

## MAE 91 INTRODUCTION TO THERMODYNAMICS

(Required for AE and ME; Elective for EnE and MSE)

- Catalog Data:** **MAE91: Introduction to Thermodynamics (Credit Units: 4) S.**  
Thermodynamic principles; open and closed systems representative of engineering problems. First and second law of thermodynamics with applications to engineering systems and design. Prerequisites: Physics 7B, Mathematics 2D. Engineering MAE91 and CBEMS40B may not both be taken for credit. (Design units: 0.5)
- Textbook:** Sonntag, Borgnakke, and Van Wylen. *Fundamentals of Thermodynamics*, 6<sup>th</sup> Edition, Wiley, 2003.
- References:** See references in textbook
- Coordinator:** Said E. Elghobashi
- Course Outcomes:** Students will:  
Analyze the energy balance of different types of practical engineering devices and calculate important quantities such as the power output of a device given the energy input or vice versa.  
Calculate the thermal efficiency of heat engine cycles (e.g. power stations) or the coefficient of performance of refrigerating cycles (e.g. heat pumps) and decide whether the design of these cycles is realistic based on whether these cycles satisfy or violate the Second Law of Thermodynamics.
- Prerequisites By Topic:** Calculus in Two- and Three Dimensions  
Fundamental Physics
- Lecture Topics:** Concepts, definitions, units  
Pressure, specific volume  
Temperature: equality, inequality, Zeroth Law  
Pure substance, T-v, P-v, P-v-T phase diagrams  
Ideal gas, Equation of state  
Work, Heat  
First law for a system  
First law for a control volume  
Steady and unsteady flow processes  
Reversible and irreversible processes  
The entropy concept and the second law  
Entropy as a property  
Macroscopic evaluation of entropy  
Second law for a control mass  
Entropy relations  
Ideal power cycles
- Class Schedule:** Meets for 3 hours of lecture and 1 hour of discussion each week for 10 weeks.
- Computer Usage:**

**Laboratory Projects:**

**Professional Component:** Contributes toward the Mechanical Engineering Topics courses and Major design experience.

Contributes toward the Aerospace Engineering Topics course and Major design experience.

**Relationship to Program Outcomes:** This course relates to Program Outcomes a, e, and l; with additional Mechanical Engineering outcome 4 as stated at:

<http://undergraduate.eng.uci.edu/degreeprograms/mechanical/mission>

**Design Content Description**

**Approach:** Discussions are held in the lectures and homework problems include how to use the principles of thermodynamics in the design of many engineering applications that involve heat transfer and work. Examples are: power generating systems for electricity, production (power stations), jet engines and reciprocating engines, in addition to refrigeration systems.

**Lectures:** 100%

**Laboratory Portion:** 0%

**Grading Criteria:**

Homework: 20%

Midterm: 40%

Final Exam: 40%

100%

**Estimated ABET Category Content:**

Mathematics and Basic Science: \_\_\_\_ credit units or \_\_\_\_ %

Engineering Science: 3.5 credit units or 88 %

Engineering Design: .5 credit units or 12 %

**Prepared by:** Said E. Elghobashi **Date:** July 2007

**CEP Approved:** Fall 2004