# ME 500
# ADVANCED THERMODYNAMICS

## Course Outcomes

1. Build an appreciation for the fundamentals and practical applications of classical thermodynamics. [1, 2, 7]
2. Significantly enhance the understanding of thermodynamic principles and their relevance to the *problems of humankind*. [1, 4, 7]
3. Provide the student with experience in applying thermodynamic principles to *predict physical phenomena* and to *solve engineering problems*. [1, 2, 7]

## Fundamental Thermodynamic Concepts ( 6 wks)

1. 1st Law of Thermodynamics
2. 2nd Law of Thermodynamics
3. Transient Analysis
4. Exergy destruction
5. Exergy Analysis of Components and Cycles

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## Thermodynamic Properties and Phase Relations ( 5 wks)

1. Equations of State
2. Thermodynamic Relationships
3. Liquid-Vapor Phase Change
4. Chemical Potential
5. Partial Properties
6. Fugacity
7. Phase Rule and Phase Equilibrium

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## Thermochemistry and Equilibrium ( 4 wks)

1. Reaction Exergy
2. Fuel Cell Processes
3. Affinity
4. Ideal and Real Gas Equilibrium
5. Chemical Exergy

## Example Engineering Problems

1. Analysis of Internal Combustion Engines
2. Analysis of Gas Turbines
3. Analysis of Vapor Compression Cycles with Refrigerant Mixtures
4. Fuel Cells
5. End Use of Resource Analyses

**COURSE NUMBER:** ME 500 **COURSE TITLE:** Advanced Thermodynamics

**REQUIRED COURSE OR ELECTIVE COURSE:** Elective

**TERMS OFFERED:** Fall (Alternate Years)

**TEXTBOOK/REQUIRED MATERIAL:** Wark, Richards, *Thermodynamics*, 6th Ed., McGraw-Hill, 1999.

**PRE-REQUISITES:** ME 300 Thermodynamics II

**COORDINATING FACULTY:** E.A. Groll

**COURSE DESCRIPTION:** The empirical, physical basis of the laws of thermodynamics. Availability/exergy concepts and applications. Properties and relations between properties in homogeneous and heterogeneous systems. The criteria of equilibrium. Application to a variety of systems and problems, including phase and reaction equilibrium.

**COURSE OUTCOMES:**

1. Build an appreciation for the *fundamentals* and *practical applications* of *classical thermodynamics*. [1, 2, 7]
2. Enhance the understanding of thermodynamic principles and their relevance to the *problems of humankind*. [1, 4, 7]
3. Provide the student with experience in applying thermodynamic principles to *predict physical phenomena* and to *solve engineering problems*. [1, 2, 7]

**ASSESSMENTS TOOLS:**

1. Weekly homework.
2. Mid-term exam.
3. Semester project report and presentation.
4. Final exam.

**PROFESSIONAL COMPONENT:**

1. Engineering Topics: Engineering Science – 3 credits (100%)

**RELATED ME PROGRAM OUTCOMES:**

1. Engineering fundamentals
2. Engineering design
3. Communication skills
4. Ethical/Prof. responsibilities
5. Teamwork skills
6. Experimental skills
7. Knowledge acquisition

**NATURE OF DESIGN CONTENT:** N/A

**COMPUTER USAGE**: At the discretion of the individual instructors.

**COURSE STRUCTURE/SCHEDULE**:

1. Lecture – 3 days per week at 50 minutes.

**PREPARED BY:** E.A. Groll **REVISION UPDATE:** April 26, 2007