

ME 4720 THERMAL DESIGN

2007 Catalog Data:	ME 4720. Thermal Design. Lecture 3. Credit 3. Prerequisites: ME 3220, ME 3710, ME 3720. Introduction to the design of thermal/fluid devices and systems; general design methodology, modeling, simulation and optimization; heat exchangers and prime movers in systems. [Required Course]														
Prerequisites by Topic:	<ol style="list-style-type: none">1. First and second laws of thermodynamics2. Conduction, convection and radiation heat transfer3. Conservation of momentum4. Incompressible flow														
Textbook and Resources:	No required text. Course notes and resource materials listed below <u>Design Analysis of Thermal Systems</u> , Boehm <u>Analysis and Design of Energy Systems</u> , Hodge <u>Design of Thermal Systems</u> , Stoecker <u>Design and Optimization of Thermal Systems</u> , Jaluria <u>Elements of Thermal-Fluid System Design</u> , Burmeister <u>Fundamentals of Heat and Mass Transfer</u> , Incropera, Dewitt, Bergman and Lavine <u>Fundamentals of Fluid Mechanics</u> , Munson, Young and Okiishi <u>Fundamentals of Engineering Thermodynamics</u> , Moran and Shapiro														
Course Objectives:	This course provides a significant design experience utilizing (primarily) the fundamental mathematics, thermodynamics, fluid mechanics and heat transfer courses taken by all mechanical engineering students. It adds the dimension of design optimization. Its major objectives are to draw together the student's experience in the fundamental subjects and to involve the student in the design of thermal systems, devices and/or components encompassing real life decision-making, including constraint specification and consideration of economic factors in engineering design.														
Course Topics:	<table><tr><td>T1. Introduction to design concepts</td><td>(8%)</td></tr><tr><td>T2. Equipment and component selection</td><td>(8%)</td></tr><tr><td>T3. Mathematical modeling</td><td>(20%)</td></tr><tr><td>T4. Simulation techniques</td><td>(12%)</td></tr><tr><td>T5. Optimization techniques</td><td>(22%)</td></tr><tr><td>T6. Codes and standards, Ethics, the Profession</td><td>(8%)</td></tr><tr><td>T7. Related special topics</td><td>(22%)</td></tr></table>	T1. Introduction to design concepts	(8%)	T2. Equipment and component selection	(8%)	T3. Mathematical modeling	(20%)	T4. Simulation techniques	(12%)	T5. Optimization techniques	(22%)	T6. Codes and standards, Ethics, the Profession	(8%)	T7. Related special topics	(22%)
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Class/Lab Schedule:	Minimum student contact time - 2200 minutes														
Course Outcomes:	Upon completion of this class, the student will be able to: C1. Define, recognize and distinguish between the various component elements and activities embodied in a general design methodology and encountered in a real design process. [c g k] C2. Formulate and solve heat exchanger problems. [a e k] C3. Formulate and solve "simulation" problems using appropriate simultaneous and/or iterative methods. [a e k] C4. Perform single and multi-variable optimization, using Lagrange Multiplier and a variety of discrete search methods. [a c e k] C5. Size and select pumps and fans for a specific application. [c e k] C6. Formulate and implement (for purposes of analysis or basic design) mathematical models encompassing the thermal/fluid performance and basic economics (costs) associated with various geometries and configurations of components and devices alone and/or in systems. [a c e k]														

- And have gained experience with and/or exposure to:
- C7. The influence of Codes and Standard Practices on the engineering design process. [f i]
 - C8. The potential impact of ethical and societal concerns on the engineer and engineering design process. [f i]
 - C9. Working, as part of a team, on a project, report or other small-group assignment. [c d g i]
 - C10. The preparation and delivery/submission of a written and/or oral presentations. [d g i]

Professional

This course is required of all Mechanical Engineering students. It involves the integration of foundational course material, within a design context; and is preparatory to and a prerequisite for the student's "culminating (major) design experience" in ME 4440 Senior Design Project.

Contribution of Course to Meeting the Professional Component:

Math and Basic Science:

General Education:

Engineering: 3 credit hours. This course includes significant design.

Other:

Relation to Program Objectives:

This course goes beyond the presentation of basic "analytical" skills, to incorporate experience in critical thinking (integration of analytical skills, quantitative and qualitative evaluation of alternatives, impact assessment) and communication (written/oral presentations, location and acquisition of information through direct contact with external sources/individuals). As a consequence, students who successfully complete this class should be more comfortable, confident and productive when engaged in career activities that involve: self-education, teamwork, and interaction with engineering and non-engineering communities and individuals.

Course Coordinator:

Undergraduate Program Committee

Prepared by:

Jeff A. Marquis

Date: 1-15-08