ME 2234 – Applied Thermodynamics

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

Instructors: Ugur Pasaogullari, Bryan Weber, Chih-Jen Sung

Textbook: *Fundamentals of Engineering Thermodynamics*, 8th edition, by M.J. Moran, H.N. Shapiro, D.D. Boettner, and M.B. Bailey, John Wiley & Sons, 2014.

Specific Course Information:

a. Catalog Description: Thermodynamic first and second law analysis of vapor and gas cycles, property relations for simple pure substances, properties of ideal gas mixtures, psychrometry, fundamentals of combustion thermodynamics, application of thermodynamics in the design of thermal engineering systems.

b. Prerequisites: ME 2233 or CHEG 2111

c. Required, Elective, or Selected Elective: Required

Specific Goals:

a. Course Outcomes:

After completing ME 2234 students should be able to:

1. Understand the components, basic assumptions, and compute energy and entropy balances of vapor and gas power cycles, and refrigeration cycles
2. Compute thermodynamic properties for mixtures
3. Compute stoichiometric balances and equivalence ratios
4. Perform an energy balance for a reacting system

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.
   Students acquire the skills to apply the laws of thermodynamics in mathematical form for the solution and optimization of thermal engineering systems.
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.
   Students gain design skills through assigned Design Project work, involving designs of thermal-power systems.
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
   Students gain the ability to analyze and interpret data, and use the data to draw engineering conclusions through the Design Project work.
4. An ability to communicate effectively with a range of audiences.
   Students gain the ability to write effectively through the Design Project work.
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.

Students learn about the importance of efficient energy utilization from a perspective of limited energy resources (optimization of system efficiency) as well as the pollution prevention aspect (combustion and air pollution). The Design Project work requires that the students include environmental and economic criteria in their design analyses.

6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.
   Students are required to perform research for their Design Project work with material outside that presented in class.
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.
   Students gain team experience working in small groups for the Design Project.

Topics Covered:

- Vapor power systems
- Refrigeration and heat pump systems
- Gas power systems
- Thermodynamic relations for simple compressible substances
- Non-reacting gas mixtures
- Psychrometry
- Reacting gas mixtures and combustion