

MAAE 2400 Section A
Thermodynamics and Heat Transfer
Fall 2016
Preliminary Course Outline

Introduction

Engineering thermodynamics is the study of how differences in temperature can be used to do work. The early development of the science arose from the desire to improve the efficiency of steam and gas engines, and today all of our working machines are built with the fundamental principles of thermodynamics in mind. How best to harvest the energy around us and channel it to do useful work is a vital question for all engineers. Energy is fundamental to our advanced technological society: civilization would collapse without abundant supplies of energy. However, energy utilization also involves serious environmental as well as economic costs. Efficient and intelligent utilization is imperative. It is therefore important that the fundamental principles of thermodynamics and their implications for an energy-hungry world be clearly understood by all of us.

This course introduces the first and second laws of thermodynamics, which are the foundations of energy conversion processes, and the conduction, convection and radiation modes of heat transfer. The laboratories provide hands-on application of these fundamental principles, as well as experience with engineering equipment, measurements, data handling and reporting.

To assimilate and understand the course material it is essential to solve the assigned problems. Teaching assistants will provide guidance during the scheduled problem analysis sessions, but to obtain a substantial benefit from these problems, students must work out the solutions themselves. This point cannot be overemphasized.

Instructor

Professor Ian Beausoleil-Morrison
CB 6209
Email contact through cuLearn Mail
Office hours: **TBD**

Lectures

Lectures will be held from September 7 through December 9, with the exception of the week of October 24.

There will be two lectures per week:

- Tuesdays from 11h35 to 12h55 in **TBD**.
- Thursdays from 11h35 to 12h55 in **TBD**.

Problem analysis (PA) sessions and laboratories

Each student must be registered in a PA/laboratory section (L1, L2,...L9). These sessions will be held each week of the term (with the exception of the week of October 24), starting the week of September **19**.

Each student will conduct 4 laboratory experiments during these PA/laboratory sessions. The schedule for each student will be according to “sign-up sheet” that is posted on the door of ME 2230 (see “laboratories” section below). Students must conduct these experiments according to the schedule established at the start of the term; exceptions will only be made for documented medical reasons. All laboratory experiments will be conducted in ME 2230.

When they are not performing a lab, students will attend the PA sessions, where teaching assistants will provide guidance. This is critical to understanding and successfully applying the material covered in the lectures.

PA/lab section	Time	PA session	Laboratory
L1	Wednesdays from 14h35 to 17h25	TBD	ME 2230
L2	Tuesdays from 14h35 to 17h25	TBD	ME 2230
L3	Fridays from 14h35 to 17h25	TBD	ME 2230
L4	Mondays from 8h35 to 11h25	TBD	ME 2230
L5	Wednesdays from 11h35 to 14h25	TBD	ME 2230
L6	Fridays from 11h35 to 14h25	TBD	ME 2230
L7	Mondays from 14h35 to 17h25	TBD	ME 2230
L8	Fridays from 8h35 to 11h25	TBD	ME 2230
L9	Thursdays from 14h35 to 17h25	TBD	ME 2230

Reference material

- *Fundamentals of Engineering Thermodynamics*, 8th Ed, Moran & Shapiro (mandatory).
- License for WileyPLUS electronic resources for Moran & Shapiro (mandatory).
- Material posted on cuLearn.

The Moran & Shapiro textbook and WileyPLUS license are bundled together at the CU Bookstore:

- ISBN 9781119190868 for a hard cover book with the WileyPLUS license
- ISBN 9781119190981 for a binder version of the book with the WileyPLUS license.

Alternatively, students may purchase a WileyPLUS license directly from Wiley. This includes access to the electronic version of the book. If you wish to do this, then click on the “Read Chapter 1” link from cuLearn’s “Lectures and assigned readings” topic; this will open the WileyPLUS website where a WileyPLUS license can be purchased.

Laboratories

Students must sign up for labs on the sheets posted in ME 2230 by September 22.

To pass the course, each student must complete all of the four assigned labs and submit the required log books and receive an average grade of at least 50% in the labs. Incomplete labs or failure to submit log books will lead to a grade of FND in the course. The log books are returned to students.

The laboratory instructions and the laboratory health and safety manual are available on cuLearn. These must be read before attending your first lab.

Assignments

Problems will be assigned on a regular basis to reinforce the lecture material. These assignments will be posted on cuLearn following each lecture. Students are expected to solve these problems on their own; plagiarism will not be tolerated.

Many assignments will be completed and submitted online through WileyPLUS (refer to “reference material” above).

Other assignments will be handwritten. These must be deposited in the grey filing cabinet located in the hallway outside the Mechanical & Aerospace Engineering office located in ME 3135. Handwritten assignments will not be accepted during the lecture—they must be deposited in the grey filing cabinet.

Both types of assignments must be submitted before the start of the lecture one week following the assignment (e.g. the assignment given during the September 8 lecture must be submitted before 11h35 on September 15). Late assignments will not be accepted and will be given a grade of zero.

Final exam

The final exam will be scheduled by the university during the final exam period. This will be an open-book examination. Standard calculators will be permitted but not laptops, tablets, etc.

Marking Scheme

The final course grade will be determined according to the following:

Final exam	65%
Laboratories*	15%
Assignments	20%

*A passing mark (50% and higher) is required in the laboratory component of the course to obtain a passing grade in the course.

According to the policy of the Faculty of Engineering and Design, the final examination is for evaluation purposes only and the marked final examination papers will not be returned to the students.

Course outline

Lectures	Topic	Corresponding chapters in Moran & Shapiro
1	Introduction to thermodynamics: basic definitions, units, notation conventions, property and state.	Chapter 1
2-4	Energy and the 1 st law of thermodynamics; energy balance for closed systems	Chapter 2
5-8	Evaluating properties	Chapter 3
9-11	Energy balance for control volumes	Chapter 4
12-13	2 nd law of thermodynamics	Chapter 5
14-16	Entropy and 2 nd law entropy balances	Chapter 6
17-19	Vapour power cycles	Chapter 8
20-21	Gas power cycles	Chapter 9
22	Refrigeration cycles	Chapter 10
23-25	Introduction to conduction, radiation, and convection heat transfer	n/a

Academic accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website: <http://www2.carleton.ca/equity/>

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website: <http://www2.carleton.ca/equity/>

Academic Accommodations for Students with Disabilities: The **Paul Menton Centre** for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your ***Letter of Accommodation*** at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (*if applicable*). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (*if applicable*) at <http://www2.carleton.ca/pmc/new-and-current-students/dates-and-deadlines/>

You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at <http://www2.carleton.ca/equity/>