Faculty of Engineering

Department of Mechanical Engineering

COURSE OUTLINE

MECH 240 Thermodynamics

Fall 2016 (201609)

Course Web Site:	http://coursespaces.uvic.ca/course/view.php?id=21439

Instructor	**Office Hours**
Dr. Henning Struchtrup	Days: Open Door
Phone: 250-721 8916	Time: whenever I am in, or appointment by e-mail
E-mail: struchtr@uvic.ca	Location: EOW 511

Prerequisites: MATH 101

LECTURE DATE(S)

Section: A01 /CRN12266	Days: TWF	Time: 9:30 – 10:20	Location: HHB 105

TUTORIAL

Tutorial: T01	Day: Th	Time: 14:30 – 15:20	Location: Fraser 159

LAB SECTIONS

none			

TA Name	**E-mail**	**Office**
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Required Text	**Optional Text**
Title: Thermodynamics and Energy Conversion	Thermodynamics: An Interactive Approach
Author: Henning Struchtrup	Subrata Bhattacharjee
Publisher/Year: Springer 2014. Download free e-book or order printed e-book (needs UVic connection) http://link.springer.com/book/10.1007%2F978-3-662-43715-5	Prentice Hall Alternative Books (Authors): Cengel&Boles, Moran&Shapiro, Borgnakke&Sonntag
Reference Materials: will be posted on the course webpage. We have a site license for TEST (http://www.thermofluids.net/), which has lots of property data, problems, animations etc. For full access, you must be registered, and connect from a UVic computer (use UVic VPN from outside)	

COURSE OBJECTIVES:

Thermodynamics deals with the description of thermal processes and devices (heating, freezing, power plants, car motors, etc.). In this course we will study the fundamental laws and relations of thermodynamics: The conservation laws for mass, momentum and energy, the balance of entropy, and property relations.
The first law, which describes conservation of energy, and the second law, which describes the desire to equilibrate, are developed for closed and open systems and then applied to analyze a broad variety of thermal systems. While the main goal is to give a thorough understanding of the fundamentals of thermodynamics,

some emphasis will be put on the discussion of basic processes in energy conversion devices and their limitations due to the second law. Towards the end of the course, we shall study simple technical processes, including Otto and Diesel engines, Rankine and Brayton cycle, refrigeration and heat pump cycles.

CALENDAR DESCRIPTION:
Properties and states of simple substances, p-v-T processes, equations of state, ideal gas law, first law of thermodynamics, control volume and control mass analyses, first law thermal efficiency, simple steady flow devices, heat engines, refrigerators, heat pumps, Carnot cycle, entropy, principle of increase of entropy, second law of thermodynamics, reversibility.

LEARNING OUTCOMES:
Students who successfully complete this course will be able to:

- **Properties of Materials**
  1. Distinguish between thermodynamic properties that are easy to measure (pressure, temperature, volume) and those that cannot be measured directly (energy, enthalpy, entropy); extract relevant data from property relations and property tables.

- **Systems and processes**
  2. Identify thermodynamic systems, distinguish between open and closed systems; describe a wide array of thermodynamic processes as change of properties.

- **Conservation of Energy: The First Law of Thermodynamics**
  3. Formulate the energy conservation principle in the first law of thermodynamics; explain energy transfer by heat, work, mass, and conversion between different forms of energy;
  4. Simplify and reduce the general form of the first law into the appropriate form for any thermodynamic system and process therein.

- **The Second Law of Thermodynamics**
  5. Explain irreversibility in simple examples (heat transfer, friction, mixing), and distinguish between reversible and irreversible processes.
  6. State the general form of the entropy balance (2^{nd} law) and reduce to the appropriate form for any thermodynamic system and process therein.

- **Energy conversion**
  7. Apply the first and second laws to analyze basic energy conversion systems; define and determine thermal efficiency and coefficient of performance;
  8. Explain the limitations of energy conversion due to the 2^{nd} law, and analyze influence of internal and external irreversible losses on performance measures.

- **Processes and cycles in closed and open systems**
  9. Apply the first and second laws to analyze basic thermodynamic processes in open and closed systems (reversible and irreversible); combine results for basic processes to analyze and evaluate thermodynamic cycles.

- **Technical applications**
  10. Explain and carry out detailed evaluation of the processes in standard devices: Otto and Diesel engines, Rankine and Brayton cycle, refrigeration and heat pump cycle;
  11. Assess influence of properties (e.g., pressure and temperature range), processes (reversible/irreversible), material (e.g. limitation of maximum temperature) etc. on performance characteristics.

Weight & Date(s) of Assessments:	Weight	Date
Assignments:	20%	Weekly / 10 assignments in total
Clicker participation	5%	Participation mark
Mid-term 1	12.5%	Date: TBA
Mid-Term 2	12.5%	Date: TBA
Final Exam	50%	Date: TBA

ASSIGNMENTS

Problems similar to assignments will be discussed in class and the tutorial. Homework assignments will be posted weekly. The assignments will be collected (dropbox), and some (or all) of the problems will be marked. Answers for the problems will be given on the webpage after the assignment is collected, so that you can check your own work (should I forget to post the solution, please notify me). The assignments try to catch the core principles, processes and problems. You are encouraged to study together, and help each other, but each student has to submit an individual solution. Most exam problems will be similar to homework problems. You should work through as many of the other problems in the book or the TEST website as possible.

iClicker

The i>clicker in-class evaluation system will be used. The i>clicker is an electronic device used to answer multiple choice questions presented in class. i>clicker participation will contribute to 5% of the course mark. Note that only participation is accounted for, not the correctness of answers: Clicker questions focus on important concepts discussed in class and in assignments. Use your responses to these questions, and the in class discussion of answers, as feedback on your level of understanding of course concepts. Moreover, the overall class response to these questions provides the instructors with immediate feedback on how well the class understands the course material. i>clickers are available for purchase in the bookstore (used 1st generation clickers suffice!), and they also have an app for portable devices (privacy warning: the app might route data through servers outside Canada). You can use the same clicker that you used in other courses. Don't forget to register the clicker, so that your answers are properly accounted for.

LABORATORIES

None

NOTE: Failure to pass the final exam will result in a failing grade for the course.
Midterm and Final are closed book examinations. Formula sheet and tables with property data will be provided. All you need to bring is pencil, eraser, and the simple calculator.

Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

COURSE LECTURE NOTES ETC

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

COURSE SCHEDULE

See the course webpage for detailed schedule, and covered material.

http://coursespaces.uvic.ca/course/view.php?id=10604

GENERAL INFORMATION

Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

Attendance

"Students are expected to attend all classes in which they are enrolled. An academic unit may require a student to withdraw from a course if the student is registered in another course that occurs at the same time…

An instructor may refuse a student admission to a lecture, laboratory, online course discussion or learning activity, tutorial or other learning activity set out in the course outline because of lateness, misconduct, inattention or failure to meet the responsibilities of the course set out in the course outline. Students who neglect their academic work may be assigned a final grade of N or debarred from final examinations.

Students who do not attend classes must not assume that they have been dropped from a course by an academic unit or an instructor. Courses that are not formally dropped will be given a failing grade, students may be required to withdraw and will be required to pay the tuition fee for the course."

UVic Calendar, (2016) http://web.uvic.ca/calendar2016-09/undergrad/info/regulations/attendance.html

Accommodation of Religious Observance (AC1210)
http://web.uvic.ca/calendar2016-09/general/policies.html

Discrimination and Harassment Policy (GV0205)
http://web.uvic.ca/calendar2016-09/general/policies.html

Faculty of Engineering, University of Victoria
Standards for Professional Behaviour

"It is the responsibility of all members of the Faculty of Engineering, students, staff and faculty, to adhere to and promote standards of professional behaviour that support an effective learning environment that prepares graduates for careers as professionals…."

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour which contains important information regarding conduct in courses, labs, and in the general use of facilities.
http://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the Undergraduate Calendar for the UVic policy on academic integrity.

Policy on Academic Integrity
http://web.uvic.ca/calendar2016-09/grad/academic-regulations/academic-integrity.html