Course alpha, number, title

ME 416 Computer Assisted Design of Thermal Systems

Required or elective

Elective

Course (catalog) description

Classifying, cataloging and processing design information. Modeling of thermal and fluid equipment. Simulation and optimization of thermal systems. Computer based design projects.

Prerequisite(s)

(ME 410 or concurrently)

Textbook(s) and/or other required material

Course web site at: http://www.egr.msu.edu/classes/me416/benard

Class/Lab schedule:

Total Credits: 3 Lecture/Laboratory/Discussion Hours: 3/2/0

Topics covered

a. Basic design evaluation and information
b. Review of thermodynamic concepts
c. Modeling thermal and fluid equipment (piping, HVAC, pumps, heat exchangers)
d. Simulation and optimization of thermal-fluid equipment
f. Optimization by operating conditions and component selection
g. Introduction to the finite element method in heat transfer

Course learning objectives

1. Basic concepts of design
   a. Students are able to participate in and conduct brainstorming sessions
   b. Students are able to evaluate design alternatives
   [L: Application] [M: Project report]

2. Thermodynamics property and basic concepts
   a. Students are able to determine thermodynamic properties using mathematical models
   b. Students are able to represent design data in terms of curve fits
   c. Students are able to solve basic thermodynamic problems for open systems
   [L: Application] [M: Questions on quizzes, exams]

3. Optimization
   a. Students are able to determine an appropriate cost function
   b. Students are able to perform a simple optimization
   [L: Application] [M: Questions on quizzes]

4. Modeling and design of thermal equipment
   a. Students are able to calculate the performance of turbomachinery
   b. Students are able to calculate the performance of heat exchangers
   c. Students are able to make equipment selection decisions
   d. Students are able to design a heat exchanger
   e. Students are able to design piping systems
   [L: Synthesis] [M: Project report]

5. Engineering Economics
   a. Students are able to understand the time value of money
   b. Students are able to perform a present worth analysis
   c. Students are able to perform interest calculations
   [L: Application] [M: Questions on quizzes]

6. System Design and simulation
   a. Students are able to calculate heating and cooling loads
   b. Students are able to calculate state and system parameters for thermal systems
   c. Students are able to design the operating conditions for a thermal system
   d. Students are able to understand the interaction between equipment selection and
7. Computer Skills and Software Usage
   a. Students are able to write computer programs for basic thermal system analysis
   b. Students are able to use various computer software for thermos-fluid systems
   c. [L: Analysis] [M: Project report ]

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Relationship of course to ME program outcomes

The following measurement standard is used to evaluate the relationship between the course outcomes and the educational-program outcomes:

2 = Strong Emphasis, 1 = Some Emphasis, 0 = Little or No Emphasis.
(a) an ability to apply knowledge of mathematics, science, and engineering—2
(b) an ability to design and conduct experiments, as well as to analyze and interpret data—2
(c) 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—2
(d) an ability to function on multidisciplinary teams—1
(e) an ability to identify, formulate, and solve engineering problems—2
(f) an understanding of professional and ethical responsibility—1
(g) an ability to communicate effectively—1
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context —1
(i) a recognition of the need for and the ability to engage in life-long learning—1
(j) a knowledge of contemporary issues—1
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice—2

Contribution to professional component:
30% Engineering Science 70% Engineering Design

Person(s) who prepared this description
Andre Benard

Date of Preparation
2016