# Thermodynamics (ENGG 3260)

# Fall 2009

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| **Instructor:** | Maryam Jedari Eyvazi<br>Rm. 207, Thornbrough Bldg.<br>mjedarie@uoguelph.ca<br>Office hours: Mon., 12:00 to 1:00 pm<br>Wed., 1:00 pm to 2:00 pm |
| **Lecture schedule:** | M, W, F 10:30 – 11:20<br>MCKN, Room 117 |
| **Tutorials:** | Consult the WebAdvisor |
| **TAs:** | Joel Citulski ( jcitusk@uoguelph.ca )<br>Sasha Rollings-Scattergood (srolling@uoguelph.ca )<br>Abdulmonem Murayyan (amurayya@uoguelph.ca ) |
| **Prerequisites:** | CHEM*1040, ENGG*2230, ENGG*2400, ENGG*2450, MATH*2270 |
| **Textbook:** | Yunus A. Çengel and Michael A. Boles, 2006.<br>Thermodynamics – An Engineering Approach<br>6th edition, McGraw Hill Higher Education |

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## Course description:

Thermodynamics, once known as the science of heat, has now become a tool that is revolutionizing the way we perceive the world. Whether contemplating evolution or economics, energy conservation or computational science, one cannot but feel the omnipresence of thermodynamics. As engineers, we study thermodynamics not only to understand the limits of our technology, but to challenge the current notions of energy, work, and waste. This course will facilitate the learning of fundamental principles of thermodynamics and an appreciation of their importance in the engineering practice. In addition to exploring the history of thermodynamics, we will learn the practical applications of such topics as energy transfer, first and second law of thermodynamics, entropy, energy analysis and exergy, and thermodynamic cycles. Einstein once said that laws of "[Thermodynamics] … will never be overthrown" and Frederic Keffer said that "the future belongs to those who can manipulate entropy". Let's learn why!

## Tutorial and review problems

Tutorials will be used to strengthen students' understanding of thermodynamics through reviewing examples which will be made available to the students during the course. These review problems provide an opportunity for the students to better understand the course materials. All students are strongly encouraged to complete these problems either individually or in groups. Additional examples will be provided by the teaching assistants during the tutorials.

## Project: Individual energy usage

We use energy for all activities. However, we are often unaware of the magnitude and forms of energy we use in our daily life. This project is designed to enable students to gain an appreciation of energy use, its magnitudes and diverse forms. At the completion of this project, each student will have determined his/her average daily energy consumption and consequent $CO_2$ generation. The project will involve an energy balance analysis. More details will be provided in the class. The final submission will be in the form of an Excel spreadsheet (electronic submission) with appropriate tables, calculations and necessary description using comments and other Excel functions

## Course evaluations and schedules

| | Weight | Date |
|---|---|---|
| Midterm Exam #1 | %25 | Wed., Oct. 7, 2009 |
| Midterm Exam # 2 | %25 | Mon., Nov 9, 2009 |
| Project : Individual energy usage | %15 | **Due on** : Dec. 3, 2009 |
| Final Exam | %35 | Wed., Dec. 9, 2009 |

**Note:**

- All materials that have been covered before the exam will be included. Exams are closed book. A formula sheet and appropriate tables and charts will be provided.

- Student must attain a combined total of 50% on the examinations and the project to pass the course. Submitting the project is a must to get the passing grade on the course.
- Failure to write an exam will lead to a zero on that exam. The only exception will be for students with a medical reason signed by a physician. **There will be no exceptions.**

## Topic outline

1. Introduction
2. Basic concepts and definitions
3. Properties of pure substances
4. Energy transfer by heat, work, and mass
5. The first law of thermodynamics
6. The second law of thermodynamics
7. Applications of entropy
8. Exergy – Introduction and application

## Recommended readings

Hans Christian von Baeyer, 1998. Warmth Disperses and Time Passes. The Modern Library, New York.

Enrico Fermi, 1936. Thermodynamics. Dover Publications, New York.

P. W. Atkins, 1994. The 2nd Law, Energy, Chaos, and Form. Scientific American Books, New York.

H. C. van Ness, 1969. Understanding Thermodynamics. Dover Publications, New York.

Materials posted on the course WebCT

## Disclaimer

The instructor reserves the right to change any or all of the above in the event of appropriate circumstances, subject to University of Guelph Academic Regulations.