- **Course Number and Title:** M E 340. Applied Thermodynamics
- **Catalog Description:** Thermodynamic cycles, Maxwell relations, Gibbs and Helmholtz functions, mixtures, psychrometrics, chemical reactions, chemical equilibrium.
- **Credit Hours:** 3 Credits (3)
- **Prerequisite(s) / Corequisite(s)** Prerequisite(s): M E 240
  Corequisite(s): None
- **Required:** Required for BSME Degree
- **Course Availability:** Fall and Spring Semesters (+ Summer)
- **Instructor (Usual):** Dr. Jesse Waller (See https://mae.nmsu.edu/people/faculty.html)
- **Textbook:** Cengel, Y., Boles, M., and Kanoglu, M., *Thermodynamics: An Engineering Approach*, 10th Ed., McGraw-Hill (ISBN-10: 1266664483 or ISBN-13: 9781266664489)
- **Course Learning Objectives:**

  After completing this course, a student should be able to:

  1) Thoroughly understand the transfer of work, heat, and energy by various thermodynamic processes in open and closed systems, and which processes and allowed and not allowed, and spontaneous and non-spontaneous.
  2) Apply knowledge predicated on the four laws of thermodynamics and application to work producing and consuming devices where efficiency must optimized by selection of appropriate fuels, energy sources, working fluids, and design considerations for engineering devices such as nozzles, turbines, condensers, diffusers, regenerators, intercoolers, and feedwater systems.
  3) Obtain the skills necessary to be successful in their professional duties in employment or further educational pursuits related to the automotive, commercial aviation, space, and energy sectors, and to be able to clearly identify, communicate, formulate, analyze, and deduce solutions to technical problems in the field of thermodynamics with peers in engineering and allied fields.
- **Topics Covered:**
  - **Old concepts (review)**: Zeroth, first and second laws, thermodynamic processes, extensive vs. intensive properties, closed and open systems, boundaries, pure substances, state postulate, phase rule, phase diagrams, *P-v-T* relationships, saturated mixtures, quality, equations of state, ideal gas laws, simple gas laws, compressibility factor, nonideal gas law, work and heat interactions,

thermal conductivity, changes in enthalpy and internal energy with temperature (heat capacity), heat capacities of pure substances

- **New concepts (focus)**: Spontaneous processes, reversibility and irreversibility, Kelvin-Planck and Clausius statements, Carnot principles and efficiency, COPs, Clausius Inequality, entropy transfer, generated entropy, entropy balance, *T-s* and *h-s* diagrams, entropy of pure substances, *Tds* relations, third law, work potential and availability in open and closed systems, gas power cycles, gas turbines, regeneration, intercooling, reheating, Rankine cycle, co-generation, process heat, refrigeration cycles, heating and cooling loads, refrigerant selection, gas liquefaction, Maxwell relations, Clapeyron and Clausius-Clapeyron eqs., Mayer relationship, Joule-Thomson coefficient, gas mixtures, Dalton's and Amagat's laws, Kay's Rule, chemical reactions, combustion, heats of combustion and formation, Gibbs-Helmholtz eq., chemical and phase equilibria, dew point, wet bulb temperatures, Introduction to entropy and exergy