Syllabus for Classical Thermodynamics, PHYS 351
Spring 2022

CRN: 35013, F01

MW 3:30-4:30 PM, REIC 138 (Lecture)

Instructor: Ataur R. Chowdhury

Office: REIC 118

Office Hours: MW 2:00-3:30 PM

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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

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

Credits: 2 credits: 2 hr. of lecture.

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:

Class Attednence/Participation:
For a better understanding of the course material attendance and participation in classroom activities are very important. This particular course is generally regarded as one of the founding courses that deal with the fundamentals of classical thermodynamics, and it is highly expected that the students will commit themselves to attend the class regularly. There will be supplemental materials for this course and the students will be held responsible for all the materials that will be brought in from outside the text. The students will be expected to participate in class activities, and take part in meaningful discussion and ask questions to better comprehend the subject material. Participation will account for 5% of your total grade.

It is highly expected that the students will cause least disruption of class activities by showing up before the class starts, not leaving the class before it stops, keeping cell phones in silent mode, and refraining from talking during the class.

It is not required that you attend class, but because of COVID-19, regular class attendance will be taken in the event of an unwanted tracing for identifying people who could be infected. Also, keep in mind that if you do not show up in class, you will not receive any credit for in-class participation.

Homework:
On the average, 6-8 problems/exercises/questions will be assigned each week on Wednesdays, and these will be posted on the blackboard. The homework will be due back by 5:00 PM on Wednesdays the following week. NO LATE HOMEWORK WILL BE ACCEPTED. NO EXCEPTIONS (barring emergencies and extreme situations). Group work is highly encouraged for solving problems, and for additional help with the homework the students are most welcome to consult the instructor during the office hour or any other time by prior appointment. Any homework you submit should reflect you own best effort. Copying of homework is absolutely not acceptable and will result in a grade of zero for the assignment. All assignments

on homework will be posted on the Black Board, and solutions have to be submitted in a designated drop box inside the physics office, REIC 102.

Quizz: During the lecture, the students will be expected to take part in meaningful discussion and ask questions to better comprehend the subject material. To engage students in active participation, there may be, from time to time, some pop quizzes and clicker questions. These quizzes will be administered at the beginning of the lecture, 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, those worked out in class, and may also include 'intuitive' question pertaining to the subject material covered during the previous week. **All quizzes, without a worsening COVID-19, will take place in class and will have to be submiotted on papers. Make-up quizzes, if you miss class for valid reasons, may be arranged with approval from the instructor.**

Examinations:
There will be two midterm examination (February 16, Wednesday, 10:30-11:30 AM, and April 6, Wednesday, TBA) and a final comprehensive examination (April 28, Thursday, 3:15-5:15) for this course. Examinations will consist of, in 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 exam, without a worsening COVID-19, will take place in class and will have to be submitted on papers. Make-up exams, for valid reasons, may be arranged in consultation with the instructor.**

Course Evaluation:

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

Homework	30%
Participation	5%
Quizzes	15%
Midterm I	12.5%
Midterm II	12.5%
Final	25%
Total	100%

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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.

Academic Honesty

UAF expects and requires academic honesty from all members of the University community, and takes any act of plagiarism and cheating seriously. It is expected that all assignments, including homework and reports, that are turned in for this course must the original work of the individual student. Failure to comply with this policy will result in penalty as stipulated under UAF regulations.

Student Protections and Services:

COVID-19 Essentials: Because of COVID-19, University has put in place some mandatory procedures to adhere to. All student are encouraged to observe these rules to ensure a safe environment for all of us for a successful fall semester. I request all of you to do the following:

1) Wear mask during class,
2) Maintain social distancing in class,
3) Use designated doors for entering and exiting,
4) Try to sit at the same place in class (for tracing),
5) Check updates about COVID-19 on the website listed below on a regular basis.

https**://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0**

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

Protection: Every qualified student is welcome in my classroom. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. As required, if I notice or am informed of certain types of misconduct, then I am required to report it to the appropriate authorities. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: www.uaf.edu/handboo

UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: alaska.edu/nondiscrimination.

Services: As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc to find reasonable accommodations.

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Effective communication: Students who have difficulties with oral presentations and/or writing are strongly encouraged to get help from the UAF Department of Communication's Speaking Center (907-474-5470, speak@uaf.edu) and the UAF English's Department's Writing Center (907-474-5314, Gruening 8th floor), and/or CTC's Learning Center (604 Barnette st, 907-455-2860).

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

Lecture, Reading, and Exam

Date	Topics	Reading Assignment
Jan 10	syllabus, introduction	
12	microscopic model of an ideal gas	1.1-1.2
17	AK Civil Rights Day (no class)	
19	equipartition of energy, heat and work	1.3-4
24	compression of an ideal gas	1.5
26	latent heat	1.6
31	conduction of heat	1.7
Feb. 2	two-state systems	2.1

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7	Einstein model of a solid	2.2
9	interacting systems	2.3
14	macroscopic systems	2.4
16	**Midterm I**	
21	interacting ideal gases	2.5
23	entropy of mixing	2.6
28	temperature and heat	3.1
Mar.2	macroscopic view of entropy	3.2
7-11	**Spring Break (no classes)**	
14	paramagnetism	3.3
16	analytical treatment of paramagnetism	3.3
21	mechanical equilibrium and pressure	3.4
23	chemical potentials	3.5
28	heat engines	4.1
30	refrigerators	4.2
Apr. 4	real heat engine	4.3
6	**Midterm II**	
11	real refrigerators	4.4
13	free energy and work	5.1
18	Gibbs free energy and chemical potential	5.2
20	phase transformations of pure substances	5.3
25	van der Waals equation	5.3

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Apr. 28 **Final Examination** 3:15-5:15, Thursday, REIC 138