Digital Syllabus for PHYS 4300: Thermal Physics

University of Georgia, Spring 2022
TR (09:35 am-10:50 am), Room 327

Basic Information

Instructor: Professor Yohannes Abate Phone: 706-542-4007
Email: *yohannes.abate@uga.edu*

Office hours: Tuesday 3:15 pm (zoom session, please make email appointment first)

Homework: Weekly problem sets are due *by 9:35 am* a week after it is assigned, unless otherwise announced in class. See below for more detail.

Textbook: *An Introduction to Thermal Physics*, by Daniel V. Schroeder.

Website: Homework, handouts, grades, and other information will be distributed via eLearning Commons: https://elc.uga.edu.

Prerequisites: PHYS 3700, PHYS 3900, MATH 2700, and MATH 2270 (or equivalent).

Email: You are expected to check your email *daily* for course announcements. If you would like to send me an email please use *yohannes.abate@uga.edu.* I do not check emails at eLearning Commons: https://elc.uga.edu.

Grading Policy

Grade components: At the end of the semester, I will compute an overall score from your performance on exams and homework, weighted as follows:

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- Best of three exams: 34%
- Middle of three exams: 28%
- Worst of three exams: 22%
- Homework average: 16%

Letter grades: Ranges for letter grades will be *no worse for you* than the following:

A+	[Nonexistent]	B+	= [83-85)	C+	= [73-75)	D±	[Nonexistent]
A	= [87-100]	B	= [77-83)	C	= [67-73)	D	= [50-65)
A–	= [85-87)	B–	= [75-77)	C–	= [65-67)	F	= [0-50)

Here a square bracket means the end point is included in the range, and a round bracket (parenthesis) means the end point is not included in the range. Actual grade ranges may end up having lower cutoffs, depending on the overall level of performance.

Re-grade requests: Any requests for a regrade of an assignment or an exam must be made no later than one week after the graded item is returned. Keep in mind that a regrade may end up raising *or* lowering your score. Correcting arithmetic errors made in totaling points does not count as a regrade and is not subject to the limitations described above.

Borderline grades: Like any other measurement, grades possess a degree of uncertainty. Therefore, factors such as improvement *may* help borderline grades.

'Incomplete' grades: According to UGA policy, a grade of Incomplete "indicates that a student was doing satisfactory work but, for non-academic reasons beyond his/her control, was unable to meet the full requirements of the course. An Incomplete should not ordinarily be given unless the student has completed a substantial part of the course. The instructor of the course should indicate to the student the deadline for completing the work in the course. No more than three semesters (counting summer school as one semester) may be allowed to complete the work in the course, but the instructor may specify an earlier deadline. If an I is not satisfactorily removed after three semesters (counting summer school as one semester), the symbol I will be changed to the grade F (or U for a course graded S/U) by the Registrar." I will adhere to this policy for this course.

Course withdrawal: Make sure you are familiar with the UGA policy on withdrawal from courses. You can find it online at the following URL:

http://bulletin.uga.edu/Bulletin_Files/acad/Courses.html

The withdrawal deadline for this semester is **March 24**. Any student who is showing serious neglect for this course (*e.g.*, routinely failing to turn in homework on time, etc.) may be asked to withdraw. A student missing 3 consecutive classes or failing to turn in 2 consecutive homework assignments, without adequate prior explanation, will be considered eligible for an instructor-initiated withdrawal from the course. All such cases will be brought to the attention of the student's academic advisor.

Exams

Number and rules: There will be three exams. The third one will take place during final exams, but will *not* be a cumulative final. All exams will be closed-book and closed-notes. However, I may provide you with sheets containing useful or difficult formulas. You may use a scientific calculator on exams *for arithmetic only*, not for algebra, calculus, graphing, or information storage; all programs and memory registers must be cleared. Unless told otherwise, you must show work on each exam problem in order to receive full credit.

Timing: The first two exams will be held in regular class time. The specific dates and times have not yet been determined. The third exam will take place during the scheduled final exam period. I will give further information on each exam before the exam date. Solutions will be posted to eLC after each exam has been graded.

Missed exams: If you need to miss an exam for a *legitimate and documentable* reason, you must contact me before the exam if at all possible, or else as soon as possible after the exam. Arrangements for dealing with missed exams will be made *only* for cases involving

legitimate, documentable reasons and *only* if you notify me in a timely fashion. If you are uncertain as to what constitutes a legitimate reason for missing an exam, please ask me.

Homework

Logistics: There will be 8–10 problem sets. Each will be due at 9:30 am on the due date given on the assignment sheet (usually a week after it is assigned), unless otherwise stated. The pace of the class and changes to the schedule may necessitate changes to the due dates, which will be announced in class (and probably by email and on eLC). Please show your work clearly for each problem in order to receive full credit. You will then take a picture of your solution and upload to elc (https://elc.uga.edu).

Write-up format: The following rules must be adhered to for all write-ups handed in for credit: (a) Use letter-size (8½"×11") paper, not legal-size paper. (b) Do not hand in papers with "fringe" from spiral notebooks. (c) Write your first and last name clearly in the upper right corner of the top page. (d) On the last page of your write-up, list all classmates you worked with and any sources you used other than the course textbook. (e) Write legibly so that the grader can read your work easily. Rule of thumb: If the person grading can't read it, then it's wrong.

Grading: Problem sets will be graded and returned to you electronically in elc in a timely fashion. Homework problems will be graded not only for correctness of the end result, but also on process. Be sure to express, clearly and legibly, the reasoning for your solutions.

Dropping lowest two: If you complete the online student evaluation for this course during the official period at the end of the semester when the evaluations website is up, then I will drop your lowest two scores when calculating your homework average for semester grades. If you do not complete the evaluation, then all homework scores will be included in your homework average. This policy serves two functions: (a) it gives you an incentive to submit a course evaluation, and (b) it compensates for unavoidable circumstances that may prevent you from submitting homework on time (*e.g.*, illness, scheduled event, emergency, etc.). *Late problem sets will not be accepted without my prior authorization.* If you have reached this point in the syllabus, write your favorite cartoon character on the upper left corner of the Agreements sheet before handing it in. Read on!

Teamwork vs. plagiarism: Teamwork can be a very good way of learning; so I encourage you to interact with your classmates on homework. However, do not mistake teamwork for plagiarism. It is unacceptable, for example, to divvy up the problems and then swap solutions. The work you hand in *must be your own*, not copied, reworded, or paraphrased from someone else's work. I will choose problems from a variety of sources, including my own imagination. It is likely that solutions for many of the assigned problems can be found on the internet or other sources. I know this, and now you do too. It is unacceptable for you to solve homework problems by "mining" for existing solutions. Nor is it acceptable to consult existing solutions for hints. Both of these constitute forms of plagiarism. Remember, the only way you will learn the subject is by sweating through problems on your own and/or with your study team.

Final comment: Working physics problems is *by far* the best way to learn physics, so it is important that you make every effort to do an honest and thorough job.

Reading Assignments:

Rationale: There are two important reasons to keep up with reading assignments: (a) Your time spent in class will be more meaningful and beneficial if you read the textbook *in advance*. Ample research shows that having some familiarity with the material to be discussed in class will help you focus on understanding the nuances and challenging concepts and techniques in a way that's not possible if the material is completely unfamiliar to you. (b) It is simply not possible to cover *in class* everything you need to learn. Fortunately it is not necessary to do so either, because there are plenty of things you are all fully capable of learning on your own through reading.

Expectation: You are expected to come to *every* class having already read that day's assigned portion of the textbook. Most reading assignments (but not all) will be less than a dozen pages (often much less), so it shouldn't take you too long to complete.

Academic Honesty

The University of Georgia has a comprehensive policy on academic honesty known as *A Culture of Honesty*. This policy not only describes required and prohibited conduct, as pertains to academic honesty, but also provides a detailed procedure for resolving matters of alleged academic dishonesty, including a description of consequences for honesty violations. The complete policy can be found online at http://www.uga.edu/honesty/. All students are responsible for knowing, understanding, and abiding by this policy. If you have any questions about the appropriateness of your work in this course, you are obligated to ask me for clarification.

I take issues of academic honesty very seriously, and it is my responsibility to uphold the University's policy. This means, among other things, that I will not hesitate to report my suspicions of dishonesty (*e.g.*, plagiarism, unauthorized assistance, etc.) to the Office of Instruction. This extends not only to exams but also to homework.

Disclaimer

Unexpected circumstances and concurrent course assessment may require changes to the rules and information contained in this syllabus. If so, such changes will be done as fairly as possible, and you will be kept informed of the changes and their causes.

Tentative Course Schedule

Day	Date	Lecture Topic	Section	Pages	PS/Exam
Tue	1/11	Introduction to the course. Qualitative discussion of micro-macro connection.	-	-	
Thr	1/13	Thermal equilibrium. The ideal gas, Equipartition of energy.	1.1-2	1-7	
			1.2-3	10-17	
Tue	1/18	Heat and work. Compression work.	1.4-5	17-26	
Thr	1/20	Heat capacities. Two-state system.	1.6, 2.1	28-35	PS #1
			2.1	49-53	
Tue	1/25	Einstein model of a solid. Interacting systems (begin).	-	-	
Thr	1/27	Interacting systems (end). Large systems (begin).	2.2-3	53-59	PS #2
			2.3-4	60-64	
Tue	2/1	Large systems (end). The ideal gas (begin).	2.4-5	64-72	
Thr	2/3	The ideal gas (end). Entropy	2.5-6	72-78	PS #3
			2.6	79-83	
Tue	2/8	Temperature.	3.1	85-91	
Thr	2/10	Entropy and heat. Paramagnetism	3.2	92-97	PS #4
			3.3	98-103	
Tue	2/15	Paramagnetism (end). Mechanical equilibrium and pressure.	3.3-4	103-110	
Thr	2/17	Diffusive equilibrium and chemical potential. Summary and look ahead.	3.4	111-113	Exam #1
			3.5-6	115-121	
Tue	2/22	Heat engines.	4.1	122-125	
Thr	2/24	Refrigerators, Real engines	4.2	127-129	PS #5
			4.3	131-137	
Tue	3/1	Real engines (end).	4.3	-	
Thr	3/3	Real refrigerators	4.4	137-147	PS #6
			4.4	-	
Tue	3/8	***Spring Break***			
Thr	3/10	***Spring Break***			
			-	-	
Tue	3/15	Free energy as available work (begin).	5.1	149-158	
Thr	3/17	Free energy as available work (end). Free energy as a force toward equilibrium (begin).	5.2	161-165	PS #7
Tue	3/22	Free energy as a force toward equilibrium (end). Phase transformations of pure substances (begin).	5.3	166-174	
Thr	3/24	Phase transformations of pure substances (continue).	5.3	180-185	PS #8
			5.3	-	
Tue	3/29	Chemical equilibrium (begin).	-	-	
Thr	3/31	Chemical equilibrium (end).	5.6	208-219	Exam #2
			5.6	-	
Tue	4/5	The Boltzmann factor (begin).	6.1	220-225	
Thr	4/7	The Boltzmann factor (end). Average values. The equipartition theorem.	6.1-2	226-233	PS #9
			6.2-3	234-240	
Tue	4/12	The Maxwell speed distribution. Partition functions and free energy (begin).	6.4-5	242-248	
Thr	4/14	Partition function for composite systems. Ideal gas revisited.	6.6-7	249-255	PS #10
				-	
Tue	4/19	The Gibbs factor.	7.1	257-260	
Thr	4/21	Bosons and fermions.	7.2	262-269	PS #11
				-	
Tue	4/26	Degenerate Fermi gases (begin).	7.3	271-278	
Thr	4/28	Degenerate Fermi gases (end). Blackbody radiation (begin)	7.3	279-285	PS #12
			7.4	288-295	
Tue	5/3	Blackbody radiation (end), and Review.	7.4	295-306	
Thr	5/5	Scheduled final exam: Thur., May 5	-	-	Exam #3