CH EN 3453 – Heat Transfer

Fall 2014 Syllabus

Meets MWF 8:35-9:25, WEB 1250

INSTRUCTOR	Prof. Kevin Whitty kevin.whitty@utah.edu Phone: 585-9388 Office hours: Open door policy, or by appointment Office: MEB 3290E
ASSISTANTS	Cody Barnhill ta1@chen3453.com Bethany Cox ta2@chen3453.com
MEETING	Lecture MWF 8:35–9:25 Warnock Engineering Building (WEB) Room 1250 Help session Wednesdays 4:30–5:30 Merrill Engineering Building (MEB) Room 2325
TEXTBOOK	Bergman, Lavine, Incropera and Dewitt Fundamentals of Heat and Mass Transfer 7th ed. (2011), John Wiley & Sons, Hoboken, NJ ISBN 978-0-470-50197-9 *<u>NOTE:</u> The 6th edition (2007) by Incropera et al. is also acceptable*
WEB PAGE	www.chen3453.com
PREREQUISITES	Major Status in Chemical Engineering, CH EN 2300 (Thermodynamics I), CH EN 2450 (Numerical Methods), CH EN 2800 (Process Engineering)

GRADING

Homework:	18%
Midterm #1:	20%
Midterm #2:	20%
Final Exam:	30%
Project:	12%

At the end of the semester, all student scores will be normalized to the highest student in the class. For example, if the top student received 93% of the total points available, then all students' scores will be divided by 0.93. Once normalized, grades will be distributed according to the following scale:

95-100	A	70-75	C+
90-94	A-	65-70	C
85-90	B+	60-65	C-
80-85	B	50-60	D
75-80	B-	0-50	E

The instructor reserves the right to lower the scale (thus improving student grades) and to reevaluate the scores of students who just miss a grade. All grades are final and are not open to discussion. As with all classes, the best way to ensure a good grade is to actively participate in class, learn the material, turn in homework on time, work hard on the project and study for the exams.

HOMEWORK

There are 12 homework assignments. Each counts for 1.5% of the overall grade, for a total of 18%. Homework due dates are shown on the schedule. Homework must be turned in to the Chemical Engineering Office (MEB 3290) by 4 pm on the day it is due. The policy for homework turned in late is as follows:

After 4:00 pm on the day it is due:	minus 50% of the grade
After 9:25 am the following class period:	no credit

This is a strict policy. Students should recognize that each homework assignment is 1.5% of the overall grade, and that if they neglect to turn in even one assignment, it can mean the difference between an A and an A-minus.

Homework assignments are equally weighted. Solutions will be posted on the web after graded homework is returned. Students are encouraged to work with other students on homework. Students should be able to set-up, solve, and understand all problems.

A help session will be held most Wednesday afternoons at 4:30 pm so that students may get assistance with challenging homework problems or get clarification on concepts of heat transfer.

EXAMS

Two midterms and one final exam. All exams are closed book. Each student will be allowed to bring to the test a single 8.5 x 11 inch piece of paper with notes written on both sides. To receive full credit for solutions, students must write out all equations used, state the values substituted in those equations and show all work.

Make-up exams are given only in very exceptional circumstances. If a student is not able to be present during exam time, arrangements will be made for the student to take test at the University Testing Center. The Testing Center charges students a nominal fee for this service.

PROJECT

The project for the class focuses on analysis of and reporting on performance of a shell-and-tube heat exchanger. The class will spend one day in the Department of Chemical Engineering's projects lab and will acquire data for the shell-and-tube heat exchanger. A key element of the project will be scientific reporting. Several class periods will be devoted to report structure, scientific writing, experimental design, data analysis and presentation. Each student will be required to write a formal report about the shell-and-tube heat exchanger experiments. The students will receive guidance as they go through this process.

COURSE DESCRIPTION

Heat transfer occurs by three modes: conduction, convection, and radiation. This course introduces methods for calculating rates of heat transfer by these three modes. The calculations usually involve energy balances and may include phase changes and flow of material to and from the system. Applications of heat transfer are extensive and include process engineering, energy conservation, environmental engineering, design of buildings, biomedical engineering, and combustion. This class encourages use computational tools including Excel, Matlab, Polymath, and the IHT software available on the book's student companion site to solve some of the problems.

COURSE OBJECTIVES

By the end of this course students will be able to:

1. Demonstrate effective approaches to solving homework problems and presenting their solutions, including the use of tools like Excel, Matlab, Polymath, and the IHT software bundled with the book.
2. Work effectively in a team to solve homework problems and to produce a well written, technically clear report.
3. Convert between the United States Customary, SI, and metric units systems.
4. Apply the accounting equation to mass and energy to formulate and solve heat transfer problems.
5. Use the Fourier Law and energy balances to formulate and solve steady and unsteady problems involving conduction.
6. Use the Newton Law of cooling, correlations, and energy balances to formulate and solve heat transfer problems involving forced and natural convection.
7. Use radiation exchange concepts to formulate and solve problems involving radiant heat transfer between multiple surfaces that can be approximated as black or gray bodies.
8. Solve problems that involve all three modes of heat transfer: conduction, convection, and radiation.
9. Apply principles of heat transfer to process engineering design calculations.
10. Discuss the relationships between heat transfer and ethical, societal, environmental, health and safety issues.

ADA STATEMENT

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

ACCOMMODATIONS POLICY

Although this is not considered to be a controversial course, it is not out of the realm of possibility that some of the writings, lectures or presentations in this course may include material that conflicts with the core beliefs of some students. Please review this syllabus carefully to see if this course is one that you are committed to taking. If you have a concern, please discuss it with me at your earliest convenience.

OTHER SUGGESTED MATERIALS

Although not required for this course, the following books are very useful and would be a good investment for any engineer:

Taylor, J.R. *An Introduction to Error Analysis. The Study of Uncertainties in Physical Measurements,* 2nd ed.; University Science Books: Sausalito, CA, 1997. ISBN 0-935702-42-3. (About $45 on Amazon.Com)

The ACS Style Guide. Effective Communication of Scientific Information; Coghill, A.M., Garson, L.R., Eds.; Oxford University Press: New York, NY, 2006. ISBN 0-8412-3999-1. (About $45 on Amazon.Com)