Mechanical Engineering and Mechanics

MEM 410 Thermodynamic Analysis II

Fall 2006/Spring 2007

Designation: Elective

Catalog Description: Covers thermodynamic analysis of ideal and real mixtures and gas
phase reacting systems. Introduces equilibrium analysis

Prerequisites: MEM 310 Minimum Grade: D

Textbook(s) and other required material:
   Required: <u>Thermodynamics an Engineering Approach</u>, Yunus A. Cengel &
      Michael A. Boles, 5th edition, WCB McGraw-Hill, ISBN 0-07-011927-9
      Spreadsheet Application
      Spreadsheet program from instructor for linear curve fitting
      Web Page: http://files.irt.drexel.edu/courseweb/mem410-00/

Course Objectives:
   1. Determine and express composition and properties of gas mixtures. Apply equations of
      state to gas mixture analysis.
   2. Learn and apply Maxwell relations to thermodynamic issues including the Clapeyron
      equation, changes in thermodynamic properties and the Joule-Thompson coefficient.
   3. Explore special topics: e.g. fuel cells, nuclear energy.
   4. Review first law analysis of combustion processes including adiabatic flame temperature
      determination. Introduce second law analysis of combustion.
   5. Show how chemical and phase equilibrium explains combustion processes and can be
      applied to other chemical reactions. Use the StanJam program to explore specific
      chemical equilibrium problems.

Topics:
   1. Gas mixtures and equations of state
   2. Thermodynamic property relations
   3. Chemical reactions and combustion
   4. Chemical and phase equilibrium
   5. Special topics

Class Schedule: 3 hours/week lecture (3 credits)

Contribution to Professional Component:
      Contributes toward the 1 ½ year of engineering topics appropriate to developing the
ability to work in the thermal systems area. Prepares students for classes in thermal system
design.

Relationship to Program Outcomes:

Outcomes a - k	Content	Explanation	Evidence
a. An ability to apply knowledge of mathematics, science and engineering	2	This course requires the students to develop a general understanding of thermodynamics. The students learn how to apply and synthesize their knowledge of mathematics, science, and engineering.	Homework, Exams, Project Report
b. An ability to design and conduct experiments as well as to analyze and interpret data	1	A design problem involving simple optimization requires the students generate data for a system and analyze them to find the optimized solutions.	Final report for the design project; Classroom example and homework problems on Adiabatic Flame Calculations
c. An ability to design a system, component or process to meet desired needs	2	The assigned design problems are always required to meet societal or industrial needs.	Final report for the project
d. An ability to function on multidisciplinary teams	0	NA	NA
e. An ability to identify, formulate and solve engineering problems	2	The problems and project require students to identify, formulate and solve engineering problems.	Homework, exams, design project
f. An understanding of professional and ethical responsibility	1	This is emphasized as part of the engineer's overall responsibility.	Classroom discussion of environmental issues; Project Report
g. An ability to communicate effectively	2	Written presentation of the final design problem is required.	Final report for the project
h. The broad education necessary to understand the impact of engineering solutions in a global/societal context	1	The impact of engineering design on the environment (pollution, greenhouse effect, etc.) and society are covered.	Classroom discussion of environmental issues; Project Report
i. A recognition of the need for and an ability to engage in lifelong learning	0	NA	
j. A knowledge of contemporary issues	0	NA	
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	2	Computer packages are used to explore the solution domain for homework and the design project	Homework; Final report for the design project

Prepared by: Dr. William J Danley, November 21, 2006