ME 6765 Syllabus

ME 6765 Kinetics and Thermodynamics of Gases, Fall 2026

CATALOG DESCRIPTION

Thermodynamics of nonreacting and reacting gas mixtures. Introductory quantum theory, statistical thermodynamics and gas kinetic theory.

COURSE OBJECTIVES

A student taking this course should develop a working knowledge of the following subjects:

1. Fundamentals of classical thermodynamics.
2. Thermodynamics of nonreacting and reacting gas mixtures.
3. Quantum states and energy levels of gas molecules.
4. Statistical mechanics/thermodynamics of gases.
5. Equilibrium kinetic theory of gases.
6. Source of transport (diffusion) properties of gases.

LEARNING OUTCOMES

A student successfully completing this course will be able to:

1. Use thermodynamic conservation laws and state relations to solve for gas properties, including equilibrium compositions, and to solve problems involving energy and energy transfer processes.
2. Use statistical mechanics/thermodynamics approaches to determine: equilibrium population distributions of ideal gas molecular energy levels; equilibrium thermodynamic properties of ideal gas mixtures from molecular parameters; and equilibrium radiation properties.
3. Use equilibrium kinetic theory to model gas velocity distribution functions, bimolecular collision rates (both elastic and inelastic), collision frequencies and mean free paths.

PREREQUISITES

Specific areas/concepts that students should have some familiarity with are:

1. Undergraduate level thermodynamics (thermodynamic properties, 1st and 2nd Laws)
2. Some computer modeling capability (Matlab, Python, spreadsheets, etc.)

REQUIRED COURSE MATERIALS

Course notes will be supplied by the instructor. There are no required textbooks.

GRADING

The class will include the following learning/assessment mechanisms with the following weightings applied to the overall course grade:

Homework assignments	:	40% of course grade
Midterms	:	30% of course grade
Final Exam	:	30% of course grade

Homework can be turned in online until the assignment closes, but with a late penalty assessed. If unusual circumstances arise that will prevent you from finishing on time, please contact the instructor **in advance**, so that special consideration can be given.

The following rubric will be used to determine course grades.

A $\geq$ 88%

B $\geq$ 75%

C $\geq$ 63%

D $\geq$ 50%

F $<$ 50%

CLASS ATTENDANCE

On-campus students: While class attendance is not required, you will find regular attendance and participation in class discussions will significantly enhance your learning experience. Also, students who regularly attend class almost always achieve better performance on exams.

Distance Learning students: Synchronous class attendance is not required; however, you are encouraged to join the class live if you are available. Additionally, it is beneficial to view the lecture videos at a similar pace to the class schedule rather than binge watching a few weeks' worth at one time.

Re-Scheduled and Missed Exams

On-campus students: In compliance with the Institute rules regarding excused absences, students who have a planned excused absence on the scheduled exam dates must inform the instructor well in advance so accommodations can be made. Students who miss the midterm exam due to an unforeseen emergency that constitutes an excused absence according to the Office of the Vice President for Student Life and Dean of Students,

should contact the Instructor as soon as possible to arrange a make-up exam or alternative grading adjustment. Students must take the Final Exam during the official period designated by the Office of the Registrar for this class, unless the meet the exceptions for excused absences or conflicts. An alternative Exam time will be provided according to the rules laid out in the Catalog.

Distance Learning students: You will typically have a window of a few days in which to take an exam. If you will be unavailable during that window of time, please contact your instructor in advance so accommodation can be made.

ACADEMIC INTEGRITY

Georgia Tech and the School of Aerospace Engineering value honesty and integrity of all members of our community. Academic dishonesty is not tolerated. This includes cheating, lying about course matters, plagiarism, or helping others commit a violation of the Honor Code. Plagiarism includes reproducing the words or visual/graphical expressions of others without clear attribution and citation. Cheating includes violating rules presented in the course syllabus, or descriptions and directions for homework assignments and the project regarding allowable collaborations, and exams regarding allowable materials/resources to be used during the exam. Students are reminded of the obligations and expectations associated with the Georgia Tech Academic Honor Code.

Plagiarism and the use of Generative AI

Copying or modifying someone else's work without attribution – including prompting a generative AI tool to do the same – or other sources such as: solutions from prior offerings of this course, Course Hero, and Chegg is plagiarism, which is a violation of the Honor Code as noted above.

Collaboration and Group Work

The homeworks are an important tool in helping you learn the course material. You are encouraged to discuss the course material and homework problems with other classmates, but you should work the problems (e.g., how you write them up) on your own - no copying. Generally what this means is: 1) try the problem on your own, 2) then if necessary ask for help/suggestions, 3) then go back on your own and try to implement the suggestions. Do not work with another student on the homework step-by-step, checking each step as you go (this will not help you learn the material or prepare you for the exams).

No collaboration is permitted on exams.

STUDENT-FACULTY EXPECTATIONS AGREEMENT

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

LEARNING ACCOMMODATIONS

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible so we can arrange a time to discuss your learning needs.

CORE IMPACTS

Not applicable