

Syllabus for Classical Thermodynamics, PHYS 351

Spring 2025

CRN: 32730

Lecture: T 3:30-4:30 PM, REIC 207

Instructor: Ataur R. Chowdhury

Office: REIC 118

Office Hours: MWF 3:30-5:00 PM, or feel free to drop in whenever I am in my office.

Contact: Phone (907) 474-6109
Fax (907) 474-6130
Email archowdhury@alaska.edu

Prerequisites: PHYS 212X, PHYS 220, PHYS 301, PHYS 341; or permission of instructor

Text: **Required:** *An Introduction to Thermal Physics* by D. Schroeder, Addison Wesley.

Reference Texts:

1. *Equilibrium Thermodynamics*, C.J. Adkins, 3rd Edition, Cambridge.
2. *Classical and Statistical Thermodynamics*, A. Carter, Prentice Hall.
3. *Fundamentals of Statistical and Thermal Physics*, F. Reif, Waveland Press.

Course Outline: Classical macroscopic thermodynamics; systems and states, equations of state, the first law and second law of thermodynamics and their consequences, entropy, enthalpy, Helmholtz and Gibbs functions, equilibrium, and Maxwell's equations.

Course Objectives: To acquire a basic understanding of the principles of classical thermodynamics.

Student Learning Outcomes:

1. Students should be able to understand the fundamentals of thermodynamics from a classical viewpoint.
2. Students should be able to gain clear understanding of founding laws of thermodynamics and should be able to explain thermodynamic processes based on these laws.
3. Students should have clear understanding of equation of states for simple thermodynamics systems.
4. Students should understand the fundamentals of thermodynamic functions that explain physics of different thermodynamic systems.

Instructional methods: Interactive lecture-based instruction

Syllabus for Classical Thermodynamics, PHYS 351

Spring 2025

CRN: 32730

Mode of Instruction: Face-to face live lectures in class

Credits: 2 credits:

Help Session: Help with homework and lab is available through the teaching assistants (TAs) during the hours posted on the door of REIC 122.

MTWR: TBA (REIC 122)

Additional help with homework is available through the instructor during his designated office hours.

Course Requirement and Policies:

Weekly Meeting:

For this independent study course, there will be no class-room instruction, but the student will be responsible to study the weekly course material listed in the schedule. There will be a one-hour weekly meeting with the student to discuss the course material and any questions about the homework. This is not meant as a substitute for the lecture but to allow the student to bring up questions for a better understanding of the course materials. This is also going to be an option for the student to ask for help with the homework. It is expected that the student will actively participate and engage in meaningful discussions for this designated hour.

Homework:

On average, 6-8 problems/exercises/questions will be assigned each week on Fridays, and these will be posted on the blackboard. The homework will be due back by 5:00 PM on Friday the following week. **NO LATE HOMEWORK WILL BE ACCEPTED. NO EXCEPTIONS** (barring emergencies and extreme situations). Any homework you submit should reflect your own best effort. All assignments on homework will be posted on the Black Board, and solutions must be submitted in the designated drop box of the instructor inside the physics office, REIC 102.

Copying homework from someone or from some online sources, including AI resources is not acceptable and will result in a grade of zero for the assignment. Make-up homework, if you miss it for valid reasons, may be arranged with approval from the instructor.

Examinations:

There will be two midterm examinations (February 27, Thursday, 3:30-4:30 PM, and April 3, Thursday, 3:30-4:30 PM, and a final comprehensive examination (May 1, Thursday, 3:15-5:15) for this course. Examinations will consist of, in the most part, problems similar to those in the homework and those worked out in class. Midterm will cover the material covered in class and homework prior to the date of test, and the final will be comprehensive and will include material covered during the entire semester. **All exams will take place in a classroom**

Syllabus for Classical Thermodynamics, PHYS 351

Spring 2025

CRN: 32730

and will have to be submitted on paper. All exams are open-text, and no digital devices of any kind, like laptops, cell phones, are allowed during the exams. Make-up exams, for valid reasons, may be arranged in consultation with the instructor.

Quizzes: There will be one quiz every week of the semester on Wednesdays, except the first week and week of midterm and final. These quizzes will be administered during the last 20 minutes of the class and are designed to test students understanding of the subject material covered during the preceding week. The quiz may include problems similar to the homework and may also include 'intuitive' question pertaining to the subject materials. Of all the quizzes only ten best will be considered for grading. **Make-up quizzes, if you miss class for valid reasons, may be arranged with approval from the instructor.**

University AI Policy:

UAF does not have yet a central university policy for AI to be abided by. Depending how you use this, this could be very useful tool for learning. However, please make sure you are not using AI to cheat and copy things out of online sources of any kind. The university takes cheating seriously and it reserves the right to take lawful actions.

Course Evaluation:

Final grade for this course will be based on student's performance on homework, classroom participation, midterm, and final with respective weights as follows.

Homework	30%
Midterm I	15%
Midterm II	15%
Quiz	15%
<u>Final</u>	<u>25%</u>
Total	100%

The final grade for this course will be based on a curve. For a given score, your letter grade will not be lower than what it would be expected based on standard grading scale (90-100 = A, 80-90 = B, etc.). No plus-minus letter grades will be given for this course.

Syllabus Addendum (Revised 8/22/2022)

COVID-19 statement: Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:

<https://sites.google.com/alaska.edu/coronavirus/uaf?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are

Syllabus for Classical Thermodynamics, PHYS 351

Spring 2025

CRN: 32730

subject to disciplinary actions if they do not comply.

Student protections statement: UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site: <https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/>.

Disability services statement: I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities.

ASUAF advocacy statement: The Associated Students of the University of Alaska Fairbanks, the student government of UAF, offers advocacy services to students who feel they are facing issues with staff, faculty, and/or other students specifically if these issues are hindering the ability of the student to succeed in their academics or go about their lives at the university. Students who wish to utilize these services can contact the Student Advocacy Director by visiting the ASUAF office or emailing asuaf.office@alaska.edu.

Student Academic Support:

- Speaking Center (907-474-5470, uaf-speakingcenter@alaska.edu, Gruening 507)
- Writing Center (907-474-5314, uaf-writing-center@alaska.edu, Gruening 8th floor)
- UAF Math Services, uaf-traccloud@alaska.edu, Chapman Building (for math fee paying students only)
- Developmental Math Lab, Gruening 406
- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120, <https://www.ctc.uaf.edu/student-services/student-success-center/>)
- For more information and resources, please see the Academic Advising Resource List (https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf)

Student Resources:

- Disability Services (907-474-5655, uaf-disability-services@alaska.edu, Whitaker 208)
- Student Health & Counseling [6 free counseling sessions] (907-474-7043, <https://www.uaf.edu/chc/appointments.php>, Gruening 215)
- Center for Student Rights and Responsibilities (907-474-7317, uaf-studentrights@alaska.edu, Eielson 110)
- Associated Students of the University of Alaska Fairbanks (ASUAF) or ASUAF Student Government (907-474-7355, asuaf.office@alaska.edu, Wood Center 119)

Syllabus for Classical Thermodynamics, PHYS 351

Spring 2025

CRN: 32730

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UAF Department of Equity and Compliance
1692 Tok Lane, 3rd floor, Constitution Hall, Fairbanks, AK 99775
907-474-7300
uaf-deo@alaska.edu

Additional syllabi statement for courses including off-campus programs and research activities:

University Sponsored Off-Campus Programs and Research Activities

We want you to know that:

1. UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: www.alaska.edu/nondiscrimination.
2. Incidents can be reported to your university's Equity and Compliance office (listed below) or online reporting portal. University of Alaska takes immediate, effective, and appropriate action to respond to reported acts of discrimination and harassment.
3. There are supportive measures available to individuals that may have experienced discrimination.
4. University of Alaska's Board of Regents' Policy & University Regulations (UA BoR P&R) 01.02.020 Nondiscrimination and 01.04 Sex and Gender-Based Discrimination Under Title IX, go to: <http://alaska.edu/bor/policy-regulations/>.
5. UA BoR P&R apply at all university owned or operated sites, university sanctioned events, clinical sites and during all academic or research related travel that are university sponsored.

For further information on your rights and resources [click here](#).

Barnette st, 907-455-2860).

Syllabus for Classical Thermodynamics, PHYS 351

Spring 2025

CRN: 32730

General Remarks

“Physics is just the refinement of everyday thinking,” A. Einstein

Physics is the subject that requires you to think and ponder. Physics is not mathematics, but it does require mathematics to make it useful. In order for you to succeed in this course you may pay heed to the following suggestions.

1. Read the chapter before it is discussed in class so that you know the material and know what questions to ask for clarification.
2. Start your homework on day one so that you have ample time to think about the questions and get the help you need.
3. Think the problems through and follow the logical sequence to get the result.
4. Do not hesitate to ask for help. We wish all of you to excel and we are here to help.

Course Calendar:

Tentative Schedule

Reading and Exam

Date	Topics	Reading Assignment
Jan. 14	syllabus, introduction	
16	microscopic model of an ideal gas	1.1-1.2
21	equipartition of energy, heat and work	1.3
23	compression of ideal gas	1.4
28	latent heat	1.6

Syllabus for Classical Thermodynamics, PHYS 351

Spring 2025

CRN: 32730

	30	conduction of heat	1.7
Feb.	04	two-state systems	2.1
	06	Einstein model of a solid	2.2
	11	interacting systems	2.3
	13	macroscopic systems	2.4
	18	interacting ideal gases	2.5
	20	entropy of mixing	2.6
	25	temperature and heat	3.1
	27	Midterm I	
Mar.	04	macroscopic view of entropy	3.2
	06	paramagnetism	3.3
	10-14	Spring Break (no classes)	
	18	analytical treatments of paramagnetism	3.3
	20	mechanical equilibrium and pressure	3.4
	25	chemical potentials	3.5
	27	heat engines, refrigerators	4.1-4.2
Apr.	01	real heat engine	4.3
	03	Midterm II (April 4)	
	08	real refrigerators	4.4
	10	free energy and work	5.1
	15	Gibbs free energy and chemical potential	5.2
	17	phase transformations of pure substances	5.3
	22	phase transformations continued	5.3
	24	phase transformation of mixtures	5.4
	29	mixed phase continued	5.4
May	01	Final Examination 3:15-5:15, Thursday	