RYERSON UNIVERSITY
Department of Mechanical and Industrial Engineering

COURSE OUTLINE

MEC309

Basic Thermodynamics

Prerequisite: MTH 240

Course Materials:

Required Text: M.J. Moran and H.N. Shapiro, **Fundamentals of Engineering Thermodynamics, 5**th ed., Toronto: John Wiley and Sons**, ©**2004**.**

Appendices: M.J. Moran and H.N. Shapiro, **Appendices to Accompany Fundamentals of Engineering Thermodynamics, 5**th ed., Toronto: John Wiley and Sons, **©**2004.

Lab Book: MEC 309 **Thermodynamics Laboratory Workbook**, Department of Mechanical, Aerospace & Industrial Engineering, Ryerson University.

Reference Text: Y.A. Çengel and M.A. Boles, **Thermodynamics – An Engineering Approach,** 4th ed., Toronto: McGraw-Hill, 2002.

Course Objective:
To present a comprehensive and rigorous treatment of engineering thermodynamics from the classical viewpoint. This course provides the foundation for subsequent courses in thermodynamics, fluid mechanics and heat transfer, and prepares students to use thermodynamics in professional practice.

Organization: 3 one-hour lectures per week and 1 two-hour laboratory session (alternate weeks) for 13 weeks.

Course Evaluation*:

Laboratory Work:	15%
Assignments:	10%
2 Term Tests:	25%
Final Exam:	50%
Total	**100%**

* See last page for details.(Over)

DETAILED COURSE CONTENT

TOPIC & NO. OF LECTURES	TEXT SECTION
Introductory Concepts and Definitions: Thermodynamic systems; property, state, process, and equilibrium; units for mass, length, time, and force; specific volume and pressure; temperature; methodology for solving thermodynamics problems. **(3 lectures)**	1.1-1.7
Energy and the First Law of Thermodynamics: Mechanical concepts of energy; energy transfer by work; energy of a system; energy transfer by heat; energy balance for closed systems; energy analysis of cycles. **(4 lectures)**	2.1 - 2.6
Evaluating Properties: State of a system; simple compressible systems; p-v-t relation; thermodynamic property data; ideal gas model; polytropic process of an ideal gas. **(8 lectures)**	3.1 - 3.8
Control Volume Energy Analysis: Conversation of mass for a control volume, conservation of energy for a control volume; analysis of control volumes at steady-state. **(6 lectures)**	4.1 - 4.3
The Second Law of Thermodynamics: Introduction; statements of the second law; irreversible and reversible processes; applying the second law to thermodynamic cycles; Kelvin temperature scale; maximum performance measures for cycles operating between two reservoirs; Carnot cycle. **(4 lectures)**	5.1 - 5.6
Entropy: Clausius inequality; definition of entropy change; entropy of a pure, simple compressible substance; entropy change in internally reversible processes; entropy balance for closed systems; entropy rate balance for control volumes (steady-state only); isentropic processes; heat transfer and work in internally reversible, steady-state flow processes. **(7 lectures)**	6.1 - 6.7, 6.9
Gas Power Systems: Internal combustion engines; air-standard Otto cycle; air-standard Diesel cycle; air-standard dual cycle; gas turbine power plants; air-standard Brayton cycle. **(4 lectures)**	9.1 - 9.6
Allowance for tests and review, etc. **(3 lectures)**	

(Over)

Term Test and Examination Details:

1. Term Tests: **OPEN-BOOK**; written; scheduled during the term, 1 hour in duration
2. Examination: **CLOSED-BOOK** (reference sheet type); written; scheduled during the examination period, 3 hours in duration.

Laboratory Experiments *:

1. a) Pressure gauge calibration - measurement of pressure and
   b) Flow measurement.
2. a) Thermocouple calibration and
   b) Steam chest.
3. Bomb calorimeter.
4. Ruston diesel engine full load test.
5. Gas turbine multi load test.

*** Notes:**

· Experiments are subject to equipment availability.
· Laboratory reports are submitted for each experiment.

All of the required course-specific written assignments and labs will be assessed not only on their technical/academic merit, but also on the communications skills exhibited through them.

Faculty/Course Survey:

Students will be required to complete this survey during the weeks of 10, 11 or 12.

Prepared by: _____ Date: June 13, 2003
W.H. Leong

Approved by: _____ Date: _____
L. Fang