MEC 305: Heat and Mass Transfer (Spring 2020)

Instructor:	Dimitris Assanis, Assistant Professor Email: <u>dimitris.assanis@stonybrook.edu</u> - use [MEC 305] in subject line 131 Light Engineering Building Office Hours: Mon 12-2 PM; Wed 12-1 PM & 3- 4 PM (131 LE)		
Teaching Assistants:	Jason Loprete, jason.loprete@stonybrook.edu Office Hours: Tues, Thur 12 PM – 2 PM (158 Light Engineering)		
Lectures: Recitation-01: Recitation-02:	MWF 11:00-11:53am (145 ENGINEERING) – attendance required M 09:00-09:53am (131 EARTH&SPACE) – attendance required after week 1 W 09:00-09:53am (201 HVY ENGR) – attendance required after week 1		
Prerequisites:	MEC 301 and MEC 364; MEC 102, or ESG 111, or ESE 124, or CSE 114 or 130 or BME 120		
Course Description:	Fundamental laws of momentum, heat, and mass transfer, and the corresponding transport coefficients. Principles of steady-state and transient heat conduction in solids. Laminar and turbulent boundary layer flows, thermal radiation, and radiation heat transfer between surfaces. Applications to heat transfer equipment.		
Required Text:	Yunus Cengel and Afshin Ghajar, Heat and Mass Transfer: Fundamentals and Applications, 6th Ed., McGraw-Hill, 2020.		
Lecture Notes:	Lecture notes will be uploaded on Blackboard prior to lectures. Students are highly encouraged to have electronic or paper copies of the lecture notes in class.		
Homework:	Assignments will be completed online using the McGraw Hill Connect portal that is accessible through your Blackboard. Homework will be assigned weekly on Blackboard every Friday. Homework will be due the following Friday at 11:59pm (one week later), at which time the homework solutions will post. Late homework will not be accepted. Lowest homework score will be dropped when calculating your final grade.		
Exams:	Two midterms and one final exam. All exams are closed book with cheat sheet(s) of allowed number of pages; subject to change. No makeup exams, unless arranged prior to the exam.		
Grading:	Attendance:5% (randomly checked at recitation/lecture, one day allowance)Homework:15%Midterm I:20% (~6th week; TBD)Midterm II:20% (~11th week; TBD)Final:40% (comprehensive exam; regular final exam schedule)•Subject to minor adjustment. Final grading may be curved (only to improve).•Question(s) on graded homework/exam will be accepted only for one week after posting scores.		
Course Outline:	 Basic Concepts of Thermodynamics and Heat Transfer (Chapter 1) Heat Conduction Heat Conduction Equation (Chapter 2) Steady Heat Conduction (Chapter 3) Transient Heat Conduction (Chapter 4) Convection Fundamentals of Convection (Chapter 6) Forced Convection (Chapters 7 and 8) Natural Convection (Chapter 9) Radiation Heat Transfer (Chapters 12 and 13) 		

Date	Day	Chapter	Торіс	HW Assigned	HW Due
27-Jan	Mon	1	Introduction, sec 1.1-1.4, essential formulations, conduction		
29-Jan	Wed	1	sec 1.5-1.8, convection, radiation		
31-Jan	Fri	1	sec 1.9 & Chapter 1 examples	HW #1 (Chapter 1)	
3-Feb	Mon	2	sec 2.1-2.2		
5-Feb	Wed	2	sec 2.3-2.4		
7-Feb	Fri	2	sec 2.5-2.6	HW #2 (Chapter 2)	HW #1
10-Feb	Mon	2	Chapter 2 examples		
12-Feb	Wed	3	sec 3.1		
14-Feb	Fri	3	sec 3.2-3.3	HW #3 (Chapter 3)	HW #2
17-Feb	Mon	3	sec 3.4-3.5		
19-Feb	Wed	3	sec 3.6 - General Fin Equation		
21-Feb	Fri	3	sec 3.6 - Fin Boundary Conditions	HW #4 (Chapter 3)	HW #3
24-Feb	Mon		Chapter 3 examples		
26-Feb	Wed	4	sec 4.1		
28-Feb	Fri		sec 4.2	No Homework Assigned	HW #4
2-Mar	Mon	4	Midterm #1 Review (1)	-	
4-Mar	Wed		Midterm #1 Review (2)		
6-Mar	Fri		Midterm #1 (Chap 1-3) 53 min	HW #5 (Chapter 4)	
9-Mar	Mon	4	sec 4.3		
11-Mar	Wed	4	Chapter 4 examples		
13-Mar	Fri	6	sec 6.1-6.4	HW #6 (Chapters 4/6)	HW #5
16-Mar	Mon		(No Class - Spring Recess)		
18-Mar	Wed		(No Class - Spring Recess)		
20-Mar	Fri		(No Class - Spring Recess)	No Homework Assigned	
23-Mar	Mon	6	sec 6.7-6.8		
25-Mar	Wed	6	sec 6.9-6.11		
27-Mar	Fri	6	sec 6.5-6.6	HW #7 (Chapter 6)	HW #6
30-Mar	Mon	6	Chapter 6 examples		
1-Apr	Wed	7	sec 7.1-7.2		
3-Apr	Fri	7	Chapter 7 examples	HW #8 (Chapter 7)	HW #7
6-Apr	Mon	7	catch-up		
8-Apr	Wed	8	sec 8.1-8.4		
10-Apr	Fri	8	sec 8.5, Midterm #2 Review (1)	No Homework Assigned	HW #8
13-Apr	Mon		Midterm #2 Review (2)	-	
15-Apr	Wed		Midterm #2 (Chap 4, 6, 7) 53 min		
17-Apr	Fri	9	sec 9.1, 9.2	HW #9 (Chapter 8)	
20-Apr	Mon	9	sec 9.3, 9.6		
22-Apr	Wed		Chapter 9 examples		
24-Apr	Fri	12	sec 12.1-12.3, sec 12.5-12.6	HW #10 (Chapter 9)	HW #9
27-Apr	Mon	12	Chapter 12 examples	· · · · · ·	
29-Apr	Wed	13	sec 13.1-13.2		
1-May	Fri	13	sec 13.3-13.5	HW #11 (Chapters 12-13)	HW #10
4-May	Mon	13	Chapter 13 examples		T
6-May	Wed		Final Review (1)		Ī
8-May	Fri		Final Review (2)		HW #11
14-May	Thur		Final Exam (comprehensive) 2h30m	Exam Hour 11:15-1:45 PM	

Tentative schedule (section & chapter numbers are based on textbook):

Course Learning Objectives:

- 1. Demonstrate the ability to identify the three modes of heat transfer: conduction, convection, and radiation, and solve simple multi-mode heat transfer problem.
- 2. Demonstrate the ability to formulate and solve the differential equation of heat conduction in various coordinates systems with proper thermal boundary conditions.
- 3. Demonstrate the ability to develop thermal resistance networks for practical heat conduction problems.
- 4. Demonstrate the ability to solve transient lumped-parameter heat conduction problems.
- 5. Demonstrate the ability to analyze convective heat transfer in boundary layer and internal pipe flows based on Newton's law of cooling.
- 6. Demonstrate the ability to analyze radiative heat transfer between nonblack surfaces.

Blackboard: All homework assignments and solutions will be posted on the Blackboard course account (http://blackboard.stonybrook.edu).

All communication off class/office hours will be done <u>exclusively</u> through Blackboard. Blackboard uses your official Stony Brook e-mail address. It is your responsibility to check this e-mail address regularly, so that you do not miss any important announcements.

Allowed Calculators: Following the Mechanical Engineering Department's mandatory calculator policy, <u>only</u> the following calculators will be allowed to be used on the midterm and final exams. There will be no exceptions. This list of calculators is identical to that allowed for the *National Council for Examiners for Engineering and Surveying* (NCEES) Fundamentals of Engineering (FE) exam that many of you will take in your senior year, as well as the Professional Engineering (PE) exam that you may take several years from now. The sooner you become comfortable on one of these calculators, the better.

Casio:	All fx-115 and fx-991 models. Any Casio calculator must
	contain "fx-115" or "fx-991" in its model name.
Hewlett Packard:	The HP 33s and HP 35s models, but no others.
<u>Texas Instruments</u> :	All TI-30X and TI-36X models. Any Texas Instruments
	calculator must contain either "TI-30X" or "TI-36X" in its
	model name.

The NCEES policy on calculators can be found here: https://ncees.org/exams/calculator/

Disability Support Services (DSS) Statement: If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities.

Academic Integrity Statement: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/.

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Critical Incident Management: Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.