

**1. Department, Course Number, and Course Title:**

**MECHANICAL ENGINEERING**

**ME 407 DESIGN OF THERMAL SYSTEMS**

**2. Designation:** Required  Elective   
Lower Division  Upper Division

**3. Course Description:** Design in engineering practice; system simulation and optimization; economic, environmental, other constraints; practical aspects of equipment selection; thermal design literature.

**4. Prerequisites:** ME 306 (Heat Transfer I) and ME 326A (Thermodynamics I)

**5. Text and Materials:** Analysis and Design of Energy Systems, Third Edition, B.K. Hodge and Robert P. Taylor. Published by Prentice Hall, 1999

**6. Course Objectives:** The student will learn the fundamental operating principles of the components of thermal systems. Further, the student will gain an understanding of the design methodology which unites the diverse elements of engineering design and engineering science and the ability to utilize this methodology.

Course Outcomes

- the ability to apply the fundamental fluid mechanics necessary to design and analyze thermal systems
- the ability to apply the fundamental heat transfer necessary to design and analyze thermal systems
- the ability to design a piping system with the purpose of transmission of thermal-fluid energy
- the ability to design and analyze shell and tube heat exchangers
- the ability to design and analyze cross flow heat exchangers
- an understanding of pump characteristics
- the ability to select a pump for a thermal-systems based on the manufacture's specifications
- an understanding of the considerations necessary to design flow systems with pumps in series and parallel configurations
- the ability to perform an uncertainty analysis on piping and heat exchanger systems
- the ability to design a thermal system to meet a realistic need

**7. Topics Covered:** (in Order of Presentation)

- The design of piping systems
- The design of simple heat exchangers
- The design of complex heat exchangers
- The principles and selection process of prime movers
- Estimating uncertainty in thermal/fluid systems analysis
- The design of thermal system

**8. Class Schedule:** Number of Sessions per week: 2  
Duration of each session: 1 hour 40 minutes

**9. Contribution of course to meeting the professional component:**

This course is part of the 24 units of technical electives required for the mechanical engineering program.

Engineering Science 2 units  
Engineering Design 2 units

**10. Relationship of course to program objectives:**

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

Knowledge outcomes:

- an ability to apply knowledge of mathematics, science, and engineering (abet a)

- a knowledge of computer aided design and simulation software

Skill outcomes:

- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)
- an ability to communicate effectively (abet g)
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
- an ability to select materials and manufacturing processes
- an ability to visualize designs from engineering drawings
- an ability to think in a logical sequential process

Attitudes Outcome:

- an understanding of professional and ethical responsibility (abet f)
- a recognition of the need for an ability to engage in lifelong learning (abet i)
- an understanding of responsibility and accountability
- a desire to be a professional that exhibits values, dedication and a need for continual improvement
- a desire to be a flexible and adaptable team player (collaborative attitude)

**11. Prepared by:** Darrell Guillaume

05/2005