ENSC 388
ENGINEERING THERMODYNAMICS AND HEAT TRANSFER
Fall 2011

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Course objective:

This is an introductory course in thermodynamics and heat transfer covering topics that Mechatronics students are most likely to need in their professional lives. Students are assumed to have an adequate background in calculus, physics, and engineering mechanics. The course objectives are:

- To cover basic principles of thermodynamics and heat transfer.
- To study real-world engineering examples to give students a feel for how thermal sciences are applied in engineering practice.
- To develop an intuitive understanding of thermal sciences by emphasizing the physics and physical arguments.

Textbook:

Introduction to Thermodynamics and Heat Transfer, 2nd Edition
Yunus A. Cengel, McGraw-Hill, 2008.

Supplementary Books:

1) *Fundamentals of Engineering Thermodynamics*, 5th Edition
Michael J. Moran and Howard N. Shapiro, John Wiley and Sons Inc., New York, NY, 2004.
2) *Fundamentals of Thermodynamics*, 6th Edition
Richard E. Sonntag, Claus Borgnakke and Gordon J. Van Wylen, John Wiley and Sons Inc., New York, NY, 2003.
3) *Fundamentals of Heat and Mass Transfer*, 5th Edition
Frank P. Incropera and David P. DeWitt, John Wiley and Sons Inc., New York, NY, 2002.

Office Hours:

Open door.

Course Schedule:

Lectures: Monday 10:30 – 12:30 and Wednesday 10:30 – 11:30 SUR 3170
Tutorial: Wed 11:30-12:30pm SUR 3170
Lab: LA01 – Mon., 13:30-16:30; LA02 – Tue., 13:30-16:30; LA03 – Fri., 8:30-11:30

Course Outline:

Chapter 1, 2 - Introduction to Thermodynamics
Chapter 4 - Properties of Pure Substances
Chapter 3, 5, 6 - First Law of Thermodynamics
Chapter 7, 8 - Second Law of Thermodynamics
----------MIDTERM----------
Chapter 10, 11 - Conduction Heat Transfer
Chapter 12, 13, 14 - Convection Heat Transfer
Chapter 15 - Radiation Heat Transfer
Chapter 14 - Cooling of Electronic Equipment

Macroscopic approach to energy analysis. Energy transfer as work and heat, the First Law of thermodynamics. Properties and states of simple substances. Control-mass and control-volume analyses. Entropy and the Second Law of thermodynamics. The Carnot cycle and its implications for practical cyclic devices. Energy conversion systems; internal combustion engines, power plants and refrigeration cycles. Introduction to heat transfer by conduction, convection, and radiation. Formulation and solution of steady and transient problems. Issues relevant to the cooling of microelectronics: applications of natural and forced convection in thermal solutions.

Course Webpage:

http://www.sfu.ca/~mbahrami/ENSC 388.htm

Tutorials:

Workshop style tutorials will be held in which students will work through selected problems and can ask questions about lecture material or assignments. Individual help will be provided.

Laboratory:

There are three laboratory exercises for this course. Lab information is posted on the website. Laboratory report requirements, background and a lab schedule will be made available in the second week of term. During the lab period, students will work in groups as assigned.

Experiment 1: Methods of Pressure & Temperature Measurements
Experiment 2: Vapor Compression Refrigeration Cycle
Experiment 3: Forced and Free Convection

Assessment:

Projects	10%
Lab Reports	10%
Midterm	35%
Final	45%

The midterm and final are closed book examinations of the course material. However, you are permitted to use a photocopy of unit conversion tables from the textbook plus a crib sheet consisting of one side of one 8 1/2× 11 sheet of paper. The preparation of a well-structured crib sheet will help during the testing of ENSC 388 but it will also help in the preparation for exams as you assign priority to what is and is not important.

Each week an **assignment of 1 or 2** problems plus a set of suggested problems will be posted online with solutions. The assignments will be assessed for completeness but will not be assigned a formal grade or returned. If you successfully complete 8 of 10 assignments, your final grade will be determined on a midterm/final weighting of (35%/45%) or (45%/35%), which ever gives you a higher grade.

There will be two or three **pop-quizzes** which will be selected from the weekly assignments and/or suggested problems. Each pop-quiz will be 5% of the total mark.

The final numerical score will be transferred to a letter grade following the Letter Grading Scheme described in the University Calendar.

Projects

Two projects will be assigned throughout the term.

- All projects must be completed individually.
- Anyone suspected of copying or cheating will be assigned a grade of zero.
- All projects must be handed in immediately following the lecture period on the Due Date.
- No extensions will be granted.
- Failure to hand the project in on time will result in a grade of zero for that project.

Project #1: Topics in Thermodynamics
Due Date: Nov 4, 2011
Grade: 5%

Project #2: Topics in Heat Transfer
Due Date: Dec 2, 2011
Grade: 5%

ENSC 388 Course Schedule

Week	Topics
1	Basic concepts of thermodynamics- thermodynamic systems and properties
2	Properties of pure substances- equations of state
3	First law of thermodynamics -control mass (closed systems)
4	First law of thermodynamics - control volume (open systems)
5	Second law of thermodynamics
6	Entropy- control mass and control volume
7	Conduction heat transfer- steady state
8	Conduction heat transfer- transient
9	Convection heat transfer- forced convection
10	Convection heat transfer- natural convection
11	Radiation heat transfer- properties
12	Radiation heat transfer- exchanged between surfaces
13	Cooling of electronic equipment- examples