Miami University
School of Engineering and Applied Science
Department of Engineering Technology

ENT415	**HEAT TRANSFER with APPLICATIONS**	**3**
Course Number	**Title**	**Credit Hours**

DESCRIPTION: Concepts of the three modes of heat transfer, conduction, convection, and radiation, are discussed separately and in combination. Each mode of heat transfer is presented by relating fundamental principles and computational methods to practical, real-world thermal systems and applications. Practical applications projects from such industries as aerospace, automotive, and chemical processing industries are assigned to reinforce these principles.

PERIODS PER WEEK: 3 Lecture

PREREQUISITE(S): ENT 312

TEXT MATERIAL: Cengel, Yunus A., Introduction to Thermodynamics and Heat Transfer McGraw-Hill 1st Ed., 1997

METHOD OF PRESENTATION:
Classroom presentations will be primarily lectures, discussions, and problem solving sessions.
Assigned homework form the text book, and assigned laboratory projects will be used to present the course materials, prepare students for testing, and course grade determination.

METHOD OF EVALUATION:
The following is the distribution of credit for the required tasks:

Laboratory Projects and Home Work Portfolio	30%
Mid-Term Test-	35%
Final Examination -	35%

OBJECTIVES:
Upon completion of the course each student should be able to:

1) Demonstrate an understanding of the principles of heat transfer.
2) Demonstrate an understanding of how these principles relate to real-world thermal systems applications.
3) Demonstrate knowledge of these principles, through the use of manual and computer generated mathematical models, applied to the solution of simple application oriented problems.

COURSE ASSESSMENT CRITERIA:

Outcome 3 "The ability to apply creative technical skills to the analysis and design of mechanical components and systems**."**
Outcome 8 "Knowledge of heat energy transfer concepts essential to the analysis and design of machines and machine systems."
Outcome 11 "Effective team work skills"
Outcome 14 "Fundamental knowledge of instrumentation used to measure parameters in fluid mechanics, heat transfer, and mechanical vibrations."

ASSESSMENT TOOLS:
Student Evaluations
Lab Assignments and Projects
Tests
Examinations
Employer Surveys
Graduate Surveys

TOPICAL OUTLINE:

Week 1 -	Fundamental Concepts	Chapter 8, sections 1, 2, and 3
Week 2 -	One Dimensional Steady State Conduction	Chapter 8, sections 4, 5, 6, and 7
Week 3 -	Heat Transfer from Extended Surfaces	Chapter 8, sections 8, 9 and 10
Week 4 -	Unsteady Heat Conduction	Chapter 9, Lab 1
Week 5	Forced Convection	Chapter 10, Lab2
Week 6	Mid-Term Test	Chapters 8, 9, and selected parts of 10
Week 7	Natural Convection	Chapter 10 continued, Lab 3
Week 8	Radiation Heat Transfer	Chapter 11, Lab 4
Week 9	Heat Exchangers	Chapter 11 continued
Week 10	Heat Exchangers	Chapter 12, sections 1, 2, 3, 4, and 5
Week 11	Cooling of Electronic Equipment	Chapter 12 continued, Lab 5
Week 12	Final Examination	Chapters 10, 11. and 12

EXPERIMENTAL PROJECT ASSIGNMENTS:

Laboratory Project I – HT11 Laboratory Teaching Exercises A and B –The objectives of this project are:

1. Measure the temperature distribution for steady-state conduction of energy through a uniform plane wall.
2. Demonstrate the effect of change in heat flow on temperature difference.
3. To understand the use of the Fourier Rate Equation in determining rate of heat flow through solid materials for one-dimensional steady flow of heat.

Laboratory Project II – HT11 Laboratory Teaching Exercises C and D –The objectives of this project are:

1. Measure the temperature distribution for steady-state conduction of energy through a composite plane wall.
2. Determine the Overall Heat Transfer Coefficient for the flow of heat through a combination of different materials in series.
3. Determine the thermal conductivity k (the constant of proportionality) of a metal specimen (good conductor)

Laboratory Project III – HT11 Laboratory Teaching Exercises E and F –The objectives of this project are:

1. Demonstrate that temperature gradient is inversely proportional to the cross-sectional area for one-dimensional flow of heat in a solid material of constant thermal conductivity.
2. Demonstrate the effect of contact resistance on thermal conduction between adjacent materials.

Laboratory Project IV – Determine, through the use of three dimensional shape factors, measured temperatures, and input power, the coefficient of thermal conductivity of a known composite.

Laboratory Project V - HT15 Laboratory Teaching Exercise A – The objectives of this project are:

1. Obtain the temperature measurements along an extended surface and make a plot of the data thermocouple position.
2. Compare the experimental plot with one constructed from a theoretical analysis.

Laboratory Project VI – HT16 Laboratory Teaching Exercise A – The objective of this project is to compare experimentally obtained convective heat transfer data with analytically obtained values by constructing a graph of Heat Transfer in Watts for air flow past a circular cylinder.

MIAMI UNIVERSITY LEARNING COMMUNITY:

Miami University is committed to fostering a supportive learning environment for all students Irrespective of individual differences in gender, race, national origin, religion, handicapping conditions, sexual preferences, or age. Students should expect, and help create, a learning environment free from all prejudice. Disparaging comments, sexist or racist humor, or questioning the academic commitment of students based upon these individual differences are behaviors that undermine our learning community. If such behaviors occur in class, please seek the assistance of your instructor or department chair.

Revised by: Professor Ron Earley, May 3, 2007