# Boston University ENG ME 304: Energy and Thermodynamics
# SYLLABUS FOR SPRING 2025

**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. Check this document prior to emailing your section instructor for logistical information.

**Class** M, W | 2:30 – 4:15 PM | EPC 207 (750 Commonwealth Ave., room 207)
Prof. Sean Lubner (slubner@bu.edu, he/him)
Student drop-in hours ("office hours"): Thursdays 4:30 – 5:30 pm, or by appointment, in Office: 730 Commonwealth Ave, Room 202D

**GSTs** S. M. Naimul Mamun (naimul11@bu.edu)
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## RESOURCES

**Summary**: Discussion sections, 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,* Wiley, via zyBooks. (The Moran & Shapiro print, ebook, or 8th edition of 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. 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" that 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 practice applying it practically to solve problems. Be sure to attend both every week**. Your discussion section will be run as a general open office hour homework-help setting and may periodically administer quizzes. Sections:

- Section B2: Thursdays, 11:15 – 12:05 pm, 100 Cummington Mall SOC B59
- Section B1: Thursdays, 3:35 – 4:25 pm, PHO 202
- Section B3: Fridays, 11:15 – 12:05 pm, PHO 202

You can locate rooms by building code here: https://www.bu.edu/classrooms/find-a-classroom/. The discussion section schedule starts on Thursday January 30th, and will continue throughout the semester. There will be no discussion section meetings prior to January 30th.

## 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 and heat pump cycles.

**iii.** Be able to carry out experiments involving thermal systems: application of 1$^{st}$ Law to open and closed systems; refrigeration system performance.

**iv.** Be able to work collaboratively on labs and write clear and concise technical reports: 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 Excel, Python, or MATLAB.

## GRADING

You can estimate your grade at any point using the ME304_Grade_Calculator.xlsx file posted to Blackboard. Your progress and evaluation for the course material will consist of weekly problem sets, two lab exercises, two midterm exams, and a final exam. The breakdown for the grade weighting is:

| | | |
|---|---|---|
| Homework engagement | 10% | |
| Homework completion | 5% | |
| 2x Lab reports | 25% | (equal weighting: 2 lab reports) |
| 3x Exams | 60% | (equal weighting: midterm 1, midterm 2, final) |

Nominally, the mean of the overall score across the class will set the dividing line between a B and a B-, but note that a curve will only be applied if the class average is *below* the standard low-80% range for a B/B- boundary. If the average exceeds this range, no curve will be applied.

## 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. These problem sets are designed to give you ample feedback regarding your understanding of the material and help you learn how to apply the theory presented in lectures to solve real problems. This is a vital skill for success in this course and in real life situations. The problems are also very representative of what you will encounter on exams.

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. **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, the GST, or the solutions**.

Solutions to the problem sets will be provided at the same time as the homework is assigned. The intent is to provide equitable access to resources and empower you to identify and resolve your own areas of

confusion. However, **it is critical (and required) that you approach the problem sets with the following process**:

1. **Sincerely attempt each problem first before consulting the solutions**. This will help you identify where you get stuck and uncover gaps in your understanding. Just because you understand the solutions when you read through them does *not* mean you won't get stuck when you must figure out the same steps on your own during an exam.
2. **Use the solutions as a learning tool**. If you get stuck, review the solutions to understand a correct approach, but then return to your own work and try to solve the problem independently without copying.
3. **Annotate your work and reflect to receive full credit**. After completing each problem, answer the following question in 1–3 sentences:
    a. "What was the trickiest part of solving this problem, and how did the solution, other resources, or your own process help correct this possible error?"
    b. Alternatively, if you found the problem very straight forward: "What is the most important or interesting takeaway from this problem?"

    Additionally, show all your work and annotate it to explain your thought process and highlight key steps, potentially including beyond what is shown in the solution. You must also indicate where in your work you sought guidance from the solution (if applicable) by boxing the word "Sol" with an arrow. Similarly, box the word "AI" with an arrow indicating anywhere in your work that you sought guidance from an AI tool. In this way you are also building a record of precisely where you've had conceptual difficulties, which future-you can use to efficiently and effectively study for exams. Many problems can be solved in more than one way, and it is ok if you solve a problem differently from the solution. See "Example Good HW Submission" on Blackboard.

**Grading**: Each problem will be graded for engagement on a 0/3/7/10 scale based on the quality of your solution, reflection, and annotations. A score of 10 will be awarded if your solution is complete and both the reflection and annotations are thoughtful, thorough, and demonstrate strong engagement; 7 if both components (reflection and annotations) are present, but one or both lack depth or clarity; 3 if one component is missing; and 0 if both components are missing or demonstrate little to no effort. You will also receive full completion credit (1/3 of the total homework grade) for submitting work that includes at least a minimal effort (score of 3 or higher) on every problem. **Therefore, even if you are short on time, it is in your best interest to always at least attempt every problem**. Finally, please start each problem on a new page, and draw a solid box around your final answer.

Problem sets will be based on class material and will be **collected via Gradescope**, most **Fridays at 11:00 PM**. But refer to the semester schedule and assignment headings for any adjustments to due dates. **Late submissions will receive a grade of zero but can still earn HW completion points**. While this is a strict policy, we recognize the eventuality of honest submission timing mistakes, system errors, and other extenuating circumstances. Therefore, **each student gets one free dropped homework per semester**, no questions asked.

## 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. **You will only attend the lab section you registered for once or twice the entire semester, and not every week**.

**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, 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 (May 9th)**.

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**. 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 BU 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, don't 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. You will be responsible for coordinating with BU's Testing Center to arrange any testing accommodations you require. Instructions to request an accommodation exam slot are here: https://www.bu.edu/disability/incoming-students/returning-students/. Slots are limited and on a first-come-first-served basis, and they are scheduling 3 to 4 weeks in advance. Exam dates are listed on the course syllabus, and are: **2/26 (Exam 1), 4/9 (Exam 2), 5/5-5/9 (Final Exam)**. Be sure to submit your requests early to guarantee appropriate accommodations for testing conditions. To help us assist with accommodations, please (a) notify your instructor 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) provide at least one week's notification prior to if you need us to make additional 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.

**USE OF AI**

Artificial intelligence (AI) is a rapidly evolving and powerful *tool* that will increasingly shape the professional world. To succeed in your future career, you will need to demonstrate what unique value you can contribute beyond what any untrained individual with access to AI could produce. First and foremost, this means genuinely *understanding* the engineering principles you will be taught in this and your other classes.

The effectiveness of a tool scales with the skill of its user. For you, this means understanding the principles you are asking AI to assist with, critically evaluating the accuracy and relevance of its output, and being able to independently justify its and your solutions. You must be able to think for yourself. **Simply using AI to blindly generate solutions without engaging with the material will harm your learning and ultimately leave you at a disadvantage after graduation.** However, if you use AI strategically as a learning aid—to explore concepts, clarify doubts, or test your understanding—you will develop an understanding and skill set that sets you apart and is truly valuable in the 21st century. Learn to *collaborate* with AI rather than *depending* on it. Focus on building a deep *understanding* of engineering principles and problem-solving skills that empower you to effectively use AI as a tool rather than relying on it as a crutch.

In this class:

- **You are permitted (but not required) to use AI tools** for take-home assignments without penalty, provided you use AI as a learning aid to enhance your understanding of the material. You must indicate where on your assignments you have consulted AI as explained above.
- **Exams will be pen-and-paper, without access to AI tools**, so your understanding and ability to perform independently will determine the majority of your grade.

**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): February 25th
The last day to WITHDRAW (with a 'W' on your record): April 4th

**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 Spring 2025 Semester Schedule and Syllabus | | | | | | |
|---|---|---|---|---|---|---|
| **L #** | **Day** | **Date** | **Reading** | **Agenda** | **HW** | **Labs** |
| 1 | Wed | 1/22 | 1.1-1.9 | Course overview | | |
| 2 | Mon | 1/27 | 2.1-2.7 | Thermodynamic forces | | |
| 3 | Wed | 1/29 | | Energy balance | #1 due Fri 1/31 | |
| 4 | Mon | 2/3 | | Work and heat | | |
| 5 | Wed | 2/5 | 3.1-3.11 | p-v-T surfaces and steam tables | #2 due Fri 2/7 | |
| 6 | Mon | 2/10 | | Enthalpy and specific heats | | Lab 1 (in lab |
| 7 | Wed | 2/12 | | Equations of state | #3 due Fri 2/14 | period) |
| | Mon | 2/17 | Holiday. Class moved to tomorrow (**Tuesday** 2/18) | | | |
| 8 | **Tue** | **2/18** | 4.1-4.12 | Mass and energy balance | | |
| 9 | Wed | 2/19 | | Open systems | #4 due Fri 2/21 | |
| 10 | Mon | 2/24 | | Open system applications | | |
| | Tue | 2/25 | Last day to drop without a 'W' | | | |
| 11 | Wed | 2/26 | | **EXAM 1** | | Lab 1 due |
| 12 | Mon | 3/3 | 4.1-4.12 | Open system applications | | Tue 3/4 |
| 13 | Wed | 3/5 | 5.1-5.10 | Second Law of Thermodynamics | #5 due Fri 3/7 | |
| 3/8 - 3/16: Spring Break. **No class.** | | | | | | |
| 14 | Mon | 3/17 | | Second Law of Thermodynamics | | |
| 15 | Wed | 3/19 | | Carnot cycle, thermal efficiency | #6 due Fri 3/21 | |
| 16 | Mon | 3/24 | 6.1-6.13 | Entropy | | |
| 17 | Wed | 3/26 | | Entropy continued | #7 due Fri 3/28 | |
| 18 | Mon | 3/31 | | Isentropic processes | | |
| 19 | Wed | 4/2 | | Isentropic efficiency | #8 due Fri 4/4 | |
| | Fri | 4/4 | Last day to drop or change to Pass/Fail | | | |
| 20 | Mon | 4/7 | 10.1-10.3 | Refrigeration systems | | |
| 21 | Wed | 4/9 | | **EXAM 2** | | |
| 22 | Mon | 4/14 | 10.1-10.3 | Heat pump systems | | Lab 2 Prelab |
| 23 | Wed | 4/16 | 8.1-8.4 | Vapor power systems | #9 due Fri 4/18 | due Wed 4/16 |
| | Mon | 4/21 | Patriot's Day. **No class**. | | | |
| 24 | Wed | 4/23 | | Vapor power systems | #10 due Fri 4/25 | Lab 2 due |
| 25 | Mon | 4/28 | 9.1-9.8 | Gas power systems I | | Tue 4/29 |
| 26 | Wed | 4/30 | | Review | #11 due Fri 5/2 | |
| 5/5 - 5/9: **Final Exam** Period | | | | | | |

| Lab Schedule | |
|---|---|
| **Deadline** | **Lab Portion** |
| Before lab | Lab 1 Prelab |
| 4-Mar | Lab 1 Report |
| 16-Apr | Lab 2 Prelab |
| 29-Apr | Lab 2 Report |

| HW Schedule | |
|---|---|
| **HW #** | **deadline** |
| 1 | 31-Jan |
| 2 | 7-Feb |
| 3 | 14-Feb |
| 4 | 21-Feb |
| 5 | 7-Mar |
| 6 | 21-Mar |
| 7 | 28-Mar |
| 8 | 4-Apr |
| 9 | 18-Apr |
| 10 | 25-Apr |
| 11 | 2-May |

**Lectures**

Lubner (A1) Mon & Wed | 2:30 pm - 4:15 pm | EPC 207

**Discussion Sections**

B2: Thursdays | 11:15 am - 12:05 pm | 100 Cumm. Mall SOC B59

B1: Thursdays | 3:35 pm - 4:25 pm | PHO 202

B3: Fridays | 11:15 am - 12:05 pm | PHO 202