Fall 2019

MECH 4315 (13026) HEAT TRANSFER

Course Description Introduction to heat transfer by conduction, convection and radiation; steady and periodic states. ***Prerequisites are MECH 3314 Fluid Mechanics and MECH 3312 Thermodynamics.***

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Textbook *Heat and Mass Transfer* Fifth Edition (2015)
by Yunus Cengel and Afshin Ghajar
McGraw Hill

Course Content

1. Heat Conduction Equation (Chapter 2)
   a. One dimensional heat conduction
   b. Heat generation in a solid
2. Steady Heat Conduction (Chapter 3)
   a. Plane walls
   b. Thermal resistance models
   c. Cylinders and Spheres
   d. Critical radius of insulation
   e. Finned surfaces
3. Transient Heat Conduction (Chapter 4)
   a. Lumped system analysis
   b. Large plane walls, long cylinders, and spheres
   c. Semi-infinite solids
4. External forced convection (Chapter 7)
   a. Flow over flat plates
   b. Flow across cylinders and spheres
   c. Flow across tube banks
5. Internal Forced Convection (Chapter 8)
   a. Mean velocity and temperature
   b. Entrance region
   c. Thermal analysis (constant heat flux, constant surface temperature)
6. Natural Convection (Chapter 9)
   a. Grashof number

b. Natural convection over surfaces
c. Natural convection from finned surfaces
d. Natural and forced convection combined
7. Radiation Heat Transfer (Chapter 13)

Grading

Quizzes	200
Tests (4 given - 3 best will count)	300
Projects	200
Possible Points	**700**

A (700-630): B (629-560): C (559-490): D (489-420): F (419 and Below)

There will be ten quizzes of 20 points each, four 80-minute tests of 100 points each, and two projects given during the semester of 100 points each. There will be no makeups for the tests or quizzes. Your lowest test grade will be dropped.

The projects will consist of small design or experimental type problems that you will have to complete. These projects will be detailed either in class or on Blackboard.

Major Course Objectives

Upon completion of this course, students should be able to:

1. To present a comprehensive and rigorous treatment of classical heat transfer while retaining an engineering perspective
2. To encourage creative thinking and the development of an intuitive feel for heat transfer
3. To prepare the student to effectively use heat transfer in the practice of engineering.

Policy for Quizzes

Quizzes will be based on helping you study for both the Fundamental of Engineering (FE) and Professional Engineering (PE) exams (http://www.ncees.org/exams/).

I recommend that you use an approved calculator similar to what you will use for your certification exams for all your work since this will help you learn how to use all the features of your calculator. These calculators include Casio: All fx-115 models. Any Casio calculator must contain fx-115 in its model name, Hewlett Packard: The HP 33s and HP 35s models, and Texas Instruments: All TI-30X and TI-36X models.

ABET Program Outcomes Impacted

This class significantly addresses the following ABET objectives:
(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a realistic system, component, or process to meet desired needs

(e) an ability to identify, formulate, and solve engineering problems

Academic dishonesty
All graded materials must represent the student's individual work. Scholastic dishonesty is the attempt of any student to present as his or her own work of another, or any work which he has not honestly performed, or attempting to pass any examination by improper means. ***Scholastic dishonesty is a serious offense and will not be accepted***. Academic misconducts will be handled according to the current university policy.

Reasonable Accommodation Policy: If you need classroom accommodation, please contact The Center for Accommodations and Support Services (CASS) at 915-747-5148, or by email to cass@utep.edu , or visit the office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

Department of Mechanical Engineering Safety Statement
The Department of Mechanical Engineering at the University of Texas at El Paso is committed to a model of excellence in education that includes providing a safe and healthy environment for its students, staff, faculty and the general public.

Our goal is to maximize education and research training that can only occur if you, the individual, minimize hazards and risks. This can be done by:

- Providing adequate control of the health and safety risks arising from any and all activities;
- Consulting with employees on matters affecting their health and safety
- Providing and maintaining safe laboratories and equipment;
- Ensuring safe handling and use of substance;
- Ensuring all employees are competent to do their task and have adequate training; and
- Maintaining clean, safe and healthy working conditions

The principal investigator or individual in charge of each laboratory is ultimately responsible for safety in that respective lab. This includes training and ultimate release of the laboratory. Within the Department, we hold every employee (staff, faculty, student) responsible for implementing our safety practices and our departmental safety policy. We hold every employee (staff, faculty, student) responsible for providing leadership within our department to establish effective environmental safety and occupational health standards.

TENTATIVE CLASS SCHEDULE
MEETING TIME: TR 900-1020
MEETING LOCATION: Physical Sciences Building 208

Week	Dates	Chapter(s)	Read Sections	Self-Study Problems	Scheduled and DUE
1	08/27 08/29	1 – Intro 2 – Heat Conduction Equation: One Dimensional	1.1-9 2.1-5	- 2-17, 2-26, 2-27, 2-29, 2-42, 2-53C, 2-58, 2-59, 2-61, 2-62, 2-64, 2-68E	Nothing due this week
2	09/03 09/05	2 – Heat Conduction Equation: Heat Generation in a Solid 3 – Steady Heat Conduction: Plane Walls	2.6 3.1-2	2-83, 2-85, 2-93 3-17, 3-20, 3-24, 3-25, 3-28E, 3-29, 3-40E	- **Quiz 1 – 09/05 - Covering Chap. 2**
3	09/10 09/12	3- Steady Heat Conduction: Thermal Resistance Models Cylinders and Spheres	3.3 3.4	3-56, 3-58C, 3-61, 3-66,3-72 3-73C, 3-75C, 3-80E	- **Quiz 2 – 09/12 - Covering Ch. 2**
4	09/17 09/19	Critical Radius of Insulation Finned Surfaces	3.5 3.6	3-101E 3-114C, 3-115C, 3-118, 3-122E, 3-123E, 3-129, 3-133	- **Quiz 3 – 09/19 - Covering Ch. 3**
5	09/24	Test Review 1 Chapters 1-3	Week 1-4 Readings	Week 1-4 Self-Study Problems	-

	09/26				**TEST 1 09/26 Chaps. 1, 2, 3**
6	10/01 10/03	4 – Transient Heat Conduction: Lumped System Analysis Large Plane Walls, Long Cylinders, and Spheres	4.1 4.2	4-15, 4-21, 4-23, 4-25, 4-26, 4-28 4-42C, 4-43C, 4-45C, 4-47	- **Quiz 4 – 10/03- Covering Chap. 3**
7	10/08 10/10	4 - Large Plane Walls, Long Cylinders, and Spheres Semi- Infinite Solids	4.2 4.3	4-52, 4-54, 4-56, 4-63 4-83C, 4-84C, 4-85E	- **Quiz 5 – 10/10- Covering Chap. 4**
8	10/15 10/17	7 – External Forced Convection Flow Over Flat Plates	7.1 7.2	7-4C, 7-5C, 7-10C 7-14, 7-17, 7-25, 7-28, 7-41	- **Quiz 6 – 10/17- Covering Chap. 7**
9	10/22 10/24	Test Review 2 Chapters 4 and 7	Week 6 -8 Readings	Week 6-8 Self-Study Problems	- **TEST 2 10/24 Chaps. 4 and 7**
10	10/29 10/31	7 – Flow Across Cylinders and Spheres Flow Across Tube Banks	7.3 7.4	7-61C, 7-62C, 7-64, 7-69, 7-74E 7-99C, 7-100C, 7-101, 7-102	**PROJECT 1 ASSIGNED** **Quiz 7 – 10/31- Covering Chap. 7**

	Course Drop Deadline: Nov 1st				
11	11/05 11/07	8 – Int. Forced Convection Mean Velocity and Temperature and Entrance region	8.1 8.2-3	8-19, 8-20 8-22, 8-23, 8-24	- **Quiz 8 – 11/07 - Covering Ch. 8**
12	11/12 11/14	Thermal Analysis Laminar/Turbulent Flow in Tubes	8.4 8.5-6	8-27, 8-28, 8-29, 8-30 8-33C, 8-36C, 8-37C 8-38, 8-46, 8-52, 8-57, 8-59, 8-62	**PROJECT 2 ASSIGNED** **Quiz 9 – 11/14 - Covering Ch. 8**
13	11/19 11/21	Test Review 3 Chapters 7 and 8 -	Week 10 and 11 Readings -	Week 10 and 11 Self-Study Problems -	- **TEST 3 11/20 Chaps. 7 and 8**
14	11/26 11/28 **Thanksgiving Holiday: November 28 and 29**	9 – Natural Convection and Grashof Number **UNIVERSITY CLOSED THANKSGIVING HOLIDAY**	9.1-2 -	9-10, 9-12, 9-13E -	**Class Project 1 DUE – 11/26** -
15	12/03	Natural Convection Over Surfaces and from Finned Surfaces	9.3-4	9-18, 9-20, 9-21, 9-27, 9-31, 9-60, 9-63, 9-85,	**Class Project 2 DUE – 12/03**

	12/05	13- Radiation Heat Transfer View Factor	13.1-2	9-86, 9-88, 9-89E 13-9, 13-11, 13-16, 13-36	**Quiz 10 – 12/05- Covering Chap. 9**
16	**FINAL EXAM (TEST 4) Tuesday December 10th 1000 -1245**				