Course Outcomes

1. Provide a fundamental microscopic understanding of thermodynamics, temperature, radiation and transport phenomena.
2. Apply concepts and calculate thermodynamic and transport properties of ideal gases.
3. Evaluate properties in reacting and non-reacting flow fields from laser spectroscopic measurements.

**Statistics of Independent Particles** (4 wks)

- Probability analysis
- Most probable distribution
- Maxwell-Boltzmann statistics
- Thermal equilibrium
- Partition function

**Molecular Structures** (3 wks)

- Quantum mechanics
- Schrödinger equation
- Translational energy
- Rotational energy
- Vibrational energy
- Electronic energy
- Infrared spectroscopy
- UV-visible spectroscopy

**Ideal Gas Properties** (4 wks)

- Diatomic gases
- Polyatomic gases
- Equilibrium constant
- Concentration measurements
- Temperature measurements
- Work and heat

**Kinetic Theory** (2 wks)

- Maxwell-Boltzmann distribution
- Collision theory
- Transport properties
- Chemical kinetics

**Additional Applications** (2 wks)

- The Solid State
- Blackbody radiation
- Ensemble theory
- Real gases

Revision Date: 7/31/2012
1. **COURSE NUMBER AND NAME:** ME 50100  Statistical Thermodynamics

2. **CREDITS AND CONTACT HOURS:** 3 credits  
   a. Lecture – 3 days per week at 50 minutes for 16 weeks

3. **COURSE COORDINATOR OR INSTRUCTOR:**  
   R. Lucht

4. **TEXTBOOK:**  

5. **SPECIFIC COURSE INFORMATION:**  
   a. **Catalog Description:** The molecular interpretation of thermodynamic equilibrium. Development of the partition function. Solution of the Schrödinger equation for single cases. The Maxwell-Boltzmann formulations of statistical mechanics and application to ideal gases, radiation, laser diagnostics, sprays and solids. The Gibbs formulations of statistical mechanics and application to real gases. Kinetic theory and application to transport properties and chemical kinetics. Typically offered in the fall (alternative years).
   
   b. **Prerequisites:**  
      ME 30000 – Thermodynamics II
   
   c. **Status:** Elective

6. **SPECIFIC GOALS FOR THE COURSE:**  
   a. **Course Outcomes:**  
      1. Provide a *fundamental microscopic understanding* of thermodynamics, temperature, radiation and transport phenomena.  
      2. Apply *concepts* and *calculate* thermodynamic and transport properties of ideal gases.  
      3. Evaluate *properties* in reacting and non-reacting flow fields from absorption and fluorescence measurements.
   
   b. **Related ME Program Outcomes:**  
      A1. Engineering Fundamentals;  
      A2. Analytical Skills;  
      A3. Experimental Skills;  
      A4. Modern Engr Tools;  
      A5. Design Skills;  
      A6. Impact of Engr Solns;  
      B1. Communication Skills;  
      B2. Teamwork Skills  
      B3. Prof/Ethical Responsibility;  
      B4. Contemporary Issues;  
      B5. Life-Long Learning;  
      C1. Leadership;  
      C2. Global Engineering Skills;  
      C3. Innovation;  
      C4. Entrepreneurship

7. **LIST OF TOPICS:** See following page.

**PREPARED BY:**  R. Lucht  
**REVISION DATE:** July 31, 2012