ME 419

ME 419: Heat Transfer Fall 2019

Instructor:Prof. Emily RyanOffice:ENG 416 (110 Cummington Mall)Email:ryanem@bu.eduPhone:617-353-7767Office Hours:Fridays 11:00-12:00

TA:Lena DubitskyEmail:lod224@bu.eduOffice Hours:Tuesdays 10:00-11:00AMOffice hour location:EMA 205

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 207Discussion: 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.

Ryan Fall 2019

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

Ryan Fall 2019

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: <u>http://www.bu.edu/academics/policies/academic_conduct-code/</u>

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.)

1 9/4/2019 Wednesday Introduction to Heat Transfer Ch 9/9/2019 Thursday No Discussion Ch 2 9/9/2019 Monday Introduction to Conduction: The Heat Equation Ch 3 9/11/2019 Wednesday Solving the Heat Equation: Boundary Conditions Ch 9/12/2019 Thursday Optional Problem Set Help 2.3 5 9/18/2019 Wednesday Fins & Finned Surfaces 3.5 9/19/2019 Thursday Quiz 1: Steady Conduction 5.4 6 9/23/2019 Monday 2D & 3D Steady Conduction 4.1 7/9/25/2019 Wednesday Transient Conduction: Lumped Systems 5.1 9/26/2019 Thursday Optional Problem Set Help 5.1 9/02/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Thursday Quiz 2: Transient Conduction S.4 10/7/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 1 10/0/2019 10/17/2019 Thursday Optional Problem Set Help 5.1 10/10/2019 Thursday Optional Problem Set Help 5.1 10/10/2019 Thursday Optional Problem Set Help	extbook Reading hapter 1 hapter 2 hp 2.4, 3.1-3.3 (3-2.5, 3.1-3.5 (5, 3.10 AR101 1-4.3	Updated: August 29, 2019 Labs and Due Dates Chapter 1 Problems
1 9/4/2019 Wednesday Introduction to Heat Transfer Ch 9/9/2019 Thursday No Discussion Ch 2 9/9/2019 Monday Introduction to Conduction: The Heat Equation Ch 3/9/11/2019 Wednesday Solving the Heat Equation: Boundary Conditions Ch 9/12/2019 Thursday Optional Problem Set Help 2.3. 5 9/18/2019 Wednesday Fins & Finned Surfaces 3.5. 9/19/2019 Thursday Quiz 1: Steady Conduction 5.4. 6 9/23/2019 Monday 2D & 3D Steady Conduction 4.1. 7/9/25/2019 Wednesday Transient Conduction: Lumped Systems 5.1. 9/26/2019 Thursday Optional Problem Set Help 5.1. 9/26/2019 Thursday Quiz 2: Steady Conduction 5.4. 9/02/2019 Wednesday Semi-infinite Bodies 5.7. 10/3/2019 5.7. 10/17/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 10/10/2019 10/17/2019 10/17/2019 Thursday Optional Problem Set Help 5.1 10/10/2019 Thursday Optional Problem Set Help 5.1 11/10/15/2019 T	hapter 1 hapter 2 hp 2.4, 3.1-3.3 3-2.5, 3.1-3.5 5, 3.10 AR101 1-4.3	Chapter 1 Problems
2 9/9/2019 Monday Introduction to Conduction: The Heat Equation Ch 3 9/11/2019 Wednesday Solving the Heat Equation: Boundary Conditions Ch 9/12/2019 Thursday Optional Problem Set Help 2.3 4 9/16/2019 Monday ID Steady Conduction: Thermal Circuits 2.3 5 9/18/2019 Wednesday Fins & Finned Surfaces 3.5 9/19/2019 Thursday Quiz 1: Steady Conduction 4.1 7 9/25/2019 Wednesday Transient Conduction: Lumped Systems 5.1 9/26/2019 Thursday Optional Problem Set Help 5.1 9/26/2019 Monday Unsteady Conduction (Slabs, spheres, cylinders) 5.1 9/10/22019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 10/07/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 10/10/2019 Nonday 2D & 3D Transient Conduction, Conduction Review (St 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 10/10/2019 Nonday Schedule on Tuesday; Introduction to Convection 6.1 11 10/15/2019 Thuesday Dotional Problem Set Help 13 10/21/2019 Monday Schedule on Tuesday; Introduction to Convection 6.1 <t< td=""><td>hp 2.4, 3.1-3.3 3-2.5, 3.1-3.5 .5, 3.10 AR101 .1-4.3</td><td>Chapter 1 Problems</td></t<>	hp 2.4, 3.1-3.3 3-2.5, 3.1-3.5 .5, 3.10 AR101 .1-4.3	Chapter 1 Problems
3 9/11/2019 Wednesday Solving the Heat Equation: Boundary Conditions Ch 9/12/2019 Thursday Optional Problem Set Help 4 9/16/2019 Monday ID Steady Conduction: Thermal Circuits 2.3 5 9/18/2019 Wednesday Fins & Fine Garfaces 3.5 9/19/2019 Thursday Quiz 1: Steady Conduction 5.4 6 9/23/2019 Monday 2D & 3D Steady Conduction 4.1 7 9/25/2019 Wednesday Transient Conduction: Lumped Systems 5.1 9/26/2019 Thursday Optional Problem Set Help 5.1 9 10/2/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Thursday Quiz 2: Transient Conduction Conduction Review (St 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 10 10 10/10/2019 Monday Exam 1: Conduction Chapters 1-5) 10 10 11 10/15/2019 Tuesday Boundary Layers and Dimensionless Numbers Ch 10/17/2019 Thursday Optional Problem Set Help 11 10 11 10/15/2019 Tuesday External Forced Convection by Correlations 7.1 10	hp 2.4, 3.1-3.3 3-2.5, 3.1-3.5 .5, 3.10 AR101 .1-4.3	Chapter 1 Problems
9/12/2019 Thursday Optional Problem Set Help 4 9/16/2019 Monday ID Steady Conduction: Thermal Circuits 2.3 5 9/18/2019 Wednesday Fins & Finned Surfaces 3.5 9/19/2019 Thursday Quiz 1: Steady Conduction \$A 6 9/23/2019 Monday D & S D Steady Conduction \$A 7 9/25/2019 Wednesday Transient Conduction: Lumped Systems \$5.1 9/26/2019 Thursday Optional Problem Set Help \$5.1 9/26/2019 Wednesday Semi-infinite Bodies \$5.7 10/2/2019 Wednesday Semi-infinite Bodies \$5.7 10/3/2019 Thursday Quiz 2: Transient Conduction \$A 10/10/2019 Monday 2D & 3D Transient Conduction Review \$Si 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) \$1 \$10/10/2019 Thursday Optional Problem Set Help 11 10/15/2019 Tuesday Monday Schedule on Tuesday: Introduction to Convection \$6.1 10/17/2019 Thursday Optional Problem Set Help \$1 \$10/17/2019 Thursday	3-2.5, 3.1-3.5 5, 3.10 ARI01 .1-4.3	Chapter 1 Problems
4 9/16/2019 Monday ID Steady Conduction: Thermal Circuits 2.3 5 9/18/2019 Wednesday Fins & Finned Surfaces 3.5 9/19/2019 Thursday Quiz 1: Steady Conduction SA 6 9/23/2019 Monday 2D & 3D Steady Conduction 4.1 7 9/25/2019 Wednesday Transient Conduction 4.1 7 9/26/2019 Monday Db & 3D Steady Conduction 4.1 9/26/2019 Monday Optional Problem Set Help 5.1 9 10/2/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Monday Quiz 2: Transient Conduction SA 10/10/2019 Monday Quiz 2: Transient Conduction Review (Si 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 10/10/2019 10 11 10/15/2019 Tuesday Optional Problem Set Help 11 13 10/21/2019 Wednesday External Forced Convection 7.1 14 10/23/2019 Wednesday External Forced Convection 7.1 14 10/28/2019 Monday External Forced Con	5, 3.10 AR101 1-4.3	
5 9/18/2019 Wednesday Fins & Finned Surfaces 3.5 9/19/2019 Thursday Quiz 1: Steady Conduction SA 6 9/23/2019 Monday 2D & 3D Steady Conduction 4.1 7 9/25/2019 Wednesday Transient Conduction: Lumped Systems 5.1 9/26/2019 Thursday Optional Problem Set Help 5.1 9 10/2/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Thursday Quiz 2: Transient Conduction SA 10 10/7/2019 Monday 2D & 3D Transient Conduction Conduction Review (St 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 10 10/10/2019 10 10/10/2019 Thursday Optional Problem Set Help 11 11 10/15/2019 Tuesday Monday Schedule on Tuesday: Introduction to Convection 6.1 12 10/16/2019 Wednesday External Forced Convection by Correlations 7.1 13 10/21/2019 Monday External Forced Convection 7.4 10/28/2019 Monday Lab 2 14 10/28/2019 Monday Lab 2	5, 3.10 AR101 1-4.3	
9/19/2019 Thursday Quiz 1: Steady Conduction SA 6 9/23/2019 Monday 2D & 3D Steady Conduction 4.1 7 9/25/2019 Wednesday Transient Conduction: Lumped Systems 5.1 9/25/2019 Monday Optional Problem Set Help 5.1 9/30/2019 Monday Unsteady Conduction (Slabs, spheres, cylinders) 5.1 9/10/2/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Thursday Quiz 2: Transient Conduction SA 10 10/7/2019 Wednesday Exam 1: Conduction Conduction Review (Si 10/9/2019 Wednesday Boundary Layers and Dimensionless Numbers Ch 11 10/15/2019 Tuesday Optional Problem Set Help 11 10/15/2019 Thursday Optional Problem Set Help 13 10/21/2019 Monday External Forced Convection by Correlations 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/24/2019 Thursday Quiz 3: Convection SA 10/31/2019 Thursday Optional Problem Set Help 1 <t< td=""><td>AR101 1-4.3</td><td></td></t<>	AR101 1-4.3	
6 9/23/2019 Monday 2D & 3D Steady Conduction 4.1 7 9/25/2019 Wednesday Transient Conduction: Lumped Systems 5.1 9/26/2019 Thursday Optional Problem Set Help 5.1 9 10/2/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Thursday Quiz 2: Transient Conduction SA 10/3/2019 Monday 2D & 3D Transient Conduction SA 10/3/2019 Monday 2D & 3D Transient Conduction SA 10/10/2019 Monday 2D & 3D Transient Conduction Conduction Review (Si 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 10/10/2019 Thursday 10/10/2019 Thursday Optional Problem Set Help 10/11/2/10/19 10/11/2/10/19 11 10/15/2019 Tuesday Monday Schedule on Tuesday: Introduction to Convection 6.1 10/11/2019 Thursday Optional Problem Set Help 10/11/2/12/19 10/11/2/2/19 13 10/21/2019 Monday External Forced Convection 7.4 10/28/2019 Monday Lab 2 11 10/31/2019 Thurs	.1-4.3	Chapter 2 Problems
7 9/25/2019 Wednesday Transient Conduction: Lumped Systems 5.1 9/26/2019 Thursday Optional Problem Set Help 5.1 8 9/30/2019 Monday Unsteady Conduction (Slabs, spheres, cylinders) 5.1 9 10/2/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Thursday Quiz 2: Transient Conduction SA 10 10/7/2019 Monday 2D & 3D Transient Conduction, Conduction Review (St 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 10/10/2019 Wednesday Boundary Layers and Dimensionless Numbers Ch 10/17/2019 10/11/2019 Monday External Forced Convection by Correlations 7.1 114 10/23/2019 Wednesday External Forced Convection 7.4 10/24/2019 Thursday Quiz 3: Convection 7.4 10/28/2019 Monday Lab 2 1 110/31/2019 Thursday Optional Problem Set Help 1 <td></td> <td></td>		
9/26/2019 Thursday Optional Problem Set Help 8 9/30/2019 Monday Unsteady Conduction (Slabs, spheres, cylinders) 5.1 9 10/2/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Thursday Quiz 2: Transient Conduction SA 10/10/2019 Monday 2D & 3D Transient Conduction, Conduction Review (Si 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 10/10/2019 10/10/2019 10 10/15/2019 Tuesday Monday Schedule on Tuesday: Introduction to Convection 6.1 11 10/15/2019 Tuesday Optional Problem Set Help 10/17/2019 Thursday Optional Problem Set Help 13 10/21/2019 Monday External Forced Convection 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/24/2019 Thursday Optional Problem Set Help 10/17/2019 SA 10/21/2019 Wednesday Internal Convection 7.4 10/28/2019 Monday Lab 2 10/31/2019 SA 10/31/2019 Thursday Optional Problem Set Help		Chapter 3 Problems
8 9/30/2019 Monday Unsteady Conduction (Slabs, spheres, cylinders) 5.1 9 10/2/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Thursday Quiz 2: Transient Conduction SA 10 10/7/2019 Monday D& 3D Transient Conduction, Conduction Review (Si 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 5 5 10/10/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 6 6 11 10/15/2019 Tuesday Optional Problem Set Help 6 11 10/16/2019 Wednesday Boundary Layers and Dimensionless Numbers Ch 10/11/2019 Thursday Optional Problem Set Help 6 13 10/21/2019 Wednesday External Forced Convection 7.1 14 10/23/2019 Wednesday Internal Forced Convection 7.4 10/24/2019 Thursday Optional Problem Set Help 8 11 10/23/2019 Wednesday Internal Convection 7.4 10/24/2019 Thursday Optional Problem Set Help 8 11 10/31/2019 Thursday Optional Problem Set Help 8 <t< td=""><td>.1-5.3</td><td>Lab 1 Begins this Week</td></t<>	.1-5.3	Lab 1 Begins this Week
9 10/2/2019 Wednesday Semi-infinite Bodies 5.7 10/3/2019 Thursday Quiz 2: Transient Conduction SA 10 10/7/2019 Monday 2D & 3D Transient Conduction, Conduction Review (Si 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) 0 (D/10/2019 11 10/15/2019 Tursday Optional Problem Set Help 61.1 11 10/15/2019 Wednesday Boundary Layers and Dimensionless Numbers Ch 10/17/2019 Thursday Optional Problem Set Help 61.1 11 0/15/2019 Wednesday External Forced Convection by Correlations 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/24/2019 Thursday Optional Problem Set Help 8.1 11 0/31/2019 Wednesday Internal Convection 7.4 10/28/2019 Monday Lab 2 8.1 10/31/2019 Wednesday Natural Convection 8.1 10/31/2019 Wednesday Natural Convection Ch 11/12/2019 Monday Applications of Internal Forced Convection 11 11/7/2019 Thursday Optional - Exam Review 11		
10/3/2019 Thursday Quiz 2: Transient Conduction SA 10 10/7/2019 Monday 2D & 3D Transient Conduction, Conduction Review (St 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 12 10/16/2019 Wednesday Boundary Layers and Dimensionless Numbers Ch 10/17/2019 Thursday Optional Problem Set Help 11 13 10/21/2019 Monday External Forced Convection by Correlations 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/28/2019 Monday Lab 2 11 10/31/2019 Nursday Optional Problem Set Help 11 10/31/2019 Thursday Optional Problem Set Help 8.1 10/31/2019 Monday Applications of Internal Forced Convection 11 10/31/2019 Monday Applications of Internal Forced Convection 11 11/11/2019 Monday Applications of Internal Forced Convection 11 11/16/2019 <td>.1-5.6</td> <td>Chapter 4 Problems</td>	.1-5.6	Chapter 4 Problems
10 10/7/2019 Monday 2D & 3D Transient Conduction, Conduction Review (St 10/9/2019 Wednesday Exam 1: Conduction (Chapters 1-5) (St 10/10/2019 Thursday Optional Problem Set Help (St 11 10/15/2019 Tuesday Monday Schedule on Tuesday: Introduction to Convection (6.1 12 10/16/2019 Wednesday Boundary Layers and Dimensionless Numbers (Ch 10/17/2019 Thursday Optional Problem Set Help (D) 13 10/21/2019 Monday External Forced Convection by Correlations 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/28/2019 Monday Lab 2 (St (St 15 10/30/2019 Wednesday Internal Forced Convection 8.1 10/31/2019 Thursday Optional Problem Set Help (Ch 16 11/4/2019 Monday Applications of Internal Forced Convection 8.1 10/31/2019 Wednesday Natural Convection (Ch 11/7/2019 11 11/6/2019 Wednesday Natural Convection <td>.7-5.8</td> <td></td>	.7-5.8	
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 12 10/16/2019 Wednesday Boundary Layers and Dimensionless Numbers Ch 10/17/2019 Thursday Optional Problem Set Help 13 10/21/2019 Monday External Forced Convection by Correlations 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/28/2019 Monday Lab 2 15 10/30/2019 Wednesday Internal Convection 8.1 10/31/2019 Thursday Optional Problem Set Help 16 10/30/2019 Wednesday Internal Convection 8.1 10/31/2019 Thursday Optional Problem Set Help 16 11/4/2019 Monday Applications of Internal Forced Convection 17 11/6/2019 Wednesday Natural Convection Ch	AR101	
10/10/2019 Thursday Optional Problem Set Help 11 10/15/2019 Tuesday Monday Schedule on Tuesday: Introduction to Convection 6.1 12 10/16/2019 Wednesday Boundary Layers and Dimensionless Numbers Ch 10/17/2019 Thursday Optional Problem Set Help Ch 13 10/21/2019 Monday External Forced Convection by Correlations 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/24/2019 Thursday Quiz 3: Convection 7.4 10/28/2019 Monday Lab 2 SA 10/28/2019 Monday Lab 2 SA 10/31/2019 Thursday Optional Problem Set Help S1 11 11/4/2019 Monday Applications of Internal Forced Convection 8.1 10/31/2019 Thursday Optional Problem Set Help S1 S1 11 11/4/2019 Monday Applications of Internal Forced Convection S1 11/1/2019 Wednesday Natural Convection Ch S1 11/1/2/2019 Thursday Optional	Supplemental Notes)	Chapter 5 Problems
11 10/15/2019 Tuesday Monday Schedule on Tuesday: Introduction to Convection 6.1 12 10/16/2019 Wednesday Boundary Layers and Dimensionless Numbers Ch 10/17/2019 Thursday Optional Problem Set Help	n ,	
12 10/16/2019 Wednesday Boundary Layers and Dimensionless Numbers Ch 10/17/2019 Thursday Optional Problem Set Help 1 13 10/21/2019 Monday External Forced Convection by Correlations 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/24/2019 Thursday Quiz 3: Convection SA 10/28/2019 Monday Lab 2 1 15 10/30/2019 Wednesday Internal Convection 8.1 10/31/2019 Thursday Optional Problem Set Help 1 6 16 11/4/2019 Monday Applications of Internal Forced Convection 17 11/6/2019 Wednesday Natural Convection Ch 1 11/7/2019 Thursday Optional - Exam Review 10 11/17/2019 Monday Boling & Condensation; Convection Review 10 11/13/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11 11/14/2019 11/14/2019 Thursday Optional - Homework Help 11 11/12/019 Monday Heat Exchangers;		
10/17/2019 Thursday Optional Problem Set Help 13 10/21/2019 Monday External Forced Convection by Correlations 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/24/2019 Thursday Quiz 3: Convection 7.4 10/28/2019 Monday Lab 2 7.4 10/28/2019 Monday Lab 2 7.4 10/38/2019 Wednesday Internal Convection 8.1 10/31/2019 Wednesday Internal Convection 8.1 10/31/2019 Monday Applications of Internal Forced Convection 8.1 11/1/2019 Monday Applications of Internal Forced Convection 7.4 11/17/2019 Thursday Optional - Exam Review 10 11/17/2019 Monday Boiling & Condensation; Convection Review 10 11/13/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11 11/14/2019 11/14/2019 Monday Heat Exchangers; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 20 11/20/2019 Wednesday Effective	.1-6.3	Lab 1 Due
13 10/21/2019 Monday External Forced Convection by Correlations 7.1 14 10/23/2019 Wednesday External Forced Convection 7.4 10/24/2019 Thursday Quiz 3: Convection SA 10/28/2019 Monday Lab 2 SA 15 10/30/2019 Wednesday Internal Convection 8.1 10/31/2019 Thursday Optional Problem Set Help 8 16 11/4/2019 Monday Applications of Internal Forced Convection 7 17 11/6/2019 Wednesday Natural Convection Ch 11/17/2019 Thursday Optional - Exam Review 10 11/17/2019 Thursday Optional - Exam Review 10 11/11/2019 Wednesday Exam 2: Convection (Chapters 6-9) 10 11/12/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11 19 11/18/2019 Monday Heat Exchapters; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchapters SA	hapter 6	
14 10/23/2019 Wednesday External Forced Convection 7.4 10/24/2019 Thursday Quiz 3: Convection SA 10/28/2019 Monday Lab 2 1 15 10/30/2019 Wednesday Internal Convection 8.1 10/31/2019 Thursday Optional Problem Set Help 8 16 11/4/2019 Monday Applications of Internal Forced Convection 1 17 11/6/2019 Wednesday Natural Convection Ch 11/7/2019 Thursday Optional - Exam Review 10 11/1/2019 Monday Boiling & Condensation; Convection Review 10 11/1/2019 Monday Boiling & Condensation; Convection Review 10 11/14/2019 Monday Boiling & Condensation; Convection Review 10 11/14/2019 Thursday Optional - Homework Help 11 19 11/18/2019 Monday Effectiveness-NTU Method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA		
10/24/2019 Thursday Quiz 3: Convection SA 10/28/2019 Monday Lab 2 Image: Convection SI 15 10/30/2019 Wednesday Internal Convection SI 10/31/2019 Thursday Optional Problem Set Help SI 16 11/4/2019 Monday Applications of Internal Forced Convection Chapter Si 17 11/6/2019 Wednesday Natural Convection Chapter Si Chapter Si 18 11/11/2019 Monday Boiling & Condensation; Convection Review 10 11/13/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11/14/2019 Inursday Optional - Homework Help 19 11/18/2019 Monday Heat Exchapters; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchapters SA	.1-7.3	Chapter 6 Problems
10/28/2019 Monday Lab 2 15 10/30/2019 Wednesday Internal Convection 8.1 10/31/2019 Thursday Optional Problem Set Help 9 16 11/4/2019 Monday Applications of Internal Forced Convection 0 17 11/6/2019 Wednesday Natural Convection 0 11/17/2019 Thursday Optional - Exam Review 10 11/11/2019 Monday Boiling & Condensation; Convection Review 10 11/13/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11 11/14/2019 Thursday Optional - Homework Help 11 19 11/18/2019 Monday Heat Exchangers; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA	.4-7.9; 8.1-8.5	
15 10/30/2019 Wednesday Internal Convection 8.1 10/31/2019 Thursday Optional Problem Set Help 10/31/2019 16 11/4/2019 Monday Applications of Internal Forced Convection 10/31/2019 17 11/6/2019 Wednesday Natural Convection Ch 11/1/2019 Thursday Optional - Exam Review 10 18 11/11/2019 Monday Boiling & Condensation; Convection Review 10 11/13/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11/14/2019 11/14/2019 19 11/18/2019 Monday Heat Exchangers; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA	AR101	
10/31/2019 Thursday Optional Problem Set Help 16 11/4/2019 Monday Applications of Internal Forced Convection 17 11/6/2019 Wednesday, Natural Convection Ch 11/7/2019 Thursday Optional - Exam Review I0 18 11/11/2019 Monday Boiling & Condensation; Convection Review 10 11/13/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11/14/2019 11/14/2019 19 11/18/2019 Monday Heat Exchangers; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA		Chapter 7 Problems
16 11/4/2019 Monday Applications of Internal Forced Convection 17 11/6/2019 Wednesday Natural Convection Ch 11/7/2019 Thursday Optional - Exam Review Ch 18 11/11/2019 Monday Boiling & Condensation; Convection Review 10 11/13/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11 11/14/2019 Thursday Optional - Homework Help 11 19 11/18/2019 Monday Heat Exchangers; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/12/12019 Thursday Quiz 4: Heat Exchangers SA	.1-8.5	
17 11/6/2019 Wednesday Natural Convection Ch 11/7/2019 Thursday Optional - Exam Review 10 18 11/11/2019 Monday Boiling & Condensation; Convection Review 10 11/14/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11 11/14/2019 19 11/18/2019 Monday Heat Exchangers; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA		
11/7/2019 Thursday Optional - Exam Review 18 11/11/2019 Monday Boiling & Condensation; Convection Review 10 11/13/2019 Wednesday Exam 2: Convection (Chapters 6-9) 11 11/14/2019 Thursday Optional - Homework Help 11 19 11/18/2019 Monday Heat Exchangers; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA		Lab 2 Occurs this week
18 11/11/2019 Monday Boiling & Condensation; Convection Review 10 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 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA	hap 9	Chapter 8 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 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA		
11/14/2019 Thursday Optional - Homework Help 19 11/18/2019 Monday Heat Exchangers; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA	0.1-10.5	Chapter 9 Problems
19 11/18/2019 Monday Heat Exchangers; LMTD method 11 20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA		
20 11/20/2019 Wednesday Effectiveness-NTU Method 11 11/21/2019 Thursday Quiz 4: Heat Exchangers SA		
11/21/2019 Thursday Quiz 4: Heat Exchangers SA	1.1-11.6	
	1.4-11.6	Chapter 10 Problems
21 11/25/2019 Monday Radiation	AR101	
	hapter 12-13	Chapter 11 Problems
22 12/2/2019 Monday Radiation Ch	hapter 12-13	
23 12/4/2019 Wednesday The Three Modes of Heat Transfer in Practice Ch		Chapter 12-13 Problems
12/5/2019 Thursday Quiz 5: Radiation SA	hapters 1-13	
24 12/9/2019 Monday The Mass Transfer Analogy: Fick's Law 14	hapters 1-13 AR101	Lab 2 Due
25 12/11/2019 Wednesday Review		
12/16/2019 Monday Final Exam 3-5PM	AR101	
22 12/2/2019 Monday Radiation Ch 23 12/4/2019 Wednesday The Three Modes of Heat Transfer in Practice Ch 12/5/2019 Thursday Quiz 5: Radiation SA 24 12/9/2019 Monday The Mass Transfer Analogy: Fick's Law 14 25 12/11/2019 Wednesday Review 14	hapter 12-13 hapter 12-13	Chapter 12-13 Problems