MME 302
Heat Transfer
Fall 2009

Lecture MWF 9:00 - 9:50 in EB A235

Instructor: Dr. Kenneth W. Miller, Ph.D., P.E., ECC 101b, (320) 308-5522, kwmiller@stcloudstate.edu
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Catalog: Fundamentals and applications of one and two dimension heat transfer through conduction, convection, and radiation. Governing equations and boundary conditions, including finite difference and finite element solutions. Prereq.: MME 200, MATH 311. 3 Cr, F.

Program: Manufacturing Engineering - Elective
Mechanical Engineering - Required

Text: Incropera, DeWitt, Bergman, and Lavine, *Fundamentals of Heat and Mass Transfer*, Sixth Edition, 2007, John Wiley & Sons, New York, ISBN 0-471-45728-0
Supplemental material available through the Desire2Learn class website (requires Huskynet ID and password)
http://huskynet.stcloudstate.edu/d2l/default.asp

References: Adrian Bejan, *Convection Heat Transfer*, Second Edition, John Wiley & Sons, New York, 1995, ISBN 0-471-57972-6

Jaluria and Torrance, *Computational Heat Transfer*, Second Edition, Taylor & Francis, New York, 2003, ISBN 1-56032-477-5

Siegel and Howell, Thermal Radiation Heat Transfer, Fourth Edition, Taylor & Francis, New York, 2002, ISBN 1-56032-839-8

Contents:

Week	Chapter	Topic
24 August	1	Introduction
	2	Conduction, Fourier's Law, Governing Equations
31 August	3	1D steady state conduction

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Contents:

Week	Chapter	Topic
7 September (2 days)	3	Extended surfaces
14 September	4	2D conduction, finite difference and finite element models
21 September	5	Transient conduction
28 September	5	Numerical methods (FDE, FEM)
5 October	6	Introduction to convection Quiz 1
12 October	6	Convection and boundary layers
19 October (2 days)	7	External flow and flat plates
26 October	8	Internal flow, energy balance, laminar flow in tubes
2 November	9	Free convection
9 November	10	Boiling convection Quiz 2
16 November	10	Condensation
23 November (2 days)	12	Radiation concepts, black and gray body, view factors
30 November	13	Radiative exchange for black surfaces and non-black surfaces
7 December	11	Heat exchangers, applications

Grading:	10%	Design Project 1 - conduction
	15%	Design Project 2 - convection
	15%	Design Project 3 – mix mode transfer
	30%	Quizzes (2) - 19 June, 26 June, 3 July

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10% Homework - homework is due at the beginning of the lecture period. After this time, 10% is taken off the score. Homework is not accepted after the beginning of the following lecture. The same policy applies to projects, but the late penalty is 25%.

20% Final Exam - Wednesday, 16 December 2009, 7:30 – 10:00

Course Outcomes and Performance Criteria:

1. Students will have the ability calculate basic heat transfer problems
   - A. Students will demonstrate the ability to solve problems with 1D SS conduction.
   - B. Students will demonstrate the ability to solve problems with 2D SS conduction.
   - C. Students will demonstrate the ability to solve problems with transient conduction.
   - D. Students will demonstrate the ability to solve problems with free and forced convection.
   - E. Students will demonstrate the ability to solve problems with black and gray body radiation.

2. Students will have the ability solve problems using the conservation of energy
   - A. Students will demonstrate the ability to solve problems that combine conduction, convection, and radiation.

3. Students will have an understanding of numerical solutions to heat transfer problems
   - A. Students will demonstrate the ability to generate and solve finite difference solutions to heat conduction problems.
   - B. Students will demonstrate the ability to solve engineering heat transfer problems using finite element methods.

4. Students will have the ability to apply heat transfer solutions to engineering problems
   - A. Students will demonstrate the ability to determine heat exchanger performance and size requirements.

Correlation between Course Outcomes and Program Outcomes

Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
Course Outcomes												
1. Basic Heat Transfer	X				X							X
2. Combined Transfer	X		X		X				X			X
3. Numerical Methods	X				X							X
4. Engineering Problems	X		X		X			X	X			X

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