ME 419: Heat Transfer
Fall 2019

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Course Information:
Textbook (Required): *Fundamentals of Heat and Mass Transfer* by Bergman, Lavine, Incropera & Dewitt, 6th, 7th or 8th Edition (Instructor will use 7th Edition as reference.)

Website: Blackboard (used for announcements, assignments, review material)
Course Meeting: Lecture: Monday & Wednesday 2:30-4:15pm, EPC 207
Discussion: Thursdays 5:00-5:50 PM, SAR 101

Course Description: While thermodynamics covers the end states of processes, heat transfer tells us about the nature and rate of movements of thermal energy within the process. This course emphasizes the development of a physical and analytical understanding of the three modes of heat transfer (conduction, convection, radiation), with emphasis placed on conduction and convection.

Topics Covered:
1. Steady and unsteady conduction
2. Numerical analysis of conduction
3. Natural and forced convection
4. Introduction to boiling, condensation and evaporation
5. Radiant heat exchange
6. Mass Transfer Analogy

Course Communication
Questions about Homework problems, Laboratories, and Exam/Quiz review topics should be posted to the appropriate Discussion Board on Blackboard. To insure fair access of information to all students, questions concerning any course material sent to either the Instructor or TA via email will not be answered via direct email, only through Discussions.

Course Outcomes:
Upon successful completion of this course, students will be able to:

1. Understand and differentiate between the three modes of heat transfer: conduction, convection, radiation;
2. Derive and simplify the Heat Equation using conduction and radiation as boundary conditions in both steady and transient states.
3. Understand the fundamental relationships between fluid flow, and convective heat and mass transfer.
4. Apply the appropriate empirical correlations for forced and natural convection to determine convective heat transfer coefficients, with a focus on understanding the role of dimensionless parameters in heat transfer analysis.
5. Understand the differences between black body and gray body radiation.
6. Develop the analogous understanding between Fourier's Law for heat transfer and Fick's Law for mass transfer.

Reading Assignments: Course lectures will coincide with the textbook for each topic as listed below on the Course Schedule. Students are expected to familiarize themselves with material before coming to class to fully engage in classroom discussions.

Course Grading: Grading for ME 419 is broken down according to the point distribution below.

Exams:	35%
Final:	25%
Quizzes:	20%
Laboratory:	15%
Homework:	5%

Homework: Practice problems for every chapter are posted on Blackboard. Chose 3 problems from each set to complete and turn in by the date posted on the class schedule. Homework should be turned in at the beginning of class. No late homework will be accepted. You will be graded only on your effort and the clarity with which the solution is provided. For each problem you should clearly layout all work (equations, assumptions, math, answer). You may drop your two lowest homework grades. Note it is highly encouraged that you work through all practice problems.

Exams: There are 2 in class exams and one final exam during finals period, as listed in the Course Schedule. Missing an exam due to vacation or early departure for a scheduled break is not excusable. Arrangements will be made on a case-by-case basis for documented medical, University conflicts (***must be arranged 1 week prior***) or other emergencies. Students requiring additional time to complete examinations must make arrangements with Prof. Ryan at ***least 3 business days in advance*** of an examination so suitable arrangements can be made.

Exam 1: Conduction	**Wednesday, October 9th**	**In Class**
Exam 2: Forced Convection	**Wednesday, November 13th**	**In Class**
Exam 3: Three Modes of Heat Transfer	**Monday, December 16th**	**Finals Period**

Quizzes: There are 5 quizzes throughout the semester. Quizzes focus on specific material taught the two weeks before the quiz, though by the nature of the course material they are cumulative. These are "fast" quizzes lasting 20 minutes during discussion. The lowest Quiz grade will be dropped.

- Each quiz is closed book, but a one page (8.5x11 inch) formula sheet may be brought in and used during the quiz. This formula sheet must be handwritten solely by the student and will be collected with the quiz.
- Students requiring additional time to complete examinations must supply proper documentation from the Office of Disability Services at ***least 3 days in advance*** of an examination to the instructor so suitable arrangements can be made.

Lab exercises:
There will be two lab exercises for this course. Sign-up sheets will be posted in advance of the labs. The experiments will be done in groups, but lab reports will be done individually.

- Reports are limited to a **strict 4 page length limit**. *pages beyond 4 will not be graded*
- Cover pages are strongly discouraged, as they will count toward the 4-page limit
- Fonts must be 11 pt or larger, margins must be 1" or larger
- Individual laboratory reports are due by 2:30 PM in class.
- Email submission is acceptable in cases of emergency; email both Prof. Ryan and the TA.
- Late labs will be accepted for grading for up to week late with a 10% late penalty provided that the student is in correspondence with Prof. Ryan.
- Students are expected to physically complete the laboratory exercise. If a student fails to sign up or misses their lab timeslot, he or she should reach out to the lab TA immediately to see if there might be another open slot. If not, the student can receive lab data to complete the report, and the report will be subject to a 25% penalty.

Boston University Academic Conduct Code: Honesty is a core value of Boston University. Any violations of the BU academic honesty and integrity standards ***will be pursued*** through appropriate University channels. Academic misconduct is conduct by which a student misrepresents his or her academic accomplishments, or impedes other students' opportunities of being judged fairly for their academic work. Knowingly allowing others to represent your work as their own is as serious an offense as submitting another's work as your own. If you have any questions as to what constitutes an honor code violation, please ask. ***Ignorance is not an excuse for cheating***. You may access the BU Academic Conduct Code at: http://www.bu.edu/academics/policies/academic-conduct-code/

Proposed Course Schedule (Please note: changes/updates to this schedule will be posted on Blackboard, but nothing will ever be due earlier than the posted dates here.)

			ME 419 - Fall 2019		Updated: August 29, 2019
Lecture	**Date**	**Day**	**Topic**	**Textbook Reading**	**Labs and Due Dates**
1	9/4/2019	Wednesday	Introduction to Heat Transfer	Chapter 1	
	9/5/2019	Thursday	No Discussion		
2	9/9/2019	Monday	Introduction to Conduction: The Heat Equation	Chapter 2	
3	9/11/2019	Wednesday	Solving the Heat Equation: Boundary Conditions	Chp 2.4, 3.1-3.3	Chapter 1 Problems
	9/12/2019	Thursday	Optional Problem Set Help		
4	9/16/2019	Monday	1D Steady Conduction: Thermal Circuits	2.3-2.5, 3.1-3.5	
5	9/18/2019	Wednesday	Fins & Finned Surfaces	3.5, 3.10	Chapter 2 Problems
	9/19/2019	***Thursday***	***Quiz 1: Steady Conduction***	***SAR101***	
6	9/23/2019	Monday	2D & 3D Steady Conduction	4.1-4.3	Chapter 3 Problems
7	9/25/2019	Wednesday	Transient Conduction: Lumped Systems	5.1-5.3	*Lab 1 Begins this Week*
	9/26/2019	Thursday	Optional Problem Set Help		
8	9/30/2019	Monday	Unsteady Conduction (Slabs, spheres, cylinders)	5.1-5.6	Chapter 4 Problems
9	10/2/2019	Wednesday	Semi-infinite Bodies	5.7-5.8	
	10/3/2019	***Thursday***	***Quiz 2: Transient Conduction***	***SAR101***	
10	10/7/2019	Monday	2D & 3D Transient Conduction, Conduction Review	(Supplemental Notes)	Chapter 5 Problems
	10/9/2019	**Wednesday**	**Exam 1: Conduction (Chapters 1-5)**		
	10/10/2019	Thursday	Optional Problem Set Help		
11	10/15/2019	Tuesday	Monday Schedule on Tuesday: Introduction to Convection	6.1-6.3	*Lab 1 Due*
12	10/16/2019	Wednesday	Boundary Layers and Dimensionless Numbers	Chapter 6	
	10/17/2019	Thursday	Optional Problem Set Help		
13	10/21/2019	Monday	External Forced Convection by Correlations	7.1-7.3	Chapter 6 Problems
14	10/23/2019	Wednesday	External Forced Convection	7.4-7.9; 8.1-8.5	
	10/24/2019	***Thursday***	***Quiz 3: Convection***	***SAR101***	
	10/28/2019	**Monday**	**Lab 2**		Chapter 7 Problems
15	10/30/2019	Wednesday	Internal Convection	8.1-8.5	
	10/31/2019	Thursday	Optional Problem Set Help		
16	11/4/2019	Monday	Applications of Internal Forced Convection		*Lab 2 Occurs this week*
17	11/6/2019	Wednesday	Natural Convection	Chap 9	Chapter 8 Problems
	11/7/2019	Thursday	Optional - Exam Review		
18	11/11/2019	Monday	Boiling & Condensation; Convection Review	10.1-10.5	Chapter 9 Problems
	11/13/2019	**Wednesday**	**Exam 2: Convection (Chapters 6-9)**		
	11/14/2019	Thursday	Optional - Homework Help		
19	11/18/2019	Monday	Heat Exchangers; LMTD method	11.1-11.6	
20	11/20/2019	Wednesday	Effectiveness-NTU Method	11.4-11.6	Chapter 10 Problems
	11/21/2019	***Thursday***	***Quiz 4: Heat Exchangers***	***SAR101***	
21	11/25/2019	Monday	Radiation	Chapter 12-13	Chapter 11 Problems
22	12/2/2019	Monday	Radiation	Chapter 12-13	
23	12/4/2019	Wednesday	The Three Modes of Heat Transfer in Practice	Chapters 1-13	Chapter 12-13 Problems
	12/5/2019	***Thursday***	***Quiz 5: Radiation***	***SAR101***	
24	12/9/2019	Monday	The Mass Transfer Analogy: Fick's Law	14.1-14.5	*Lab 2 Due*
25	12/11/2019	Wednesday	Review		
	12/16/2019	Monday	Final Exam 3-5PM		