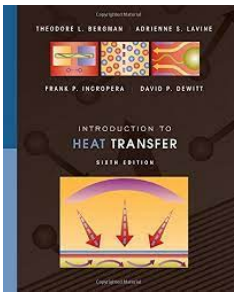
MEEN 3210 **Heat Transfer** **Summer 2022**

Instructor: Xiaohua Li Office: NTDP F101G; Tel: 940-369-8020; xiaohua.li@unt.edu
Lecture Time: Tuesday & Thursday 4:00 p.m.- 5:50 p.m. room NTDP K120
Office Hours: Tu/TR: 1-3 p.m. plus open office policy; email to make appointment



Required Textbook: Introduction to Heat Transfer, 6th edition
Incropera, DeWitt, Berman, & Lavine
ISBN-13: 978-0-470-50196-2

Course Description: This is a required course in MEE program
3 hours. A basic course covers the fundamentals of heat transfer by conduction, convection and radiation, together with applications to typical engineering systems. Topics include one- and Two-dimensional steady state heat conduction, transient heat conduction, internal convection, external convection, and natural convection
Pre-requisites: MEEN 3120 Fluid Mechanics. **Credit Hours**: 3 credit hours

Course Learning Outcomes (CLO):
Upon successful completion of this course, students will able to:
1. Apply conservation of mass, momentum, and energy to heat transfer problems.
2. Understand the concepts of one-dimensional steady-state heat conduction.
3. Understand the concepts of multi-dimensional steady-state heat conduction.
4. Understand the concepts of transient heat conduction.
5. Use thermal circuits method to solve heat transfer problems.
6. Understand the concepts of internal forced convection for both laminar and turbulent flows.
7. Understand the concepts of external forced convection for both laminar and turbulent flows.
8. Understand the concepts of natural convection.
9. Understand the basic theory behind radiation heat transfer.

ABET Student Learning Outcomes (SO)
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

CLO	ABET Student Outcomes (SO)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	X						
2	X						
3	X						
4	X						
5	X						
6	X						

7	X						
8	X						
9	X						

Grades:				
	Homework (10)	10%	≥ 90	A
	Quizzes (highest 3/5)	10%	80-89.9	B
	Exam #1 (Ch1, 2&3)	25%	70-79.9	C
	Exam #2 (Ch4, 5&6)	25%	60-69.9	D
	Final (Exam #3) (Ch 7, 8 &9)	25%	< 60	F
	Attendance (5/6)	5%		
	Total	100%		

Calculator Policy:

The use of a calculator is required and allowed on all homework, exams and quizzes. Calculators with graphing capabilities will be allowed in the course for homework and quizzes. However, only calculators currently allowed in the Fundamentals of Engineering (FE) and Professional Engineering (PE) exams will be allowed in ALL EXAMS (Exam #1, Exam #2 and Exam #3/final exam). **NO other calculators will be approved for exams.** Please refer to the National Council of Examiners for Engineering and Surveying (NCEES) calculator policy for the list of acceptable calculators.

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

Homework Policy:

1. "Homework Day": **Tuesday.** The day new homework will be assigned (HW assignment will be posted in Canvas) and previous homework will be collected through Canvas;
2. Homework should be turned in before the deadline (5:50pm) through canvas. **NO late homework will be collected, accepted or graded.** (Canvas window will be automatically closed)

   Exceptions: refer to UNT Policies 06.039.
   An absence may be excused for the following reasons:
   - ❖ religious holy day, including travel for that purpose;
   - ❖ active military service, including travel for that purpose;
   - ❖ participation in an official university function;
   - ❖ illness or other extenuating circumstances;
   - ❖ pregnancy and parenting under Title IX; and
   - ❖ when the University is officially closed.

   Procedure: Please request accommodations/exceptions through UNT "Dean of Students Office"

3. Solutions to Homework Assignments will be available in Canvas after HW has been collected.
4. Having no textbook is not a valid excuse for not doing homework. It is the student's responsibility to acquire textbook for his/her study

5. All homework assignments should be turned in through Canvas. There will be a window/link in canvas open for submitting HW.

Format of Homework:

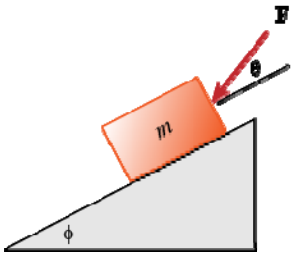
(1) Use engineering paper only (noncompliance: 10 points off; cumulative)

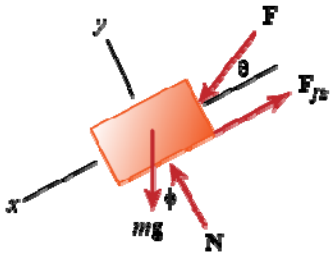
(2) **O**nly solve one problem per page of engineering paper **(noncompliance: 10 points off; cumulative)**. You may extend that problem into another page but then should begin the next problem on a new page if you require more room. If more than one page is needed for a solution you should number each page and the first page should be marked with a "continued on next page" note on the bottom.

(3) Done in pencil, no ink. **(noncompliance: 10 points off; cumulative)**

(4) No cross outs, use an eraser. **(noncompliance: 10 points off; cumulative)**

(5) **Free-body diagrams (FBD)** – **WHEN NECESSARY/NEEDED**, Draw a neat FBD that includes arrows with arrowheads, necessary dimensions, and parameters needed to solve the problem
(noncompliance: problem/HW will NOT be graded; no points will be honored)
Example:





Problem Statement F.B.D

(6) **Solution** – provide all the details so that anybody can easily follow your solutions and problem-solving approach. All intermediate values should be identified with the variable name and units (e.g., F_1=50 N; Xc = 2.1 m).**(noncompliance: 10 points off; cumulative)**

(7) **Answer** – the **Final Answer** at the end of the problem should be identified with the **variable name, include units, and inside a box.** Include an arrow (from the far right side of the page) pointing to each final answer.
(noncompliance: 10 points off; cumulative)
Example:

$\boxed{F_1 = 50\ \text{N}}$ ←

Exam and Quiz Policy:

(1) Exams and quizzes will be announced in advance; Exams are closed book and closed notes with approved formula sheets only; Quizzes will be open book open notes and open to all the resources.

(2) Formula sheets: Use the formula sheets approved only, NOTHING ELSE.

(3) Calculator: **ONLY** FE exam approved calculator models allowed
Casio: All fx-115 and fx-991 models;
Hewlett Packard: The HP 33s and HP 35s models;
Texas Instruments: All TI-30X and TI-36X models;

(4) Using ANY unauthorized/unapproved materials during the exam is prohibited and considered as cheating.

(5) Exchanging (either borrowing or giving) ANYTHING without the approval from the proctor, including but not limited to, calculators/scratch papers/formula sheets/ thermodynamics tables/writing tools during the exam between/among students is prohibited and considered as cheating.

(6) Using cell PHONE for WHATEVER purpose during the exam is prohibited and considered as cheating.
(7) Using Internet through any device during the exam is prohibited and considered as cheating.
(8) Peeking, talking or discussing (either by oral/written/sign language) between/among students during the exam is prohibited and considered as cheating.
(9) Using any type of earpiece/earbuds/earphone/Bluetooth/Stereo Headset (except with doctor's prescription/notes) during the exam is prohibited and considered as cheating.
(10) Using any type of smart glasses (except with doctor's prescription/notes) during the exam is prohibited and considered as cheating.
(11) Using any type of smart watches during the exam is prohibited and considered as cheating.
(12) Cheating will result in SCORE ZERO in the exam
(13) Cheating will be reported to the Department, College and University
(14) There will be NO make-up exam.
Exceptions: refer to UNT Policies 06.039.
Procedure for Exceptions: Please request accommodations/exceptions through UNT "Dean of Students Office"
(15) Makeup exam should be scheduled within one week after the regular exam date.

Disability Accommodations: If you need academic accommodations for disability, you must have document which verifies the disability and makes you eligible for accommodations, then you can schedule an appointment with the instructor to make appropriate arrangements.

Academic Dishonesty:
There is a zero-tolerance policy. Cheating of whatsoever will result in an automatic 'F' in this course and the matter will be turned over to the appropriate student disciplinary committee.

Professionalism:
One of the goals of this course is to teach students about professionalism, including the standards and expected behavior of your chosen profession. With this in mind, students are expected to demonstrate a behavior consistent with the conduct of an individual practicing in the engineering profession. Students are expected to: (1) come prepared for class; (2) respect faculty and peers; (3) demonstrate responsibility and accountability for your own actions; (4) sensitivity and appreciation for diverse cultures, backgrounds, and life experiences; (5) offer and accepts constructive criticism in a productive manner; (6) demonstrate an attitude that fosters professional behavior among peers and faculty; (7) be punctual to class meetings; (8) maintain a good work ethic and integrity; and (9) recognize the classroom as a professional workplace.

Classroom Inclusivity Statement
I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

MEE Program Educational Objectives
The educational objectives of the Mechanical & Energy Engineering program are to produce graduates who will:

- Graduates are prepared for successful employment in mechanical and/or energy engineering positions and other related fields.
- Graduates engage in lifelong learning demonstrated by advanced education, professional development activities and/or other career-appropriate options.
- Graduates are prepared to successfully demonstrate technical and leadership competence through ethical conduct, teaming, communication and/or problem-solving skills learned in our program.

ABET Student Outcomes

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- An ability to communicate effectively with a range of audiences.
- An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

IMPORTANT EXAM DATES

Exam #1 (tentative; depends on when chapter 3 is finished; Covers Ch 1/2/3):
Tuesday July 5, 2022

Exam #2 (tentative; depends on when chapter 6 is finished; Covers Ch 4/5/6):
Tuesday July 26, 2022

Exam #3 (UNT official final exam schedule; Covers Ch 7/8/9)
Friday August 12, 2022. 4:00 p.m.-6:00 p.m.

UNT Official Academic Calendar: Summer 2022

June 6, 2022	First class day
June 10, 2022	Student-requested schedule changes may be made during add/drop.
June 10, 2022	Last day for change of schedule other than a drop. (Last day to add a class.)
July 1, 2022	Last day for change in pass/no pass status.
July 4, 2022	Independence Day (university closed)
July 27, 2022	Last day to drop a course.
July 27, 2022	Last day to withdraw from the semester. Process must be completed by 5 p.m. in the Dean of Students Office. Grades of W are assigned.
July 28, 2022	Beginning this date a student who qualifies may request a grade of I, incomplete. (See "Grading system" in the Academics section of this catalog.)
August 11, 2022	Last class day
August 12, 2022	Final examinations
August 12, 2022	Last day of session

MEEN 3210 Heat Transfer
Schedule Overview

Week	Date	Topic
#1	Jun. 6- Jun. 10	Overview of syllabus; Ch.1: introduction Ch.1: introduction to heat transfer: three modes of heat transfer
#2	Jun. 13- Jun. 17	Ch 2: introduction to conduction: Thermal Conductivities Ch 2: introduction to conduction: The Heat Equation; Quiz#1 (Ch1 &2)
#3	Jun. 20- Jun. 24	Ch 3: One Dimensional, Steady-State Conduction: Plain Wall and Thermal Resistance Concept Ch 3: One Dimensional, Steady-State Conduction: Thermal Circuit Method; Quiz#2(Thermal circuit method)
#4	Jun. 27- Jul. 1	Ch 3: One Dimensional, Steady-State Conduction: Extended Surface Ch 3: One Dimensional, Steady-State Conduction: Extended Surface
#5	Jul. 4- Jul. 8	-Exam #1: covers Ch 1,2 and 3 Ch 4: Two-dimensional Steady State Conduction: Finite Difference Method
#6	Jul. 11- Jul. 15	Ch 4: Two-dimensional Steady State Conduction: Finite Difference Method Ch 5: Transient conduction: LCM method
#7	Jul. 18- Jul. 22	Ch 5: Transient conduction: one term approximation Quiz#3(Ch 4 & 5) Ch 6: Introduction to convection: Convection Boundary Layers
#8	Jul. 25- Jul. 29	Exam #2: covers Ch 4, 5 and 6 Ch 7: External Flow: Flat Plate in Parallel Flow
#9	Aug. 1- Aug. 5	Ch 7: External Flow: Cylinder & Sphere in Cross Flow Quiz#4 (Ch7) Ch 8: Internal Flow: Hydrodynamic & thermal considerations
#10	Aug. 8- Aug. 12	Ch 8: Internal Flow: Energy Balance Quiz#5 (Ch 8) Ch 9: Free convection Exam #3 (Final): covers Ch 7, 8, 9