

ME 4210 HEAT TRANSFER THEORY & LABORATORY

Winter 2005

Dr. J. C. Ku

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Class: 0293 Manoogian 3:30-5:20 PM M W

Office (2117 Eng.) Hours: 3-3:20, 5:30-7 PM M W
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TA : Mr. Mian Wang, 313 577-8896, al1460@wayne.edu, 2116 Eng.; 2-4 PM T & 10-noon Th.

Text : Fundamentals of Heat and Mass Transfer, 5th ed., Incropera & DeWitt, Wiley, 2001

References : Lecture Notes (PowerPoint Slides), Ku, Mechanical Engineering, WSU
Heat Transfer Laboratory Manual, Ku, Mechanical Engineering, WSU

The course consists of mostly regular lectures and 2 lab experiments. Students are required to sign up for laboratory sessions, **most of which are on different days/hours during the week.**

Prerequisites: ME 3300, BE 3040, BE 3220 and ENG 3050. (completed **all** with **C- or better.**)

Material Fee Requirements: \$25

Course Learning Objectives:

(Letters in brackets refer to BSME Program Educational Objectives A - J. Numbers in brackets refer to the methods of evaluation, with 1 = Homework; 2 = Quizzes & Exams; 3 = Projects & Competitions; 4 = Presentations; and 5 = Lab Reports.)

Students who successfully complete ME 4210 will be able to:

- understand heat transfer fundamentals, and apply them to engineering problem solving [A, C, E, G; 1, 2, 5]
- understand and practice heat transfer measurements in laboratories, and compare measurements with theories [A, C, D, E, G, H; 1, 2, 5]
- use Excel for data analyses and engineering plots, and use Word for technical report writing [B, D; 1, 5]
- consider experimental design issues for heat transfer laboratories [I; 5]

Relationship of Course to Program Educational Objectives:

Strongly contributes to the BSME Program Educational Objectives that successful students will:

- be able to understand scientific principles and apply them to the practice of engineering [A];
- possess the problem-solving skills, background, and confidence necessary to educate themselves continually throughout their careers [C];
- be able to apply the basic principles of measurement, data analysis, and design of experiments, learned through “hands-on” laboratory experience [E].

Contributes to the BSME Program Educational Objectives that successful students will:

- be able to communicate effectively [B];
- be able to apply computers as tools for engineering [D];
- be able to develop creative solutions to engineering problems [G];
- be able to work well as part of a team [H];
- be able to apply the design process to engineering problems, including the consideration of different technical alternatives while bearing in mind cost, environmental concerns, safety, and other constraints [I].

Grading and Other Policies:

1. Point distributions for the theory part are: 12% for homework, 12% for pop quizzes, and 17% each for 1st, 2nd, and 3rd exams. **All test scores will count – we don't throw out the worst.**
2. Point distributions for the lab part are: 2% for homework, 3% for pre-labs, 6% for reports, and 14% for 2 exams. Deductions will be assessed for tardy or missing labs. **Students will be required to repeat unacceptable lab assignments or reports.**
3. The grades are (**roughly**): A = 80 & above, B = 70 – 80, C = 60 – 70, D = 50 – 60, and E = below 50. These are based on **straight points with no curving**. **Students may fail the class for not maintaining C or better in both theory and lab part of the course.**
4. All quizzes and exams are **closed book** and **no notes** are allowed. Formulas and data will be provided. **Bring your own paper** – Bluebook optional. Stapled letter-size paper acceptable.
5. **Cheating, including collaborating in exams or lab assignments, will result in a grade of E for the course. Please read carefully the STUDENT CONDUCT clause attached.**
6. There will be **no makeup exams or projects** of any kind. **Instructor's approval in advance** is required for missing any quizzes/exams or lab assignments. **Late homework or lab report will not be accepted and will not be graded.**
7. Homework problems will be assigned with answers provided. For each set assigned, **only a randomly selected subset of problems will be graded. 3 to 4 pop quizzes** will be given on any of the days when homework is due. Quiz problems could be from any chapters already covered. Selected homework solutions will be posted on Blackboard.
8. Observe the withdrawal deadlines for tuition refund, etc. After the engineering deadline, withdrawal is allowed only under exceptional circumstances (poor grades not included).
9. Students are advised to spend 20 hours per week on this course.
10. **Assignments are required to be turned in at the beginning of class or 1st lab session.**

Student Conduct: *[Copying or collaborating on assignment is considered as CHEATING.]*

It is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavors. Thus, a student should not falsely claim the work of another as his/her own, or misrepresent him/herself so that the measures of his/her academic performance do not reflect his/her own work or personal knowledge. In this regard, cheating will not be tolerated. Cheating includes (but is not limited to) any communication (written or oral) during examinations and sharing of work, such as using the same models or computer programs or copying work. All homework and projects must be an individual effort unless specifically noted. **STUDENTS WHO CHEAT ON ANY ASSIGNMENT OR DURING ANY EXAMINATION WILL BE ASSIGNED A FAILING GRADE FOR THE COURSE.** Therefore avoid all appearance of improper behavior! Students who witness cheating should report the incident to the instructor as soon as possible. Students are also welcome to discuss any concerns related to cheating with Dr. K. A. Kline, Chair of Mechanical Engineering.

Schedule for Lectures, Homework Assignments, Exams, and Labs (*labs in italicized font*):

<u>Date</u>	<u>Section</u>	<u>Materials Covered</u>	<u>Quiz/Exam/Lab*</u>
1/10 M	1.1-4	Intro. to Cond., Conv., & Rad., Energy Balance	
1/12 W	1-4, 2.1-4	Energy Balance, Intro. to Cond., Conductivity	
1/19 W	3.1,3-4	1-D SS Conduction - Plane Wall, Thermal Resistance	Chap. 1 & 2
1/24 M	3.3-4,6	1-D SS Conduction - Radial Systems, Fins	
1/26 W	5.1-2	Trans. Cond. - Lumped Capacitance Analysis	Chap. 3
1/31 M	5.4-6	Trans. Cond. - Approx. Solution & Heisler Charts	
2/2 W	---	<i>Lab Grouping, Word Processing and Spreadsheet</i>	Chap. 5
2/7 M	---	1st Exam – Conduction	Exam 1
2/9 W	6.1–3, 6-8	Introduction to Convection	
2/14 M	7.1-3	Convection - Flow over a Flat Plate	<i>Lab HW</i>
2/16 M	7.4-6	Convection - Cylinders, Spheres, & Tube Banks	
	8.1, 2	Velocity- & Temperature-profiles in Pipe Flows	
2/21 M	8.3-5	Convection Correlations for Pipe Flows	Chap. 6 & 7
2/23 W	9.1-6,9	External Free and Mixed Convection Correlations	Chap. 8
	11.1-5 (reading)	Heat Exchangers: Types, LMTD and ϵ -NTU Analyses	
2/28 M	---	<i>Lecture for Lab #1 Convection</i>	Chap. 9
3/2 W	---	<i>Lab #1 Convection (lab session, no class)</i>	<i>Pre-lab #1</i>
3/7 M	---	<i>Lab #1 Convection (lab session, no class)</i>	
3/9 W	---	Exam for Lab #1 Convection	Lab Exam
		<i>Lecture for Lab #2 Radiation</i>	
3/21 M	---	<i>Lab #2 Radiation (lab session, no class)</i>	<i>Pre-lab #2</i>
3/23 W	---	<i>Lab #2 Radiation (lab session, no class)</i>	<i>Lab #1</i>
3/28 M	---	2nd Exam – Convection	Exam 2
3/30 W	---	Exam for Lab #2 Radiation	Lab Exam
4/4 M	12.1-2	Radiation Intensity, Emission/Irradiation/Radiosity	<i>Lab #2</i>
4/6 W	12.3	Blackbody Radiation	
4/11 M	12.4-7	Emission, Absorption, Reflection, & Transmission	<i>Lab #2</i>
4/13 W	13.1	The View Factor	Chap. 12
4/18 M	13.2-3	Blackbody Radiation Exchange; Radiation between Diffuse, Gray Surfaces	
4/20 W	---	Make-up class, if necessary. No class otherwise.	Chap. 13
4/25 M	---	3rd Exam – Radiation	Exam 3

* ***Homework assignments and reports are collected at the beginning of class, pre-labs are collected at the beginning of the 1st lab session. Turning in assignments at the ME front desk is NOT recommended.***

‡ ***Schedule for lab sessions will be announced later.***