ME 3242 – Heat Transfer

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

Instructors: Wilson Chiu, Jason Lee, Xinyu Zhao

Textbook: *Fundamentals of Heat and Mass Transfer*, by T.L. Bergman and A.S. Lavine, 8th Edition, John Wiley & Sons, 2017.

Specific Course Information:

a. 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.

b. Prerequisites: ME 2233 and ME 3250

c. Required, Elective or Selected Elective: Required

Specific Goals:

a. Course Outcomes:

After completing ME 3242 students should be able to:

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.

b. Relationship of Course Outcomes to Criterion 3 Student Outcomes:

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
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. 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.

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that 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.

3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
   Not Applicable
4. An ability to communicate effectively with a range of audiences.
   Not Applicable
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
   Not Applicable
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.
   Knowledge of contemporary issues is introduced through the newer applications and problems relevant to current and emerging technologies. Students may choose from a variety of tools, such as IHT, Maple, Mathematica, and MATLAB in the solution of the various problems.
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.
   Not Applicable

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