Syllabus for Chemical Engineering 3453 Heat Transfer

Fall Semester 2015

University of Utah

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Office hours: Stop by anytime or by appointment

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Office: 1622 WEB (tutoring center)
e-mail: luke.kooyman@utah.edu
Tutoring hours: Tuesdays 11:45 AM -12:45 PM
Thursdays 11-noon

Meetings: Monday, Wednesday, Friday 11:50 – 12:40, MEK 3550
Study Session: Question and answer session Mondays, 4:10 PM – 5:00 PM, WEB L120

Prerequisites: Grade of C- or higher in MATH 2250 and Major Status in Chemical Engineering.


Suggested Reference


Course Content and Objectives

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 change and mass balances. Applications of heat transfer are extensive and include power generation, process engineering, energy conservation, environmental engineering, design of
buildings, biomedical engineering, and combustion. This class will use computational tools such as MATLAB, Polymath, and Excel to solve some of the problems.

By the end of this course you will be able to

1. Demonstrate effective approaches to solving homework problems and presenting their solutions, including the use of tools like Excel, Polymath, and MATLAB.
2. Work effectively in a team to solve homework problems, complete a heat transfer lab, and 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.
8. Make furnace calculations involving participating media.
9. Solve problems that involve all three modes of heat transfer: conduction, convection, and radiation.
10. Apply principles of heat transfer to process engineering design calculations.
11. Discuss the relationships between heat transfer and ethical, societal, environmental, health and safety issues.
12. Make mass transfer calculations for dilute systems that are based on heat transfer analogies.

**Grading**

The weightings for the exams and assignment are given below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>First exam</td>
<td>20%</td>
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<tr>
<td>Second exam</td>
<td>20%</td>
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<tr>
<td>Final exam</td>
<td>30%</td>
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<tr>
<td>Lab project</td>
<td>15%</td>
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<tr>
<td>Homework</td>
<td>10%</td>
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<tr>
<td>Muddiest point</td>
<td>5%</td>
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</tbody>
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Final grades will be based on the following table. The table represents grade guarantees. I reserve the right to lower the scale and to reevaluate the scores of students who just miss a grade. The high score in the class will be used to scale all other scores. For example, if the high score is 95%, all scores will be divided by 0.95. I reserve the right to lower the score used for scaling.
<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
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<tbody>
<tr>
<td>93-100</td>
<td>A</td>
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<tr>
<td>90-93</td>
<td>A-</td>
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<tr>
<td>85-90</td>
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<td>80-85</td>
<td>B</td>
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<tr>
<td>75-80</td>
<td>B-</td>
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<td>70-75</td>
<td>C+</td>
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<td>65-70</td>
<td>C</td>
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<tr>
<td>60-65</td>
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<td>50-60</td>
<td>D</td>
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<td>&lt; 50</td>
<td>E</td>
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**Examinations**

All examinations are closed book, notes, and homework. You may bring one 8.5-by-ll-inch, handwritten sheet of notes into the exams. All required conversion factors and data will be provided with the exam. The notes will not be turned in with your exam. Sample exams are available on the class website. Assigned seating will be used for all exams.

Exams 1 and 2 will be 55 minutes long, from 11:50 AM to 12:45 PM, on the dates specified on the class website. The final, comprehensive exam will be 120 minutes and is scheduled from 10:30 – 12:30 on Monday, December 14. All exams will be held in WEB 2230.

Calculators are permitted but cell phones and smart watches must be stowed away and out of sight. If you must leave the room during an exam, your exam must be turned over to me or a TA.

To receive credit for your solutions, you must write out all equations that you use and you must state all values substituted in those equations. You must show all of your work to receive credit.

No make-up exams will be given except in exceptional circumstances. If you must miss an exam, please notify me before the exam.

**Project**

You will be working in teams of three to make heat transfer measurements in the Projects Lab and will be preparing a project report as outlined at http://www.che.utah.edu/~geoff/writing/report_writing.pdf. Examples of various report formats and guidelines for literature references are available at http://www.che.utah.edu/~geoff/writing/.

**Homework**

Solutions to the homework are due by 11:59 PM on Tuesdays and must be submitted electronically through CANVAS as a single PDF file.
Late homework will not be accepted unless you have made prior arrangements with me. Late homework will not be accepted after the solutions have been posted. The neatness, organization, and completeness of your homework are important. The text (Sect 1.5) outlines a useful approach for problem solving. You need not follow that methodology, but it may be helpful. It is important that you develop a systematic, organized approach that works for you.

To receive full credit for your solutions, you must write out all equations that you use and you must state all values substituted in those equations. You must show all of your work to receive credit.

Homework assignments will be equally weighted. The solutions will be posted in CANVAS. I encourage you to work with other students on the homework but you must turn in your own solution. You may not turn in identical copies. You should be sure that you can set-up, solve, and understand all of the problems on your own.

**Muddiest Point of the Week**

What is the muddiest point (MP) in the material covered in the previous week? What concept, definition, problem formulation, or solution caused you the most difficulty? The MPs are due by 5 PM on Tuesdays and should briefly state the muddiest point and provide an attempted solution or explanation. The MPs must be submitted through CANVAS as a single PDF file. I will respond to these points in class.

**Using E-mail**

I will be using your utah.edu email address. You should check it regularly or arrange to have it forwarded. I will not be using the mail system that is part of Canvas.

**Academic Misconduct**

All instances of academic misconduct will be handled in accordance with the Student Code (http://regulations.utah.edu/academics/6-400.php).

**Addressing Sexual Misconduct**

Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran’s status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).
Students with Disabilities

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, http://disability.utah.edu/, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and Prof. Silcox to make arrangements for accommodations.

All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.