Boston University ENG ME 304: Energy and Thermodynamics
SYLLABUS FOR FALL 2023

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 emailing your section instructor for logistical information.

Class A1: Tu, Thu 1:30 – 3:15 pm, EPC (750 Comm Ave), Room 205
Prof. Sean Lubner (slubner@bu.edu, he/him)
Student drop-in hours: **M, Tu 5:30 – 6:30 pm**, or by appointment, in
Office: 730 Commonwealth Ave, Room 202D

A2: Tu, Thu 9:00 – 10:45 am, WED (2 Silber Way), Room 130
Prof. Chuanhua Duan (duan@bu.edu, he/him)
Student drop-in hours: **Tu, Thu 12:30 – 1:30 pm**, or by appointment, in
Office: 730 Commonwealth Ave, Room 202C

GSTs Savannah Schisler (sschisle@bu.edu, she/her)
Office hours: W 2:15 – 3:15 pm, F 10 – 11 am, EMA 205

Bamidele Aroboto (atbami@bu.edu, he/him)
Office hours: W 6:30 – 8:30 pm, EMA 205

Catherine Wang (cjswang@bu.edu, she/her)
Office hours: Tu 5 – 7 pm, EMA 205

RESOURCES

Summary: Discussion sections, Prof. & GST office hours, blackboard example problem videos, textbook and posted lecture notes, reviewing HW solutions and graded exams.

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)

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. These will include the course syllabus, homework problems, and solutions. **NOTE** that while grade assignments will be posted for your review, we do NOT use the Blackboard grade book to calculate semester grades. Ignore any interpretation of your grade based on whatever Blackboard-reported "points" are displayed.

Example problems: We have a library of videos of example problems for you to reference and study. They will be made available to Blackboard in the Example Videos folder on a weekly basis. We encourage you to review these as you study the material and prepare for the homework.

DISCUSSION SECTION

ME304 instruction consists of your twice-weekly class and a discussion section. **Lecture is where you will learn the theory, and discussion is where you will learn how to apply it practically to solve**

problems. Be sure to attend both. During Discussion, the GSTs will work through practice problems and select problems from that week's homework (before it is due).

- Section B1: Thursdays | 11:15 am – 12:05 pm | STH 113 | (Catherine)
- Section B3: Thursdays | 3:35 pm – 4:25 pm | WED 140 | (C/B alternating)
- Section B4: Thursdays | 6:30 pm – 7:20 pm | CAS 226 | (Bamidele)
- Section B2: Fridays | 11:15 am – 12:05 pm | WED 140 | (Savannah)

You can locate rooms by building code here: https://www.bu.edu/classrooms/find-a-classroom/.

GRADING

Your progress and evaluation for the course material will consist of weekly problem sets, two lab exercises and reports, two midterm exams, and a final exam. The breakdown for the grade weighting is:

Homework (grades)	10%
Homework (completion)	5%
Lab reports	25%
Exams	60%

Nominally, the mean of the overall score across the class will set the dividing line between a B and a B- and the distance between letter grades will be based on the class standard deviation. High rates of class attendance and engagement (e.g., answering questions in class or office hours) can translate to extra credit when a student is near the cutoff for the next highest grade.

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 Office Hours and your 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 discuss (but not copy) the problem sets. The exams are solo efforts however, so **it is in your own best interest to make sure you understand the problems and not rely too heavily on your classmates or the GST**.

A perfect homework (or exam) solution should:

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

Each homework 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 (for HW or particularly for exams), please at least attempt to set up and show how you would solve the problem to help us be able to give you partial credit**. 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.

Problem sets will be based on class material, and will be **collected via Gradescope**, most Fridays (first half of the semester) or Tuesdays (second half of the semester) at 11 pm, but make sure to consult with the semester schedule AND assignment heading, as some dates will shift. Office hours and the Discussion section will be some of your best resources for assistance with questions on the homework. Solutions to the problem sets will be automatically posted immediately after the due date time, so **late problem sets are not permitted** and will receive a zero. The lowest homework grade will be dropped.

EXPERIENTIAL COMPONENTS

There are two lab exercises in this course: a First-Law Boiling Lab and a Second-Law Refrigeration Lab. The GSTs will assist with the labs. Lab reports will be written in groups of two. Details on the report formats will be discussed in class and posted on the course website.

EXAMS

There will be two in-class exams given during the semester; see the schedule for dates. The final exam will be given during the final exam period (12/15 – 12/21), 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.

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 Python, MATLAB, or Excel.

CLASS POLICY

We expect that if you are registered for ME304, **you will attend class and discussion**. 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. **Laptops and phones may not be open or on your desk during lecture** (tablets are allowed, but only for digital note taking). If you find that we are going

over material too quickly or you do not understand something crucial, do not hesitate to ask questions during class. For longer questions, see us or the GST outside of class.

Accommodations for students with documented disabilities: If you are a student with a disability or believe you might have a disability that requires accommodations, please contact the Office for Disability Services (ODS) at (617) 353-3658 to coordinate any reasonable accommodation requests. ODS is located at 19 Deerfield St, on the second floor. We will make every effort to accommodate such requests but (a) please notify your instructor at the beginning of the semester if you have received approved accommodations in previous semesters (even if you have not received your paperwork for this semester yet!) and (b) **provide at least one week's notification prior to each exam** so we can make the necessary arrangements.

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 notification at least a week in advance**, particularly if an accommodation must be made, for such occasions.

COVID 19 & BU Community Health Expectations: You are expected to follow all university guidelines with respect to your vaccination and symptom check. For a detailed description of official BU policies regarding COVID, please visit:

https://www.bu.edu/back2bu/campus-life-undergraduates/

There exists the possibility that any of us may be required to quarantine and miss class. The University has been clear that class-via-Zoom is not an environment that is supported going forward. We will do our best to be in touch with you about contingency plans should we need to quarantine, and we ask that you be in touch with your instructor should you need to miss class. We have some, but not unlimited, digital resources available to present you with the course material, should you need to miss class, but it is important that you remain proactive in doing so should you need to quarantine.

ETHICAL RESPONSIBILITIES

Cheating on homework, 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.

Please 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/

DROP AND WITHDRAWAL DATES

The last day to DROP (with no 'W' on your record): October 10
The last day to WITHDRAW (with a 'W' on your record): November 13

INCOMPLETES
Incompletes will be permitted only for extenuating circumstances and must be arranged 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.

ME304 Fall 2023 Semester Schedule and Syllabus						
L #	**Day**	**Date**	**Reading**	**Agenda**	**HW**	**Labs**
1	Tue	9/5	1.1-1.9	Course overview		
2	Thu	9/7	2.1-2.7	Thermodynamic forces		
3	Tue	9/12		Work and Heat		
4	Thu	9/14		Energy balance	#1 due Fri 9/15	
5	Tue	9/19	3.1-3.11	P-V-T surface and steam tables		
6	Thu	9/21		Enthalpy and specific heats	#2 due Fri 9/22	
7	Tue	9/26		Equations of state		Lab 1 (in lab period)
8	Thu	9/28	4.1-4.12	Mass and energy balance	#3 due Fri 9/29	
9	Tue	10/3		Mass and energy balance		
10	Thu	10/5		Open system applications	#4 due Fri 10/6	
	Tue	10/10		**LAST DAY TO DROP WITHOUT A 'W'**		
	Tue	10/10		Substitute Monday Schedule. No Class.		
11	Thu	10/12		**EXAM 1**		
12	Tue	10/17		Open system applications		
13	Thu	10/19	5.1-5.10	Second Law of Thermodynamics		Lab 1 due Fri 10/20
14	Tue	10/24		Second Law of Thermodynamics	#5 due Tue 10/24	
15	Thu	10/26		Carnot cycle, thermal efficiency		
16	Tue	10/31	6.1-6.13	Entropy	#6 due Tue 10/31	
17	Thu	11/2		Entropy continued		
18	Tue	11/7		Isentropic processes	#7 due Tue 11/7	
19	Thu	11/9		Internally reversible steady-state flow		
	Mon	11/13		**LAST DAY TO DROP OR CHANGE TO PASS/FAIL**		
20	Tue	11/14	10.1-10.3	Refrigeration systems	#8 due Tue 11/14	
21	Thu	11/16		Heat pump systems		
22	Tue	11/21	8.1-8.4	Vapor power systems	#9 due Tue 11/21	Lab 2 prelab due Tue 11/21
11/22 - 11/26: Thanksgiving Recess. No class.						
23	Tue	11/28		**EXAM 2**		
24	Thu	11/30		Vapor power systems		
25	Tue	12/5	9.1-9.8	Gas power systems I	#10 due Tue 12/5	
26	Thu	12/7		Gas power systems II		Lab 2 due Fri 12/8
27	Tue	12/12		Review	#11 due Tue 12/12	
12/15 - 12/21: **Final Exam** Period						