ME 3242 – Heat Transfer

**Credits and Contact Hours:** 3 Credits. Three 50 minute or two 75 minute lectures per week.

**Instructors:** Theodore Bergman, Brice Cassenti, Wilson Chiu, Amir Faghri, Yen-Lin Han, Eric Jordan


**Specific Course Information:**
- **Catalog Description:** Fundamentals of conduction, convection and radiation heat transfer. Application of the general laws of heat transfer and heat exchange to a wide variety of practical problems. The analytical, numerical, and graphical solution of one, two, and three dimensional problems.
- **Prerequisites:** ME 2233 and ME 3250
- **Required, Elective or Selected Elective:** Required

**Specific Goals:**
- **Course Outcomes:**
  1. Describe the three modes of heat transfer.
  2. Apply the second law of thermodynamics, and its relation to thermodynamic properties.
  3. Apply Fourier’s law of conduction.
  4. Apply Newton’s law of cooling.
  5. Understand the relationship between heat transfer properties and real materials.
  6. Estimate the quantity of the convective heat transfer coefficient for a given flow regime and process.
  7. Determine the surface properties (e.g. emissivity) for radiation heat transfer.
  8. Apply Stefan-Boltzmann law of radiation.

- **Relationship of Course Outcomes to Criterion 3 Student Outcomes:**
  a) **an ability to apply knowledge of mathematics, science, and engineering:**
     *This course continually requires the students to apply their knowledge of mathematics, science and engineering. The problem formulation and solution calls for techniques learned in Calculus and Differential Equations courses.*
  b) **an ability to design and conduct experiments, as well as analyze and interpret data:** *not applicable*
  c) **an ability to design a system, component, or process to meet desired needs:**
     *The course teaches students a science-based approach to analysis using the fundamental principles learned in class; the analysis approach ultimately forms the basis for science-based designs to meet desired needs.*
  d) **an ability to function on multi-disciplinary teams:** *not applicable*
e) an ability to identify, formulate, and solve engineering problems:
This is the essential thrust of the course. Throughout the semester the students are taught, through examples and problem sets, a systematic approach to problem identification, simplification, formulation, and analytical solution of engineering problems involving heat transfer.

f) an understanding of professional and ethical responsibility: not applicable

g) an ability to communicate effectively: not applicable

h) the broad education necessary to understand the impact of engineering solutions in a global and societal context: not applicable

i) a recognition of the need for, and an ability to engage in life-long learning:
The need for life-long learning is introduced through the use of new applications and problems relevant to current and emerging technologies (such as nanotechnology, biotechnology, and information technology).

j) a knowledge of contemporary issues:
Knowledge of contemporary issues is introduced through the newer applications and problems relevant to current and emerging technologies.

k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice:
Students may choose from a variety of tools, such as IHT, Maple, Mathematica, and MATLAB in the solution of the various problems.

Topics Covered:
- Introduction to the three modes of heat transfer
- Conduction Heat Transfer—one-dimensional, multi-dimensional, and transient
- Introduction to finite difference techniques
- Convection heat transfer
- Radiation heat transfer
- Heat exchangers