MECH3310 Heat Transfer

Instructor: YAO, Shuhuai (RM2577, Tel 2358-7205, meshyao@ust.hk)

Lectures: Tu 10:30-11:50, RM4619, Lift31-32
Th 10:30-11:50, RM4619, Lift31-32

Office Hours: We 16:00-17:00

TA's: Qichao Li (CYT4001, qlich@connect.ust.hk)
Ruoyuan Li (CYT4001, rlibd@connect.ust.hk)
Ali Safari (CYT4001, asafari@connect.ust.hk)
Meeting by appointment

Tutorial: Mo 18:00-18:50, RM2502, Lift25-26

Textbook: *Principles of Heat Mass Transfer, Ebook*, Incropera et al.
Course Web: https://canvas.ust.hk/courses/51188

Scope and Objectives:

This course teaches the basic physics and practical calculation methods for conduction, convection, and radiation heat transfer. You will encounter problems involving the flow of heat from nearly every aspect of our lives. From this course, you will learn the science behind the heat flow and also get introduced to the engineering of it. You will learn how to apply rule-of-thumb approximations, empirical correlations, or rigorous solutions to a practical heat-transfer process. With a little effort, you can take the knowledge from this course directly to an industrial job and become a career thermal engineer. You may be surprised to find out later in your work that you can solve the heat transfer problems in many projects based solely on the knowledge from this one course. Yet, for most of you, this is the only heat transfer course you will ever take. I wish you an enjoyable learning! I will do all that I can to help you along the way.

Exams and Grading:

There will be a mid-term examination and a three-hour final examination. Your final grade will be based as follows: Homework (20%) Class Participation (5%) Midterm (35%) Final (40%).

Homework assignments will be posted on course web. Extra exercises and solution manual are also available for you to practice on your own. The weekly tutorials will help you on homework problems by giving step-by-step instructions on sample problems. Please submit your homework on canvas before the due time (the system will close after the due time). Late homework only for pre-approved situations will be accepted. You are strongly encouraged to discuss with others on the difficult problems. If you don't understand the problem, contact your TAs and myself. However, you must prepare your own solutions. Copying from others will not be tolerated. Identical write-ups may result in zero credit in that homework assignment. There will be 8 homework assignments.

Schedule:

Week	Day	Topic	Reading	Due
1	5/9	*CONCEPTS:* Definition, Modes of heat transfer	1.1-1.2	
	7/9	*CONCEPTS:* Conservation of energy	1.3-1.7	
2	12/9	CONDUCTION FUNDAMENTALS: Governing equations	Ch.2	
	14/9	*1-D STEADY CONDUCTION:* w/o E_{gen}: Thermal circuit	3.1-3.2	HW#1
3	19/9	*1-D STEADY CONDUCTION:* w/o E_{gen}: Radial system	3.3-3.4	
	21/9	*1-D STEADY CONDUCTION:* with heat generation	3.5	
4	26/9	*1-D STEADY CONDUCTION:* Extended surfaces (fins)	3.6.1-3.6.3	
	28/9	*TRANSIENT CONDUCTION:* Lumped capacitance model	5.1-5.3	HW#2
5	3/10	*TRANSIENT CONDUCTION:* Semi-infinite solid	5.4, 5.7	
	5/10	*2-D CONDUCTION:* Numerical method	Ch.4, 5.10 (brs)	HW#3
6	10/10	*MIDTERM REVIEW*		
	12/10	*CONVECTION FUNDAMENTALS:* Boundary layers Similarity and analogies	6.1-6.8	HW#4
7	17/10	*EXTERNAL CONVECTION:* Flat-plate, Bluff bodies	7.1-7.5	
	19/10	*INTERNAL CONVECTION:* Hydrodynamic and thermal	8.1-8.2	
8	24/10	***MIDTERM***		
	26/10	*INTERNAL CONVECTION:* Energy balance	8.3-8.4	
9	31/10	*INTERNAL CONVECTION:* Heat transfer correlations	8.4-8.5	
	2/11	*NATURAL CONVECTION:* Governing equations, scaling	9.1-9.6	HW#5
10	7/11	*INTRO TO PHASE CHANGE*		
	9/11	*RADIATION FUNDAMENTALS*: Radiation intensity	12.1-12.2	HW#6
11	14/11	*RADIATION FUNDAMENTALS*: Blackbody, Gray surface,	12.3-12.8	
	16/11	*RADIATION FUNDAMENTALS*: Kirchhoff's law Environmental radiation	12.9	
12	21/11	*RADIATIVE TRANSFER:* View factors Radiation exchange b/w two surfaces	13.1-2	
	23/11	*RADIATIVE TRANSFER:* Radiation exchange b/w three surfaces, Radiation shields	13.2-4	HW#7
13	28/11	*RADIATIVE TRANSFER:* Multimode heat transfer	13.4	
	30/11	*FINAL REVIEW*		HW#8

Week	Day	Topic	Due
1	5/9	CONCEPTS	
	7/9	CNOCEPTS	
2	12/9	CONDUCTION FUNDAMENTALS	
	14/9	1-D STEADY CONDUCTION	HW#1
3	19/9	1-D STEADY CONDUCTION	
	21/9	1-D STEADY CONDUCTION	
4	26/9	1-D STEADY CONDUCTION	
	28/9	TRANSIENT CONDUCTION	HW#2
5	3/10	TRANSIENT CONDUCTION	
	5/10	2-D CONDUCTION	HW#3
6	10/10	MIDTERM REVIEW	
	12/10	CONVECTION FUNDAMENTALS	HW#4
7	17/10	EXTERNAL CONVECTION	
	19/10	INTERNAL CONVECTION	
8	24/10	**MIDTERM**	
	26/10	INTERNAL CONVECTION	
9	31/10	INTERNAL CONVECTION	
	2/11	NATURAL CONVECTION	HW#5
10	7/11	PHASE CHANGE	
	9/11	RADIATION FUNDAMENTALS	HW#6
11	14/11	RADIATION FUNDAMENTALS	
	16/11	RADIATION FUNDAMENTALS	
12	21/11	RADIATIVE TRANSFER	
	23/11	RADIATIVE TRANSFER	HW#7
13	28/11	RADIATIVE TRANSFER	
	30/11	FINAL REVIEW	HW#8