

## ENGR 4123/5023 Heat Transfer / Thermal Science

Fall 2010

Department of Engineering and Physics

University of Central Oklahoma

<b>Location</b>	Howell Hall 100
<b>Time</b>	TR 4:00 – 5:15 p.m.
<b>Instructor</b>	Evan Lemley, Ph.D.; Prof. of Engineering and Physics
<b>Office</b>	Howell Hall 221D
<b>Web</b>	<a href="http://evan.lemley.org">http://evan.lemley.org</a>
<b>email</b>	<a href="mailto:elemley@uco.edu">elemley@uco.edu</a>
<b>Phone</b>	(405)974-5473
<b>Office Hours</b>	MWF 11:00 a.m. – 12:00 p.m.
<b>Final</b>	R Dec 16, 2010 from 3:00 – 4:50 p.m.

### Course Description

This course includes advanced coverage of conduction, convection, and radiation heat transfer. This course emphasizes specification of problem and boundary conditions along with interpretation of results from the successful use of numerical and analytical techniques. Some recent developments in computational heat transfer and fluid flow will be covered with particular emphasis on algorithms and implementation of numerical solvers for incompressible flow and heat transfer.

### Prerequisites

ENGR 3443, MATH 3103, and ENGR 3703 (or concurrent enrollment)

### Textbook

***Fundamentals of Heat and Mass Transfer, Sixth Edition*** by Frank P. Incropera, David P. DeWitt, Theodore L. Bergman, and Adrienne S. Lavine, 6th Edition, ISBN: 978-0-471-45728-2, Wiley, 2007.

### Other Books (not required, but the instructor frequently uses these as references for this course)

*A Heat Transfer Textbook*, 3<sup>rd</sup> Edition, John H. Lienhard IV and John H. Lienhard V, Phlogiston Press, Cambridge MA, 2002.

This book is available via the web at <http://web.mit.edu/lienhard/www/ahtt.html>.

*Convection Heat Transfer*, Adrian Bejan, Published by Wiley, 1984, ISBN = 0471896128, 9780471896128.

*Conduction Heat Transfer*, Vedat S. Arpaci, Published by Addison-Wesley Pub. Co, 1966, ISBN = 0201003597, 9780201003598

*Thermal Radiation Heat Transfer*, John R. Howell & Robert Siegel, 1981, Published by HPC, ISBN = 0070573166.

## General Topics

1. Introduction
2. Introduction to Conduction
3. One-dimensional, Steady-State Conduction
4. Two-dimensional, Steady-State Conduction
5. Transient Conduction
6. Introduction to Convection
7. External Flow
8. Internal Flow
9. Free Convection
10. Boiling and Condensation (time permitting)
11. Heat Exchangers
12. Radiation: Processes and Properties
13. Radiation Exchange Between Surfaces

## Calculator

For exams in this course (unless specifically indicated otherwise) you may use any calculator on the following list:

<http://www.ncees.org/exams/calculators/index.php#approved>

## Engineering Paper

Engineering Paper -- available from the UCO bookstore, Thompson's Bookstore, and Triangle A&E at Broadway Ext. and 63rd. Please use engineering paper for all homework assignments.

## Internet & E-mail

Access to the Internet and ability to send and receive E-mail. If you do not have a computer at home you can use machines on the UCO campus: Look at

<http://technology.ucok.edu/support/microcomplab.htm>

for a full list of available general use computers on campus.

Note: E-mails directed to the entire class such as class announcements will go to your official UCO e-mail address (the address that ends in *ucok.edu*).

## Portable Electronic Devices (including cell phones)

Please turn off any portable electronic devices (esp. cell phones) during class. You may not access any portable electronic device during exams except calculators that are on the approved list (See link above).

## Laptops

Access to laptop computers during lectures is not prohibited. If there is a reason to think you using your laptop for reasons other than those related to the lecture or current class activities you will be asked to put the laptop away. Abuse of this privilege could result in a complete ban of laptops in the course.

## Instruction Techniques

Lecture will be used predominantly although sometimes recitation periods will be employed. Lectures often involve examples and are ***encouraged to be as interactive as possible***.

## Class Polices

- Prepare before you arrive in class by reading sections ahead of time.
- Come to class (some lecture info will be placed on the course website – which you should

review as well as attend class). Attendance in lecture sessions is **very strongly recommended and VVVV**. This is not the only one way you learn, but come prepared for the session and you will learn as much as possible.

- Take notes.
- Listen carefully.
- Keep background conversation and noise to a minimum in class and lab.
- You are responsible for paying attention to all class announcements and notes. Sometimes the course web-site may not have the latest announcements.
- Attendance is mandatory for all exams or other graded activities (e.g. project competitions or presentations).
- Cheating or academic dishonesty of any kind will not be tolerated (see Code of Student Conduct – [http://evan.lemley.org/courses/2006\\_2007\\_cosc.pdf](http://evan.lemley.org/courses/2006_2007_cosc.pdf) )

### **Errors**

It is possible given the amount of information covered that the instructor may occasionally make a mistake in the course of a lecture or there will be either a poorly grasped or poorly explained topic. The instructor will attempt at the earliest possible opportunity to either correct the mistake or issue a different or better explanation of a particular topic.

### **Homework**

Working HW problems in a timely manner is the best way to do well on exams and in the class as a whole. Homework is due at the beginning of the class period on the due-date or due-day. Each HW problem you turn in is worth ten points. Some problems will be graded on detailed solutions and others will be graded on effort. I will **not** tell you ahead of time which or how many problems will be graded relative to a detailed solution, but on the returned and graded HW paper a check mark next to the problem number will indicate full effort (or ten points) and a numerical score (e.g. 8/10) next to the problem number will be used on those problems under more scrutiny.

#### Paper Homework

Homework papers should be folded length-wise with your name written on the outside of the folded pages before turning it in. Each problem should fit all of the following criteria: clearly labeled, **one problem per sheet of paper**, legible and organized. HW papers that do not fit these criteria will be penalized accordingly. See the following link ( [http://evan.lemley.org/courses/hwk\\_format.php](http://evan.lemley.org/courses/hwk_format.php) ) for details on the presentation of HW problems. You may also visit the following site for an electronic version of the homework format requirements:

#### Electronic Assignments

These may be homework, design projects, or other projects that require an electronic document to be sent to Dr. Lemley.. What will need to be turned in will vary, but whatever documents you need to submit should be attached to an e-mail message to Dr. Lemley. File names should be distinct from other students – following is the general format for file names:

***date\_lname\_assignment.ext***

where

*date* =  
current date in MMDDYY format

*lname* =  
last name

*assignment =*

assignment (e.g. hw for a homework, dpr for design project, prg for a programming project)

*ext =*

file extension that indicates the type of file (e.g. doc for a Word document, program source, xls for a spreadsheet, ppt for a PowerPoint presentation, etc...)

### Late Homework/Assignments

Homework is generally due at the **beginning of class**. HW turned in after this time will have 20% deducted per late class period. For example: if a paper is turned in one minute after class begins on the day it is due, 20% will be deducted. If it is turned in one minute before the next class meeting time after the assignment is due, 20% will also be deducted. Dr. Lemley will check e-mail just before class – any electronic assignment must be received by the due date/time, or 20% will be deducted.

### **Project**

There will be a project in this course which will constitute a significant portion of your grade. More information will be given to you at the time the project assignment is made.

### **Grading Policies**

The following table shows the breakdown of credit for the course.

HW (~10)	10%
Exams (2)	35%
Project (1)	25%
Final Exam (1)	30%
<b>Total</b>	<b>100%</b>

### **Tentative Grading Scale**

90-100% -- A, 80-90% -- B, 70-80% -- C, 60-70% -- D, <60% -- F

### **Final Exam Policy and Exam Attendance**

The final exam in this course will be comprehensive and will take place as shown in the tentative schedule included in the syllabus. In the case that a student scores higher on the final exam than their lowest regular exam, the lowest regular exam score will be replaced by the final exam score. In no event will the final exam score be discarded. Attendance for all exams is required unless an event beyond the student's control intercedes. A missed exam may be excused if the student notifies the instructor as soon as possible (before the exam occurs if possible). Official notification of the reason for the missed exam should be sent via e-mail.

### **STUDENT INFORMATION SHEET / SYLLABUS ATTACHMENT**

<http://broncho2.uco.edu/academicaffairs/StudentInfoSheet.pdf>

**ENGR 4123 Tentative Schedule for Fall 2010**

<b>Week</b>	<b>Date</b>	<b>Day</b>	<b>Planned Activities</b>
1	08/24/10	Tue	Introduction
	08/26/10	Thu	1-Dim. Steady State Conduction
2	08/31/10	Tue	1-Dim. Steady State Conduction
	09/02/10	Thu	1-Dim. Steady State Conduction
3	09/07/10	Tue	2-Dim. Steady State Conduction
	09/09/10	Thu	2-Dim. Steady State Conduction
4	09/14/10	Tue	2-Dim. Steady State Conduction
	09/16/10	Thu	Transient Conduction
5	09/21/10	Tue	Transient Conduction
	09/23/10	Thu	<b>Exam 1</b>
6	09/28/10	Tue	Transient Conduction
	09/30/10	Thu	Transient Conduction
7	10/05/10	Tue	Intro to Convection
	10/07/10	Thu	External Flow
8	10/12/10	Tue	External Flow
	10/14/10	Thu	External Flow
9	10/19/10	Tue	Internal Flow
	10/21/10	Thu	<b>NO CLASS – Fall Break</b>
10	10/26/10	Tue	Internal Flow
	10/28/10	Thu	Internal Flow
11	11/02/10	Tue	<b>Exam 2</b>
	11/04/10	Thu	Free Convection
	<b>11/05/10</b>	<b>Fri</b>	<b>Last Day to Drop</b>
12	11/09/10	Tue	Free Convection
	11/11/10	Thu	Radiation: Processes and Properties
13	11/16/10	Tue	Radiation: Processes and Properties
	11/18/10	Thu	Radiation Exchange Between Surfaces
14	11/23/10	Tue	Radiation Exchange Between Surfaces
	11/25/10	Thu	<b>NO CLASS – Thanksgiving</b>
15	11/30/10	Tue	Heat Exchangers
	12/02/10	Thu	Heat Exchangers
16	12/07/10	Tue	Heat Exchangers
	12/09/10	Thu	Boiling and Condensation
17	12/16/10	Thu	<b>FINAL – 3:00 – 4:50 p.m. HOH 100</b>