ME 412 Heat Transfer Laboratory

Required or elective
Required

Course (catalog) description
Practices and measurement techniques for heat transfer and thermal systems. Experimental problem solving applied to heat transfer.

Prerequisite(s)
(ME 410) and completion of Tier I writing requirement.

Textbook(s) and/or other required material

Class/Lab schedule: Total Credits: 2 Lecture/Laboratory/Discussion Hours: 1/2/0

Topics covered
a. Laboratory Introduction
b. Error Estimation
c. Thermocouple Fabrication
d. Thermocouple Calibration
e. Conduction Measurements
f. Radiation Measurements
g. Convection Measurements
h. Heat Exchanger Measurements
i. Thermal Systems Measurements
j. Thermal Design/Build/Test/Report Project

Course learning objectives

1. Heat Transfer Measurements and Apparatus
   a. Students fabricate thermocouples
   b. Students demonstrate an understanding about the calibration of thermocouples
   c. Students demonstrate an understanding about the use of thermocouples
   d. Students participate in computer data acquisition
   e. Students calculate uncertainty error
   f. Students identify systematic errors

2. Demonstrating Basic Heat Transfer Principles
   a. Students experience the basic principles of conduction
   b. Students experience the basic principles of convection
   c. Students experience the basic principles of radiation
   d. Students experience the basic principles of heat exchangers
   e. Students experience the basic principles of thermal systems
   f. Students process experimental data to provide meaningful results

3. Employing Experiments in Problem Solving
   a. Students design an experiment to be used in solving a problem
   b. Students participate in a design, build, and test project

4. Communication and Teaming
   a. Students communicate experimental results with a technical memo
   b. Students communicate project results with a technical report
   c. Students are provided with team building experiences

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:
3 = Strong Emphasis, 2 = Some Emphasis, 1 = Little or No Emphasis.
(a) an ability to apply knowledge of mathematics, science, and engineering—3
(b) an ability to design and conduct experiments, as well as to analyze and interpret data—3
(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—3
(d) an ability to function on multidisciplinary teams—3
(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—3
(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—2
(j) a knowledge of contemporary issues—1
(k) an ability to use the techniques, skills, and modern engineering tools necessary for
engineering practice—3
(l) application of advanced mathematics—2
(m) design, build, and test in mechanical systems area—1
(n) design, build, and test in thermal/fluids area—3
(o) capstone design experience—2

Contribution to professional component: 50% Engineering Science  50% Engineering Design

Person(s) who prepared this description: Laura Genik and Craig Somerton

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