ME 419

Prerequisite: ME 303, 304
Corequisite: ME 400

Eng ME 419 - Heat Transfer

Fall 2015

Instructor

Prof. **Chuanhua Duan** (Course coordinator)
Lecture Section A1: TT 2-4 pm, PHO 201
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Graduate Teaching Fellow

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Course Description

This course covers the fundamentals of heat transfer from a macroscopic view with emphasis both on understanding why matter behaves as it does and on developing practical problem solving skills. The course is divided into four parts: introduction, conduction, convection, and radiation. Topics will include: introduction to heat transfer; steady state heat conduction; transient heat conduction; introduction to convective heat transfer; external forced convection; internal forced convection; natural/free convection; heat exchanger analysis and design; blackbody radiation and radiative properties; radiative exchange between surfaces.

Course Objectives

Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to conduction, convection and radiation heat transfer; use appropriate analytical and computational tools to investigate conduction, convection and radiation heat transfer; are both competent and confident in interpreting results of investigations related to heat transfer and thermal design; recognize the broad technological and historical context of where heat transfer is important.

Course Prerequisites

Students are expected to be familiar with fluid dynamics (ME 303 or equivalent), thermodynamics (ME 304 or equivalent) and engineering mathematics with partial differential equations (ME 400 or equivalent).

Course Website

Under Blackboard: Use http://blackboard.bu.edu/.

[1] Subject to change. Check the course website for the latest version.

Textbook
Yunus Cengel and Afshin Ghajar, "Heat and Mass Transfer," 4th Edition

Class/Laboratory Schedule
Four hours of lecture and one hour of discussion per week. There are two experimental labs for this course. Sign-up sheets will be posted once the labs have been scheduled. The experiments will be done in groups, but reports are individual. There will also be a numerical design project using the COMSOL software package. This class has totally eleven homework problem sets. Homework and the due date/time will be announced in lecture and posted on the course website. Homework submitted late will not receive credit.

Quizzes and Exams
There will be five 20-minute quizzes this semester, given during the regularly scheduled class time. The exact dates are listed in the syllabus. Each quiz will cover previous four lectures. There will be NO make-ups for quizzes for any reason. All of the quizzes will be closed book, closed notes. No electronic devices (calculators, cell phones, PDAs, etc.) will be allowed during quizzes.

There will be three exams, including two midterms and one comprehensive final exam. The exact dates are listed in the syllabus. All exams are open book, open notes. Calculators are allowed to use during exams but other electronic devices (cell phones, PDAs, laptops, etc.) are prohibited. The only valid reasons for missing an exam are: death in the immediate family, serious illness (documented by a physician), or a conflict with a scheduled Boston University event. If you feel that you have a valid reason for missing an exam, you must petition to Prof. Duan for permission to take the make-up exam. This petition must be received **BEFORE** the regularly scheduled exam. Petitions are not always granted! If the petition is granted, a mutually convenient time for the make-up exam will be arranged. Make-up exams will be more difficult than the regularly scheduled exams.

Collaboration Policy
Students are allowed (in fact, encouraged) to work together on the homeworks and on the lab worksheets, and in groups on the project. Working together means truly working together, exchanging ideas, NOT copying. Copying another's work is cheating, as is allowing someone else to copy your work. All quizzes and exams must be done by each student individually. Anyone caught cheating may be subject to disciplinary action by the Committee on Student Conduct of the College of Engineering. Also, anyone found guilty of cheating will receive a 0 for that particular grade. When in doubt, ask before you collaborate!

Grading Policy
Labs 10% Design Project 10% Homework 15% Quizzes 10%
Midterm 1 15% Midterm 2 15% Final Exam 25%

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Lecture and Exam Schedule[1]

Week	Date	Topics	Reading	Deadline	Other
1					
	09/03	Introduction	1-37		
2	09/08	Introduction to conduction	63-98		
	09/10	1-D steady state conduction& resistance network	63-98, 135-163		
3	09/15	1-D steady state conduction (cylinder, sphere) & conduction with internal heat generation	63-107	HW 1	
	09/17	Extended surfaces- Fins	163-179	Lab 1 starts	Quiz 1
4	09/22	Transient conduction – lumped capacitance	22-25& 226-232	HW 2	
	09/24	Transient conduction: slabs/spheres/cylinders	232-248		
5	09/29	Semi-infinite bodies	249-256	HW 3	
	10/01	General governing equation for conduction Multi-dimensional conduction	256-276		Quiz 2
6	10/06	Exam Review		HW 4	
	10/08	Midterm 1			
7	**10/13**	**Monday's schedule (no class)**			
	10/15	Multi-dimensional conduction & Numerical Methods I	296-351	HW 5 Project starts	
8	10/20	Numerical methods II & Introduction to convection, boundary layer	296-351 & 374-408	Lab 1 due	
	10/22	External Flow	418-446	Lab 2 starts	
9	10/27	Internal flow	467-507	HW 6	Quiz 3
	10/29	Natural convection & Boiling and condensation	520-563 & 582-617		
10	11/03	Heat exchangers I	630-667	HW 7	
	11/05	Heat exchangers II	630-667		
11	11/10	Exam review		HW 8	Quiz 4
	11/12	Midterm 2			
12	11/17	Introduction to radiation	684-713	HW 9	
	11/19	Blackbody radiation	732-748		
13	11/24	View factor relations	732-748	HW 10	
	11/26	**Thanksgiving Recess**			
14	12/01	Gray body networks	748-763	Lab 2 due	
	12/03	Heat Transfer beyond ME 419			Quiz 5
15	12/08	Project presentation		HW 11, Project due	
	12/10	Final Exam Review			

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