Boston University ENG ME 304: Energy and Thermodynamics
SYLLABUS FOR SPRING 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 emailing me for logistical information.

CLASS MW 2:30 – 4:15 PM, EPC207

PROFESSOR Caleb Farny (farny@bu.edu)
Office: 110 Cummington, Rm 207, 353-8664
Office hours: Tues 2-4 pm, Thurs 9:30-11 am, or by appointment

GSTs Patrick Doran (pdoran@bu.edu) Office hours (CILSE 504): Tuesdays 11-12 pm
Shirantha Welikala (shiran27@bu.edu) Office hours (EMA 205): Mondays 4:30-5:30 pm

RESOURCES

Text: Moran and Shapiro, *Fundamentals of Engineering Thermodynamics,* 9th ed., 2018. Wiley. (The print, ebook, or 8th edition are all fine as well; I 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, I 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:

Section B1 (Patrick): Thursdays 3:35 – 4:25 pm, STH B20
Section B2 (Shirantha): Thursdays 11:15 – 12:05 pm, EPC 203
Section B3 (Patrick): Fridays 12:20 – 1:10 pm, EPC 203

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.

GRADING

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

Class attendance & participation	5%
Homework	10%
Project	5%
Lab reports	20%
Exams	60%

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

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, I 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) Do not submit work that has ragged edges.
(c) Start each problem on a new page.
(d) Indicate the final solution by drawing a solid box around it.

Problem sets will be based on class material, and generally will be due in class most Wednesdays. 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 Wednesday night, so **late problem sets are not permitted** and will receive a zero.

EXPERIENTIAL COMPONENTS

There is one lab exercise in this course (a turbine lab) and a simulated lab analysis project (espresso maker). The lab exercise will be run by the GSTs and will be scheduled on an ad hoc basis (see the syllabus

for the rough timing). 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 in-class exams given during the semester, administered in class on February 24th and April 8th. **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.

PROJECT
There will be a two-part project involving a report and peer feedback on a current commercial research and development application of thermodynamics. You may choose to work with a partner or make this a solo effort.

CLASS POLICY
I 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 B.U. is expensive, so make the most of your time and money by taking advantage of all the resources you are paying for! I 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 I know from experience that paying attention 100% of the time can be a difficult task. However, I 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 I am going over material too quickly or you do not understand something crucial, don't hesitate to ask questions during class. For longer questions, see me 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, I will be using the Top Hat student feedback system to help you explore the concepts and avoid misconceptions. I 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. I have negotiated a discounted price ($22/semester; free if you've already purchased a year or 4 year-long subscription). From my observations of teaching this course in previous semesters I 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 and attendance will earn full credit for the class participation grade. Please let me 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 is: **810897**.

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. I will make every effort to accommodate such requests but (a) please notify me 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) my policy is that I need at least one week's notification prior to each exam so we can make the necessary arrangements.

Religious accommodations: I am 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. I require notification at least a week in advance, particularly if an accommodation must be made, for such occasions.

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): day, February 25th
The last day to WITHDRAW (with a 'W' on your record): day, April 3rd

INCOMPLETES

Incompletes will be permitted only for extenuating circumstances and must be arranged with me 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).

I am happy to discuss any comments and concerns that may arise during the semester during my office hours.

I’ve read through this document and the semester dates.

Signature: _____

Name: _____

ME304 Spring 2020 Semester Schedule and Syllabus					
L #	**Date**	**Reading**	**Agenda**	**HW**	**Labs**
1	1/22	1.1-1.9	Course overview		
2	1/27	2.1-2.7	Thermodynamic forces		
3	1/29		Work, heat, energy balance	#1 due	
4	2/3	3.1-3.14	P-V-T surface and steam tables		
5	2/5		Enthalpy and specific heats	#2 due	
6	2/10		Equations of state		
7	2/12	4.1-4.12	Mass and energy balance	#3 due	
8	2/18		Mass and energy balance		
9	2/19		Open system applications	#4 due	Lab 1
10	2/24		**EXAM 1**		
	2/25		**LAST DAY TO DROP WITHOUT A 'W'**		
11	2/26		Open system applications		
12	3/2	5.1-5.10	Second Law of Thermodynamics		
13	3/4		Second Law of Thermodynamics	#5 due	
14	3/16		Carnot cycle, thermal efficiency		
15	3/18	6.1-6.13	Entropy	#6 due	
16	3/23		Entropy continued		
17	3/25		Isentropic processes	#7 due	Lab 2
18	3/30		Internally reversible steady-state flow		
	4/3		**LAST DAY TO DROP**		
19	4/1	8.1-8.4	Vapor power systems	#8 due	
20	4/6		Vapor power systems		
21	4/8		**EXAM 2**		
22	4/13	9.1-9.8	Gas power systems: Internal combusion		
23	4/15		Gas power systems: Internal combusion	#9 due	
24	4/20		Gas power systems: Turbines		
25	4/22	10.1-10.3	Refrigeration systems	#10 due	
26	4/27		Refrigeration systems		
27	4/29		Review	#11 due	