Elements of Heat Transfer (ME 325)
Fall 2001 (3 Credit Hours)
Course Information, Assessment and Policy Statement

Instructor:	Dr. Jack Leifer	**Office hours**:	"Open Door" Policy
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Lecture: MWF 9:00 – 9:50 AM, Crounse 221
Text: *Fundamentals of Heat and Mass Transfer,* (5th Edition), Incropera and DeWitt (Wiley)
Prereq: MA 214, ME 330, CS 221 and Engineering Standing. Students not meeting these prerequisites will be dropped.

Catalog Course Description: Fundamental principles of conduction, convection and radiation heat transfer. Numerical methods for heat transfer problems. Design and application of heat transfer equipment such as fins and heat exchangers.

Course Goals:[♥] The goals of this class are to:

1. Familiarize the students with the three basic forms of heat transfer.
2. Develop a basic understanding of steady state and transient heat conduction, including simplified and numerical methods of computing conduction heat transfer.
3. Develop an understanding of convection heat transfer correlations for internal and external flows, as well as free and forced convection, with some applications of heat exchangers.
4. Develop a basic understanding of radiation heat transfer applied to gray body radiation exchange, including simple spectral analysis.

Learning Outcomes:[♥] At the completion of this course, the students should:

1. Understand the three modes of heat transfer. This knowledge will be demonstrated by having successfully worked problems in all three areas of heat transfer.
2. Have a working knowledge of basic conduction equations and processes. This knowledge will be demonstrated by being able to compute 1-D heat transfer through composite wall and cylindrical sections, perform numerical computations for 2-D steady state and transient heat conduction.
3. Understand the application of the many convection correlations used for various shapes, fluids, and flow conditions. This understanding will be demonstrated by being able to use appropriate correlations for forced versus free convection, internal versus external flows, and the use of the two commonly applied procedures for designing heat exchangers.
4. Have a basic understanding of radiation heat transfer applied to simple gray bodies. This understanding will be demonstrated by the ability to compute heat transfer between a body totally surrounded by a gray body, as well as radiation exchange between multiple surfaces forming an enclosure.
5. Complete at least one open-ended design problem, and write a concise summary based on the outcome of their design.

[♥] Based on syllabus of Dr. W. Murphy, Fall 1999

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Policy on enrollment: Students may not be enrolled for a third time in any Mechanical Engineering course. If a student has enrolled in ME 325 two times previously and has received two E's, he/she will be dropped from the course.

Homework: Reading assignments and homework assignments are shown on Page 3 of this syllabus. Homework problems will be due the Wednesday following the week they were assigned, and will be collected at the beginning of class. **If you are not in class, it is still your responsibility to keep up with the class, and turn in your assignments by FAX or email.** Homework is to be completed in the format illustrated in the attached sample homework problem. **Homework problems are an integral part of the course. Students cannot reasonably expect to develop the necessary skills in this course unless the homework problems are completed as scheduled. Homework problems will be collected when they are due, and checked off (but not graded in detail).** ***Homework offered for late submission will not be accepted***. Solutions will be available after homework has been turned in.

Quizzes: Short (20-25 minute, one-problem) quizzes will be given periodically, at the beginning of class. Your lowest quiz grades will be dropped. They have been scheduled as follows:

Quiz 1 Friday 8/31/01	Quiz 2 Friday 9/21/01
Quiz 3 Wednesday 10/8/01	Quiz 4 Wednesday 10/24/01
Quiz 5 Wednesday 10/31/01	Quiz 6 Wednesday 11/28/01

Tests: Tests have been scheduled as follows:
Calculators **must** be brought to class

Test I:	Wednesday 9/26/01
Test II:	Wednesday 11/14/01
Final:	Thursday 12/13/01, 8 AM – 10 AM

Make-ups: If you do not notify me of an absence in advance, only extreme circumstances will be considered.

Attendance: Make it a habit to both **attend** class and to arrive to class **on time.** Attendance will be recorded. If you have to miss class, make sure you get the lecture notes from a classmate, as well as handouts or any important announcements pertaining to the schedule, etc. Please refer to p. 49 of the *University of Kentucky 2000-2001 Bulletin* for details. Absence from more than two class sessions for any reason may result in a grade of *E* (which is a failing grade).

Tobacco, food and drink: PCC policy prohibits the consumption of food, drink, or tobacco in classrooms and laboratories.

Design Project: As mentioned in the Learning Outcomes, you will be expected to complete at least one open-ended design project, and submit a short (5-7 page) report outlining your results and methodology. I will offer a list of topics later in the semester. Reports are to be typed in Microsoft Word (or similar text processing program), and are to be checked by you for accurate spelling and grammar. As an engineering professional, you will find that the appearance and accuracy of your written documents will matter as much as their technical content, therefore, your reports will be graded on writing quality as well as content. You are encouraged to take advantage of PCC's writing center for assistance. This report will be due in class on Friday December 7th.

Computer access: Computers for engineering student use are generally available in the student computer labs M-Th until 10:30 PM, and on certain weekends. All software needed for this class is installed on those computers. Additional lab hours will be announced as they become available.

Special Circumstances: If you have a learning or physical disability which might affect your performance in this class, please contact Bonita Lykins as soon as possible for further instructions. Once an evaluation has been made, appropriate accommodations will be determined.

Course Grading: Grades for the course will be determined as follows:

Collected homework:	10%	A = 90 - 100
Quizzes:	25%	B = 80 - 89
Project/Report:	10%	C = 70 - 79
Tests:	30%	D = 60 - 69
Comprehensive Final Exam:	25%	E = Below 60
Total:	100%	

Cheating and Plagiarism: The University's minimum penalty for cheating or plagiarism is a failing grade for the course.

Midterm Grade: An estimate of the midterm grade will be made prior to the withdrawal deadline.

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Tentative Course Outline:[♣] The following topics will be covered in this course, in the order shown. Homework assigned during week *n* should be turned in the Wednesday of week *n+1* **at the beginning of class. Late homework will not be accepted.**

Week	Month	M	W	F	Topic	Sections	Problems
1	Aug.		22	24	Introduction Conduction Equation	Chapter 1 Chapter 2	1: 9,22,30,38,52 2: 8,18,32
2	Aug.	27	29	31[Q1]	Conduction Equation 1-D Steady State Conduction	Chapter 2 3.1 – 3.4	2:39,45 3: 7,12,39
3	Sept.	3[NC]	5	7	1-D with generation Extended Surfaces	3.5 3.6 – 3.7	3: 57,91 3: 99,109
4	Sept.	10	12	14	Fin Analysis and Design Fins, Shape Factors Finite Difference Equations	3.6 – 3.7 4.3 4.4 – 4.6	3: 121,132 4: 11,29 4: 75*
5	Sept.	17	19	21[Q2]	Lumped Capacitance Method Spatial Effects	5.1 – 5.3 5.4 – 5.6	5: 5,20 5: 42, 82
6	Sept.	24	26[T1]	28	Semi-infinite solid/mult dimension Finite Difference Equations	5.7 – 5.8 5.9 – 5.10	5: 79,91 5: 126*
7	Oct.	1	3	5[NC]	Intro to Convection Boundary Layer Equations	6.1 – 6.4 6.5 – 6.7	6: 6,21 6: 32,56
8	Oct.	8	10[Q3]	12	Boundary Layer Analogies External Flow, Flat Plate	6.8 – 6.11 7.1 – 7.3	none 7: 7,29,54
9	Oct.	15	17	19	External Flow – Other Shapes Internal Flow Fully Developed	7.4 – 7.9 8.1 – 8.3	7: 82,89 8: 15,42
10	Oct.	22	24[Q4]	26	Internal Developing Flow	8.4 – 8.10	8: 55,89,90
11	Oct.	29	31[Q5]	1	Free Convection, Plates Free Convection, other shapes	9.1 – 9.5 9.6 – 9.11	9: 7,39 9:92,108
12	Nov.	5	7	9	Heat Exchangers	Chapter 11	11: 20,35,59,69
13	Nov.	12	14[T2]	16	Introduction to Radiation Blackbody Radiation	12.1 – 12.2 12.3 – 12.4	12: 7,16 12: 21,49,88
14	Nov.	19	21	23[NC]	Surface Properties View Factors	12.5 – 12.9 13.1	12: 77,94 13: 1,7
15	Nov.	26	28[Q6]	30	Radiation Exchange	13.2 – 13.4	13: 36,60,70,73
16	Dec.	3	5	7	Multimode Heat Transfer Review	13.2 – 13.4	13: 74,120

Notes:

(1) Please note that the homework programs shown represent the minimum amount of work a student should do if he or she expects to pass the course. Other problems that should be completed (but are not subject to collection) are those examples shown in class, and the solved example problems included in your textbook.

(2) Working on assignments in groups is encouraged. Studies have shown that students learn faster and retain more when they participate in study groups. If you have trouble finding an appropriate group, please contact the course instructor.

(3) Although group work is encouraged, you must turn in your own work. Please indicate the names of any study partners on your homework. Note the penalties for plagiarism stated previously.

(4) This is a fast-paced class. Preparing for each lecture by reading the assigned sections is essential, as there is too material to allow all of it to be covered in detail!

(5) This is a three-hour class. If you expect an average grade, it should be expected that three hours of outside preparation are required for every hour you spend in class, on the average. Adjust your outside commitments accordingly!

[♣] Based on the syllabus of D.R Munoz, Colorado School of Mines, Spring 2001