ME 419: Heat Transfer Spring 2019

Instructor:
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Course web page: Blackboard

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Lab GST: Rami Yazbeck (ramiyaz@bu.edu)

Course schedule:
Lectures: MW 2:30-4:15pm (PHO 210)
Discussions: W 10:10-11:00am EPC 207
Instructor Office hours: Th. 12:30-1:30pm (EMA 220); if you have class during this time, but would like to meet, please email instructor to find a suitable time.
GST Office hours: M 9:30-10:30am (EMA 205)
Labs: 2 labs – locations TBA

Textbook: Fund Heat Mass Transfer 8e by Bergman et al., Wiley Publishing
ISBN: 9781119447658

Prerequisites:
ME 303 & ME 304 or equivalent. Familiarity with engineering mathematics with partial differential equations.

Course description:
Understanding and controlling heat is critical for many engineering systems. This course covers the fundamentals of heat transfer from a macroscopic perspective, with an emphasis on modeling and simplifying approximations to solve real-world engineering problems. Examples are taken from a number of fields including manufacturing, electronics, consumer products, and energy systems.

Policy on collaboration:
Collaboration is encouraged on homework and labs, however students should turn in their own work in their own words. No collaboration is permitted on exams.

Grading:

Homework (5%):	Problem sets assigned roughly every week
Lab reports (20%):	Two laboratory exercises
Quizzes (10%):	Two closed-book quizzes; self-written formula sheet permitted
Exam I (15%):	Closed-book exams; formula sheets will be provided
Exam II (20%):	Closed-book exams; formula sheets will be provided
Final Exam (25%):	Closed book; formula sheet will be provided.
Participation (5%):	Will be evaluated on overall participation in class and discussion

Homework:
Homework assignments will be announced in class and tentative dates are on this syllabus available on the course webpage. Homework can be passed in during class or at the ME front desk (110 Cummington Mall, Room 101).

- Due date and time will be specified on the assignment.
- Late homework *will not* be accepted.
- Please list the names of any collaborators on the top of the first page

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 4 PM in class or to the ME office (110 Cummington Mall, Rm 101).
- Email submission is acceptable in cases of emergency; email both Prof. Bird and the GST.
- 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. Bird. Labs will only be accepted beyond this point with prior approval by Prof. Bird and will be subject to greater late penalties.
- 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 GST 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.

Quizzes:
Each quiz will take place over the first 20 minutes of class. Each quiz will cover a block of lectures as noted in the schedule.

- 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.

Exams:
Each exam will take place over an entire class period. Each exam will cover a block of lectures as noted in the schedule. The Final Exam is cumulative.

- Missing an exam due to vacation is not excusable. Arrangements will be made on a case-by-case basis for documented emergencies or University conflicts.
- 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.
- The final exam is Tuesday May 7th in the lecture room from 3 PM to 5 PM

Boston University Academic Conduct Code*:* Honesty is a core value of Boston University. Any violations of BU academic honesty and integrity standards ***will be pursued*** through appropriate University channels. This includes, but is not limited to: cheating, plagiarism and misrepresentation. 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/

Lecture by topic: We will cover the following topics around these given dates.

Lecture	Date	Topic	Suggested Reading	Due
1	1/23	Introduction to Heat Transfer	1.1 – 1.3	
2	1/28	Intro to conduction – Heat Equation	2.1 – 2.3	
3	1/30	Solving the Heat Equation: Boundary Conditions	2.4, 3.1	
4	2/4	1D Steady Conduction: Thermal Circuits	3.2-3.5	PS #1
5	2/6	Fins & Finned Surfaces	3.6	
6	2/11	**Quiz 1 - [1-5]** + 2D & 3D Steady Conduction	4.1-4.3	PS #2
7	2/13	Transient Conduction: Lumped Systems *Lab 1 Begins This Week*	5.1-5.3	
8	2/19	Unsteady Conduction (Slabs, spheres, cylinders) **[Guest Lecture]**	5.4-5.6	PS #3
9	2/20	Semi-infinite Bodies **[Guest Lecture]** Constant surface temp and surface flux	5.7-5.8	
10	2/25	Conduction Review		PS #4
Exam	2/27	**Exam 1 – [Lect. 1-9]**		
11	3/4	Intro to Convection: Fluids & Mass Transfer	6.1-6.3, 14.1	Lab #1
12	3/6	Boundary Layers & Dimensionless Numbers	6.4-6.7	
13	3/18	External Forced Convection	7.1-7.5	PS #5
14	3/20	Internal Forced Convection	8.1-8.4, 8.10	
15	3/25	Applications of external & internal forced convection, Intro to natural (free) convection	7.4, 8.4-8.5, 9.1-9.5	PS #6
16	3/27	**Quiz 2- [11-14]** + Natural (Free) Convection	9.6, 9.8, 9.10	
17	4/1	Boiling *Lab 2 Occurs During This Week*	10.1-10.5	PS #7
18	4/3	Condensation	10.6-10.11	
19	4/8	Heat Exchangers: LMTD Method	11.1-11.3	PS #8
Exam	4/10	**Exam 2 – [Lect. 11-18]**		
20	4/17	Heat Exchangers: Effectiveness-NTU Method	11.4-11.6	Lab #2
21	4/22	Radiation	Ch. 12-13	PS #9
22	4/24	The Three Modes of Heat Transfer in Practice	Ch. 1-13	
23	4/29	The Mass Transfer Analogy: Fick's Law	14.1-14.5	
24	5/1	Review		PS #10
Exam	5/9	**Final exam** (Thurs) 12:30-2:30pm SCI 109		