

Boston University ENG ME 304: Energy and Thermodynamics
SYLLABUS FOR FALL 2020

NOTE: You are expected to read through this document and be familiar with the policies and dates described within; print out, sign, and pass in the signature page with your first homework assignment. Some dates may be subject to change; changes will be announced in class, via email, and on the website. Check this document prior to contacting your section instructor for logistical information.

Class A1: MW 4:30 – 6:15 PM, LSE B01 (actual time varies depending on designated group)
 Prof Caleb Farny (farny@bu.edu), 110 Cummington Mall, Rm 207, 353-8664
 Office hours: Tues & Thurs: 4:15-5:15 pm (or by appointment), via [Zoom](#)

 A2: TR 9 – 10:45 AM, EPC 207 (actual time varies depending on designated group)
 Prof Chuanhua Duan (duan@bu.edu), 730 Commonwealth Ave., Rm 202C, 353-3270
 Office hours: Weds 9-10 am, Thurs: 12:30-1:30 pm, via [Zoom](#)

GSTs Geoffrey Van Dover (gdover@bu.edu) Office hours: TBD
 Kelsey Snapp (ksnapp@bu.edu) Office hours: TBD
 Bill Zhao (zz52@bu.edu) Office hours: 5:30 – 6:30 pm, via Zoom

Resources

Text: Moran and Shapiro, *Fundamentals of Engineering Thermodynamics*, 9th ed., 2018. Wiley. (The print, ebook, or 8th edition are all fine as well; we will typeset the HW problems for you)

Website

The course website is on BlackBoard (learn.bu.edu). Electronic materials will be posted periodically throughout the semester, so check the website often for updates. We have transitioned to a Blackboard Ultra website, so the format may look different from what you're used to seeing. **NOTE** that while grade assignments will be posted for your review, we do NOT use the Blackboard Gradecenter to calculate semester grades. Ignore any interpretation of your grade based on whatever Blackboard-reported "points" that are displayed.

Discussion Section

ME304 instruction consists of your twice-weekly class and a discussion section. The Discussion section will be run by the Graduate Teaching Fellow (GST) noted below. The GST will review relevant problems to the current topics in the course. Please attend the section you registered for, particularly since these classrooms have limited seating. Each session will also be streamed via Zoom; the link will appear on Blackboard.

Section B1 (Geoff – PHO 201, Kelsey – Zoom): Thursdays 11:15 – 12:05 pm
Section B2 (Bill – PHO 201, Geoff – Zoom): Fridays 11:15 – 12:05 pm
Section B3 (Kelsey): Thursdays 3:35 – 4:25 pm, EPC 208
Section B4 (Bill): Tuesdays 6:30 – 7:20 pm, EPC 208

Course description

4 Credits. Macroscopic treatment of the fundamental concepts of thermodynamic systems. Zeroth, first, and second laws; properties of simple compressible substances; entropy; energy availability; ideal gas mixtures and psychometrics; and thermodynamic cycles. Application to engines, refrigeration systems, and energy conversion.

Course Learning Outcomes

As an outcome of completing this course, students will:

- i. Understand underlying principles of engineering thermodynamics: properties of simple compressible fluids, use of "steam tables" for fluids, use of closed-form expressions for gasses, first and second laws of thermodynamics for closed and open systems, concept of entropy, thermodynamic temperature scale, concept of humidity.
- ii. Understand and be able to analyze simple gas and vapor cycles: Carnot cycle, Rankine cycle, Brayton cycle, Refrigeration cycle, Otto and Diesel cycles.
- iii. Be able to carry out experiments involving thermal systems: application of 1st law to open and closed systems; refrigeration system performance.
- iv. Be able to write clear, concise, technical reports: Individual reports are required for each laboratory exercise. Students are expected to succinctly describe the experimental system, present the measured results, and compare results to the theory developed in class.
- v. Be able to use computational tools: The analysis of experimental data and a selection of homework problems require the use of computational programs such as Matlab or Excel.

Instructional Format, Course Pedagogy, and Approach to Learning

Due to the Covid social distancing limitations, we are limited in the number of students who may be in the classroom at any given time. In the face of this extreme restriction, we decided to entirely flip the course. In order to stay on track, the semester is divided into 13 weeks, rather than 27 class sessions.

We have made a series of instructional videos that cover the entirety of the course material. Class time will be used to cover active learning exercises based on that week's concepts. You should watch the designated week's set of instructional videos **before** attending your class session. There are engagement questions embedded in the videos, so make sure to answer the questions that appear in the videos **before** your class session.

The two sections have different room seating capacities and therefore have different in-class arrangements:

A1 (Farny)

Our section's enrollment-to-LfA room capacity means we must divide into 4 groups, each limited to a 45-minute in class session per week. The section roster will be divided into 4 groups: 3 in-class groups and a synchronous remote group.

In class students: You will be in either a "M", or "W" class session. The "M" or "W" corresponds to "Monday" and "Wednesday" session, respectively. This assignment will be emailed and posted to Blackboard.

Remote students: You will be in the "W" session.

A1 Class session timing

M: Mondays 4:30-6:15 pm, LSE B01

W: Wednesdays 4:30-6:15 pm, LSE B01

Remote: Wednesdays 4:30-6:15 pm, via [Zoom](#)

NOTE that the first class of the semester falls on a Wednesday (Sept 2nd) but is designated for the "M" groups!! October 13th is similarly shifted, as it is a Tuesday but follows a Monday schedule. The course schedule shows the full schedule, and otherwise all other "M" and "W" meetings fall on a Monday or Wednesday as expected.

A2 (Duan)

Based on the section enrollment-to-LfA room capacity we are limited to a 105-minute in-class session per week. The section roster will be divided into 2 groups. Students with last names starting with A-M will be assigned to the “Group I” and students with last names starting with N-Z will be assigned the “Group II” no matter whether they choose “in class” or “remote” in the LfA attendance. This assignment will be emailed and posted to Blackboard. Students from the two groups will come to the class room once per week as noted on the course schedule.

NOTE that the first class of the semester falls on a Thursday (Sept 3rd) is designated for “Group I”. Students in “Group I” will join class every Thursday and students in “Group II” will join class every Tuesday until October 6th. There will be a “Zoom” only class for all students on October 8th. In the week of October 12th, there will be no class on Tuesday October 13th and an online “Exam 1” on Thursday, October 15th. Afterwards, students in “Group I” will join class every Tuesday and students in “group II” will join class every Thursday.

Lab kits and lab section

Due to the LfA mode we can no longer rely on a single set of on-campus laboratory equipment. You have been contacted by the ME Department regarding your location and plans for distributing a ME310 lab kit. Assuming no supply issues, you should ultimately receive the following LfA Lab kits:

Scale

Multimeter pack: Digilent multimeter and thermocouple

On campus (and nearby remote) students will pick up their full kit from the ME office. Remote students outside of the Boston area will receive theirs via a shipping service. Contact Prof Farny if you are missing something by Sept 14th or haven’t received your shipment.

Grading

Your progress and evaluation for the course material will consist of weekly problem sets, a reporting project, one lab exercise and report, two midterm exams, a final exam, and participation with class learning exercises. The breakdown for the grade weighting is:

Class attendance & participation 10%

Homework 15%

Lab report 10%

Exams 65% (20% for the two lowest scores, 25% for the highest)

Nominally, the mean of the overall score across the class will set the dividing line between a B and a B-.

Videos

Note: We have not designed the website or videos for a smartphone platform; the videos are best watched on a computer screen with headphones for properly hearing the audio.

Each week of the course has an accompanying set of videos that we have written and recorded for you to watch. Understanding the content in the videos is a key step to learning the course material and passing this course. The number and length of each week’s set of videos vary depending on the complexity of the topic. Each video has an accompanying time-synced written transcript that appears next to the video; these transcripts are searchable and hyper-linked to the spot of the video that they appear. NOTE that we will not formally cover these topics in class.

Also note that a few questions are embedded in most videos. You are responsible for writing these questions down and answering them. These make up your “video questions” and are due on the day you

have class for that week of the semester. Make sure to take notes and post any questions (“muddiest point”) that you have from the videos as requested by the built-in video question.

Pedagogical research has demonstrated that listening to a chalkboard lecture results in low retention of material, not to mention transcription mistakes from the presented material to your notes. This is why we provide the videos and transcripts for your reference. They are valuable resources that you should reference as you study the course material.

Problem Sets

One of the best methods to learn the material is to read the text *before* the material is presented in class, attend and pay attention in class, and work through the assigned problem sets. The course is structured to give you ample feedback regarding your understanding of the material through the problem sets. Assistance will be provided in the Discussion Section, so please seek out help if you need it!

Another helpful practice is to alternate teaching the problems to your classmates, which will force you to think about how to tackle and solve a problem. It is common for engineers to work in groups, so keeping in mind the Ethics Code, we encourage you to form groups to work out (but not copy) the problem sets. The exams are solo efforts however, so it is in your best interest to make sure you understand the problems and not rely too heavily on your classmates or the GST.

A perfect homework solution (this applies to exams as well) should be:

- (a) legible and well organized, with labeled diagrams
- (b) demonstrate a thought process and worked-out steps
- (c) correct!

Each problem will be graded on a 10/7/3/0 scale. A high score of 10 indicates that you worked through the entire problem and came to a correct or mostly correct solution. A score of 7 indicates that you made a valiant effort, a 3 will be given for a starting effort with several mistakes or incomplete work, and a 0 will be given for a minimal attempt or lack thereof. Partial credit will be given for all forms of evaluation, so steps (a) and (b) are in your best interest! If you are short on time (particularly for exams), please at least attempt to set up and show your steps for how to solve the problem. Please keep the following rules in mind when writing up your solution:

- (a) Your name, section number, and problem set number must appear at the top of every sheet.
- (b) Start each problem on a new page.
- (c) Indicate the final solution by drawing a solid box around it.

The due dates differ based on the section, so carefully look at the schedule and assignment for the correct date. The Discussion Section will be one of your best resources for assistance with questions on the homework. Solutions to the problem sets will be posted by Thursday night, so **late problem sets are not permitted** and will receive a zero.

Experiential Components

The lab exercise will be overseen by the GSTs. Lab reports will be written individually. Details on the report formats will be discussed in class and posted on the course website.

Exams

There will be two (online) exams given during the semester, administered on the week of October 13th and November 23rd. **DO NOT MAKE TRAVEL PLANS FOR THESE DATES.**

The final exam will be given during the final exam period, and the date is TBD. Since the Registrar will set the date later during the semester, **DO NOT MAKE TRAVEL PLANS BEFORE THE END OF THE EXAM PERIOD.**

Make-up exams will be given only in extreme circumstances. It is your responsibility to let your instructor know as far in advance as possible of an unavoidable conflict or medical emergency.

Class Policy

We expect that if you are registered for ME304, you should attend class – in person if possible but online if not. Most of the course material can be found in a textbook, but not everything, and you will be tested on what is covered in class, not what is simply covered in the textbook. Tuition at B.U. is expensive, so make the most of your time and money by taking advantage of all the resources you are paying for! We also expect that you will do your best to pay attention during class. You will have a busy schedule with many academic (and social) demands, so we know from experience that paying attention 100% of the time can be a difficult task. However, we do ask that you not distract your peers if your attention starts to wander. Please ignore all forms of non-approved (!) electronic communication temptation (texting, email, web surfing, etc) and put your phone into ‘Do not disturb’ mode during class. Please charge up and bring your phone to class, as you will be using your phone in class as a response device. If you find that we are going over material too quickly or you do not understand something crucial, don’t hesitate to ask questions during class. For longer questions, see us or the GSTs outside of class.

Active learning

Many peer-reviewed studies have demonstrated that active learning/in-class engagement exercises have a measurable effect at helping students learn the material. While the math isn’t difficult, ME304 is a concept-heavy course, as parameters such as energy transfer and temperature are difficult to wrap your hands around. For this reason, we will be using the Top Hat student feedback system to help you explore the concepts and avoid misconceptions. We will use it to register attendance, give you an anonymous feedback system for concepts you’re stuck on, and to present concept-based questions as a basis for class discussion and comprehension clarification. BU offers a discounted institutional price (\$26/semester; free if you’ve already purchased a year or 4 year-long subscription). From our observations of teaching this course in previous semesters we think it will be a worthwhile investment towards improving comprehension and grades. Your participation grade will largely be based off participation with the Top Hat responses in class: 90% participation with the exercises will earn full credit for the class participation grade. Please let us know if you have any concerns about this aspect of the course. Technical issues with your account should be brought directly to Top Hat.

The class identifier/join code for our Top Hat site, depending on your section: 399371 (A1, Farny), 288974 (A2, Duan). Note that the TopHat participation grades will automatically upload to the Blackboard gradecenter for the A2 students only. The A1 student participation grades will only appear in your TopHat account information.

Community of Learning: Class and University Policies

A. **Homework and video questions:** Individual assignments. However, you are encouraged to consult with classmates on general concepts.

B. **Lab reports:** Everything you write needs to be your own work. This policy extends to **ALL** components (text, plots, tables, etc) of the document. **Do NOT share digital files other than whatever raw data needs to be shared within your group.** Your lab report should be a stand-alone document, and therefore you may not ‘reference’ any section in one of your peers’ reports. However, you may **and are encouraged** to consult with your peers to discuss findings and results. Screen sharing your results to facilitate a discussion via Zoom or a similar web conferencing application **is OK** -- just don’t use screen shots as part of your report. Take this guidance **very seriously but PLEASE feel free to come talk to us if you’re unsure about boundary lines!**

C. Academic Conduct Statement: Cheating on homework, quizzes, exams, project reports, or any form of assignment, may be a form of plagiarism and is an infringement of every code of engineering ethics. Plagiarism is a serious academic offense and should not be taken lightly. Understanding your ethical responsibilities is an integral part of becoming a professional. A copy of the Code of Ethics of engineers, promulgated by the Accreditation Board for Engineering and Technology (ABET) and the National Society of Professional Engineers, can be found on the main course web site.

Recall that when you enrolled at Boston University, you agreed to an Academic Honesty Pledge. The Academic Conduct Code details your responsibilities as well as the results of code violations, and is posted at: <https://www.bu.edu/academics/policies/academic-conduct-code/>

D. COVID 19 & BU Community Health Expectations: Masks are required and face coverings must be worn over the mouth and nose at all times when in public spaces on campus, including classrooms. You should be prepared to show proof that you are compliant with health attestations and testing in order to attend class. You are expected to follow all university guidelines with respect to daily symptom checks, testing, social distancing, and mask wearing when you leave your dorm or home. For a detailed description of official BU policies regarding COVID, please visit: <http://www.bu.edu/dos/policies/lifebook/covid-19-policies-for-students/>

E. Inclusion: We consider our classrooms to be a place where you will be treated with respect, and we welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

F. Accommodations for students with documented disabilities: If you are a student with a disability or believe you might have a disability that requires accommodations, requests for accommodations must be made in a timely fashion to Disability & Access Services, 25 Buick St, Suite 300, Boston, MA 02215; 617-353-3658 (Voice/TTY). Students seeking academic accommodations must submit appropriate medical documentation and comply with the [established policies and procedures](#).

We will make every effort to accommodate such requests but (a) please notify us at the beginning of the semester if you've received approved accommodations in previous semesters (even if you haven't received your paperwork for this semester yet!) and (b) our policy is that we need at least one week's notification prior to each exam so we can make the necessary arrangements.

G. Religious accommodations: We are aware of and in agreement with Boston University's Policy on Religious Observance, whereby absences for any religious beliefs are understood and missed assignments on such occasions will be given a chance to be made up. We require advanced notification at least a week for such occasions.

Drop and Withdrawal Dates

The last day to DROP (with no 'W' on your record): November 6th

The last day to WITHDRAW (with a 'W' on your record): December 1st

Incompletes

Incompletes will be permitted only for extenuating circumstances and must be arranged with your instructor as soon as such a circumstance arises. This situation only pertains to assignments whose due dates have not yet passed.

Course Evaluations

There will be a standard course and instructor evaluation near the end of the semester, including an evaluation on how well you believe the course accomplished its stated learning outcomes (see above).

We are happy to discuss any comments and concerns that may arise during the semester during office hours.

I've read through this document and the semester dates (sign and submit this with your first homework assignment).

Signature: _____

Name: _____

Section: _____