

PHY 3513 Thermal Physics (Class number 18511)
Fall 2021 syllabus

PHY 3513 has two sections, under class numbers 18511 and 27531. This syllabus is for 18511, taught by Takano.

Instructor: Yasu Takano, NPB 2356, phone 392-9326 (email: takano AT phys dot ufl dot edu)
Class meetings: M W F period 7 (1:55 PM – 2:45 PM), NPB room 1101
Textbook: Herbert B. Callen, *Thermodynamics and Introduction to Thermostatistics, 2nd edition* (Wiley, 1985)
Corequisite: PHY 2049 (Physics 2 with calculus) or an equivalent. Multivariable calculus, covered by MAC 2313 (Calculus 3), will be used extensively, although that course is not an official corequisite.
Office hours: M F period 8 (3:00 PM – 3:50 PM)

Synopsis

This course covers equilibrium thermodynamics, the study of relations among the state variables—such as temperature, pressure, magnetization—that specify the macroscopic internal state of a system as well as the study of interconversion of heat, internal energy, and work. It forms essential part of the foundation of many courses in science and engineering. Close to home, it is one of the prerequisites for PHY 4523, Statistical Physics, which provides a microscopic basis for equilibrium thermodynamics and methods for deriving—from a microscopic model—what Callen calls a fundamental equation of a given macroscopic system. (As you will learn in this course, once a fundamental equation is obtained, equilibrium thermodynamics will allow you to calculate anything you want about the state variables of the macroscopic system.)

Through September the 8th, lectures will be devoted to reviewing basic thermodynamics you have learned in high school and in General Chemistry 1. Those are subjects covered in many introductory-physics textbooks, including Halliday, Resnick, and Walker. (If you have taken PHY2048 or an equivalent at UF, see a few sections near the end of Part 2 of the book.)

Starting from September 10th, lectures will closely follow the first nine chapters, and Chapter 11, of Callen. We will skip Chapter 10, although it covers a very important subject in physics and materials science.

Class expectations specific to Fall 2021

In response to COVID-19, the following practices are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones. The situation in Florida is so grave, but the UF cannot mandate vaccination and wearing of approved face coverings because of political constraints imposed by Tallahassee. So please, please be responsible and do your part.

* If you are not vaccinated, get vaccinated. Vaccines are readily available at no cost and have been demonstrated to be safe and effective against the COVID-19 virus. Visit this link for details on where to get your shot, including options that do not require an appointment: coronavirus.uflhealth.org. Students who have receive the first dose of the vaccine somewhere off-campus and/or outside of Gainesville can still receive their second dose on campus.

- * You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.
- * Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
- * Hand sanitizing stations will be located in every classroom.
- * If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
- * If you are withheld from campus by the Department of Health through Screen, Test & Protect you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- * Continue to regularly visit coronavirus.UFHealth.org and coronavirus.ufl.edu for up-to-date information about COVID-19 and vaccination.
- * All lectures in this course are given in the HyFlex format. This allows you to attend lectures remotely and synchronously via Zoom, if you do not want to, or cannot, attend them F2F for any reason.
- * Lecture notes and Zoom videos of the lectures will be accessible to you via Canvas.

Your aims in this course

By completing this course, students will obtain firm grasp of the logical structure of equilibrium thermodynamics and how the very large number of formulae that appear in it are inter-related. Note that the emphasis of logical structure and how formulae are embedded in it is unique to equilibrium thermodynamics, which has little resemblance to other physics courses. Consequently, derivations are especially important in this course. Your goal in this course is to become able to make all the derivations in the book and to solve all Examples and recommended problems. More on this under **How to Study**.

Lectures

As you must have learned by now, lectures in upper-level physics are not meant to spoon-feed recipes for solving problems, nor are the exams in those courses meant for you to apply those recipes. Lectures are intended to help you develop critical thinking, learn the habit of using math as a tool to develop conceptual understanding, and learn by doing problems yourself. In this course, most of recommended problems from the book cannot be solved by simply applying memorized recipes.

For these reasons, lectures will assume that you have read the corresponding part of the textbook.

All lectures in this course are given in the HyFlex format. This allows students to attend lectures remotely and synchronously via Zoom, if they would like to—or have to—stay away from the classroom for any reason.

Office hours

Office hours will also be in the HyFlex format so that a social distance can be maintained as recommended by the CDC. In Zoom, waiting rooms will be used to allow privacy.

Zoom

Zoom meetings for lectures start with your microphone muted. When you ask a question or give a comment, un-mute yourself temporarily by pressing the space bar on your keyboard. Releasing the space bar will automatically mute your mic, so that you will not have to remember to click the mute icon after you have spoken. Office hours start with your mic on and use waiting rooms.

Lectures are recorded. To protect your privacy, the recordings are made accessible only on UF OneDrive via a link in Canvas and only to students who are registered for this course. They will be deleted from OneDrive after Exam 3. All parts that are recorded before a lecture starts at 1:55 PM and after it ends at 2:45 PM will be edited out before posting. Office hours are not recorded.

Students who attend lectures via Zoom with their camera on or use a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your video or profile image recorded, be sure to keep your camera turned off and do not use a profile image.

Students who participate orally in lectures are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you are allowed to communicate via Zoom's chat, which is not recorded or shared. If you do send a question or comment to the instructor via chat, please immediately alert him orally because it is difficult for him to keep an eye on the chat indicator during a lecture.

Unauthorized recording and unauthorized sharing of recorded materials is prohibited.

The URLs, meeting IDs, and passwords for all Zoom meeting will change every six to seven weeks. For this reason, you are advised to join lectures and office hours via Canvas, instead of directly via Zoom.

To set up a Zoom study group with other students who are taking this course, read instructions in Canvas > Files > How-Students-Meet-with-Each-Other-via-Zoom.pdf.

How to Study

As you already know, physics cannot be studied without doing problems. The primary purpose of doing problems is to acquire conceptual understanding of the subject and to develop intuition on the behavior of physical systems. There are a right way and wrong way of doing problems. The right way comprises five components: (1) to expect the result before embarking on calculation, (2) to keep track of information content as you manipulate equations, (3) to examine the result for correct dimensions and symmetry, and to check whether it agrees with simple/obvious/known results for special cases (e.g. the limit in which one of the independent variables becomes infinite or zero), and (5) to compare the result with what you have expected and, if your expectation has turned out to be wrong, to correct the wrong intuition that has led to the wrong expectation. Of these, 1 and 5 are the keys to developing intuition. What is the wrong way of doing problems? It is what I call "black-box shaking"—putting equations in a figurative black box and shaking it until a solution pops out.

You are expected to do all Examples in the book and all recommended problems, a list of which will be provided for each chapter, sometimes tacked at the end of a homework-assignment pdf file. Homework problems are intended to supplement recommended problems, not to replace them. They, as well as exams, will assume that you have done recommended problems. Without doing recommended problems, you will not do well in the exams.

When doing problems, it is critically important that you first make a genuine effort to solve them by yourself. When stuck, discuss with other students or seek help from the instructor.

Homework

There will be 6 homework assignments, each corresponding roughly to one chapter of the book and containing about 8 problems. Of those, 2 randomly chosen problems will be graded. All homework assignments weigh the same.

Collaboration with other students are strongly encouraged (read **Zoom** below for how to set up Zoom meetings with your classmates), but the work you turn in must not be a copy of solutions by others. If the work shows a sign of copying a solution, be it from another student or internet, a zero will be given for the entire assignment. Homework must be written neatly, with words and sentences provided to make your solutions understandable and the final results clearly marked as such. Points will be deducted if your solutions are hard to read or hard to understand. Points will also be taken away if your homework shows a sign of “black-box shaking”—such as circular arguments and undirected manipulation of equations—or your result lacks required symmetry or is dimensionally incorrect. There will be no penalties for errors arising from typos that cannot be detected by symmetry and dimension checks.

Homework must be uploaded as a single pdf file to Canvas by 1:00 PM of the due date. No other way of submitting homework is allowed. To create a pdf file from handwritten sheets, some students use CamScanner, but there are also alternatives to this app, some of them free: <https://seawallalife.com/camscanner-alternatives/>. You may also use a real scanner or take a picture of each handwritten sheet. An instruction on how to combine multiple pdf file to a single one can be found in Canvas, under Files > ConvertingCellPhonePics2pdf.pdf.

No late work is accepted, since solutions to the assigned problems will be posted in Canvas on the due date, immediately after 1:00 PM. No make-up assignment will be given for a missed homework. Graded homework will be returned to students via Canvas usually within one week after the due date.

Exams

There will be 3 two-hour exams. The date and time of Exam 3 have been assigned by the Registrar, as they appear in the Course Schedule. Those of Exams 1 and 2 are tentative and subject to change. For an exam missed for an excusable reason with a verifiable supporting document, a makeup exam will be provided, but only if the student contacts the instructor before the exam or—in case of unexpected emergency—within one week after the exam.

Each exam will have three problems, each with a few parts. They will be closed book, closed note, with formula sheets posted in Canvas before each exam and provided in the exam. You will not be allowed to use your own formula sheets, nor a calculator (there will be no numerical questions). Exam 1 will cover Chapters 1 and 2 of Callen, Exam 2 Chapters 3 through 5, and Exam 3 Chapters 6 through 9 and 11.

You will do well in exams only if you do all recommended problems and homework problems. Turning in homework by copying solutions without understanding them will not lead to a good grade.

Grading

Grades will be based 84% on exams and 16% on homework. Each of the 3 exams is worth 28% of the grade. All homework assignments weigh the same, although the number of problems may vary from assignment to assignment. The lowest homework score will be dropped, whereas no exam score will be dropped.

The lower threshold of each letter grade will be as follows.

A 85%

A- 80%

B+	75%
B	70%
B-	65%
C+	60%
C	55%
C-	50%
D+	45%
D	40%
D-	35%
E	less than 35%

For most science and engineering majors, the lowest passing grade is C.

Announcements

All announcements are made in Canvas, which will automatically send you an email. Three most recent announcements will appear also on the course homepage, and all announcements will be archived in Canvas, under Announcements.

How to contact the Instructor

To contact the instructor, always send an email to takano at phys dot ufl dot edu from your GatorNet account, with the word “PHY3513” included in the subject line. Do not contact him via Canvas “features” such as Help > Ask Your Instructor a Question. He will ignore all messages sent from Canvas because his very secure email client—he does not use Outlook—will not allow him to directly respond to messages and questions sent from Canvas. He will also ignore emails that are sent from non-GatorNet accounts. Gmail users beware.

Inclusion and diversity

Physics is practiced and advanced by a scientific community of individuals with diverse backgrounds and identities and is open and welcoming to everyone. The instructor recognizes the value in diversity, equity and inclusion in all aspects of this course. This includes—but is not limited to—differences in race, ethnicity, gender identity, gender expression, sexual orientation, age, socioeconomic status, religion and disability. Students may have opportunities to work together in this course. We expect respectful student collaborations such as attentive listening and responding to the contributions of all teammates.

Physics, like all human endeavors, is something that is learned. It is the aim of the instructor to foster an atmosphere of learning that is based on inclusion, transparency and respect for all participants. He acknowledges the different needs and perspectives we bring to our common learning space and strive to provide everyone with equal access. All students meeting the course prerequisites belong here and are well positioned for success.

In-class recording by students

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation,

assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Additional Information

Requirements for lecture attendance, exams, assignments, and other work in this course are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://disability.ufl.edu>) by providing appropriate documentation. Once registered, students will receive an Accommodation Letter, from the Center, which must be forwarded to the instructor within the first two weeks of the semester.

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://gatorevals.aa.ufl.edu/students/>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code.” On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. You are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor.

Campus Resources

Canvas technical support: <http://helpdesk.ufl.edu/>, 352-392-4357, helpdesk@ufl.edu.

U Matter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit <https://umatter.ufl.edu> to refer or report a concern and a team member will reach out to the student.

Counseling and Wellness Center: <https://www.counseling.ufl.edu>, 352-392-1575.

Student Health Care Center: <https://shcc.ufl.edu>, 352-392-1161 (a 24/7 number).

University Police Department: <https://police.ufl.edu/>, 352-392-1111 (or 9-1-1 for emergencies).

UF Health Shands Emergency Room / Trauma Center: <https://ufhealth.org/emergency-room-trauma-center>. For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608.

Student Complaints On-Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code>.

On-Line Students Complaints: <https://distance.ufl.edu/getting-help/student-complaint-process/>.

Career Connections Center: <https://career.ufl.edu>. Reitz Union Suite 1300, 352-392-1601.