordinator should they become aware that you or any student has experienced sexual violence or sexual harassment.

Course Schedule

Date	Topic
8/19	Syllabus and introduction (0^{th} Law)
8/21	Energy and 1^{st} Law (closed system)
8/26	Energy and 1^{st} Law (open system)
8/28	Evaluating properties (ideal and real fluids)
9/2	Evaluating properties (EES software)
9/4	Entropy and 2^{nd} Law (closed and open systems)
9/9	Evaluating properties (TdS equations and isentropic relations)
9/11	Thermo-mechanical exergy (closed and open systems)
9/16	Exergetic efficiency
9/18	Power cycles (vapor – Rankine cycle)
9/23	Power cycles (gas – Brayton cycle)
9/25	Combined cycle and other advanced power cycles
9/30	Refrigeration and heat pump cycles (vapor compression)
10/2	Sorption and other cooling technologies
10/7	*Fall break*
10/9	**Midterm** **tentative**
10/14	Introduction to chemical thermodynamics
10/16	Partial molar properties and Maxwell's relations
10/21	Mixtures – ideal gas and least work of separation
10/23	Mixtures – real gas (fugacity) and multicomponent mixtures (activity)
10/28	Psychrometrics: revisiting air conditioning
10/30	Phase equilibrium (Clapeyron equation)
11/4	Phase diagrams
11/6	Chemical equilibrium (van't Hoff equation)
11/11	Reacting mixtures – combustion
11/13	Chemical exergy
11/18	Introduction to statistical mechanics (microscopic view)
11/20	Revisiting the 2^{nd} Law (statistical mechanics)
11/25	Revisiting ideal gas properties (equipartition theorem)
11/27	*Thanksgiving break*
12/2	Review session
12/8	**Final Exam (11:20 am – 2:10 pm)**