ME 378: HEAT TRANSFER

This class is in-person instruction

Course Syllabus (1447/1448 H)

Instructor: Dr. Mohammed Alanazi

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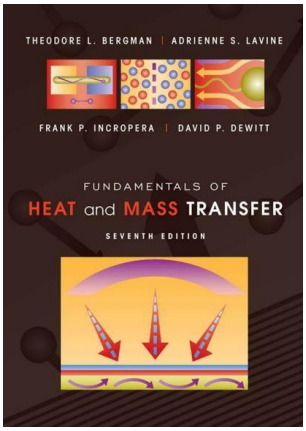
Class Time: Mondays and Wednesdays (10:00 am to 11:50 am)

Office Hours: Wednesdays (1:00 pm to 2:00 pm) or by email

Number of Credit: 4(4,1,0) (X, Y, L)

Text: *Fundamentals of Heat and Mass Transfer, Bergman, T. L. and Lavine, A. S., 7th Edition, John Wiley & Sons, 2011.*



Course Description: ME 378 (Heat Transfer) is a 4-credit hour fourth-year course. The course is designed to introduce the students to the basic modes of heat transfer; namely, conduction (steadystate and transient), convection (forced and free in external and internal flows), and radiation, and to develop relations to calculate material temperatures and heat transfer rates, as well as to apply knowledge of heat transfer with the first law of thermodynamics to solve problems relevant to technology and environment. Emphasis is also placed on numerical techniques, heat exchanger thermal analysis, radiation processes and properties, and radiation exchange between surfaces. Throughout the semester, the students are required to submit homework assignments, take frequent quizzes, and carry out a group mini-project which usually involves a computer assignment related to design / performance of a thermal system. The intent of these activities is to deepen the students' understanding of basic heat transfer knowledge, raise their awareness of technological, environmental, and energy issues related to heat transfer.

Prerequisite by Course: ME 384 (Fluid Mechanics).

Prerequisite by Topics:

1. First law of thermodynamics (conservation of energy principle).

2. Boundary layer equations (mass continuity and momentum).

3. Calculus.

Science/Design Contents:

Engineering Science: 100%

Engineering Design: 0%

Class/Tutorial Schedule: Four 65-minute lecture sessions including tutorial sessions per week.

Attendance: Attendance at every class meeting is expected.

Computer usage: Students are encouraged to use MATLAB, MATHEMATICA, and Engineering Equation Solver (EES).

Lectures: At the beginning of each week, lecture notes will be posted on the course website. These notes are PDF files which you can print and bring to class to assist with note taking. ***Distribution notes to other students/faculty members are not allowed***. "**No matter who are you, welcome to my class**".

Homework: The assigned reading is to be completed by the beginning of the class on the dates shown. Homework problems are due on the dates listed on the syllabus. All assignments will be collected and graded. ***Any late submission, 50% penalty will be applied.***

Quizzes: 3 Quizzes will be given throughout the semester, normally after each main topic. These quizzes will be based on the lecture material and homework assignments and will be closed textbook, closed notes.

Term Mini Project: Groups of 3 students work on a real-life hands-on-experience problem involving thermal analysis of a system by using thermal instrumentations.
Computer engineering programs are used to analyze the data and present the results. Complete report should be submitted.

Tests & Exam: Two midterm tests will be given on the dates shown on the assignment schedule and will be in person. The final exam is mandatory and will also be in person too. Makeup tests will only be given in extenuating circumstances. The final exam will be comprehensive, i.e., it covers all the course material.

Honor Code System: I strongly trust my students and I encourage them to do their work by own. Students who copy from their class mates honor code system will be promptly reported.

Grading: Your final grade will be based on your performance, as follows:

Midterm I Test:	**22.5%** (Instructor assessed)
Midterm II Test:	**22.5%** (Instructor assessed)
Homework:	**5%** (TA/Grader assessed)
Quizzes:	**5%** (TA/ Grader assessed)
Term project:	**5%** (Instructor assessed)
Final Exam:	**40%** (Instructor assessed)

No grades will be dropped.

Grade Ranges:

A+	95-100%
A-	90-94.99%
B+	85-89.99%
B-	80-84.99%
C+	75-79.99%
C-	70-74.99%
D+	65-69.99%
D-	60-64.99%
F	<60%

Course Learning Statements: Having completed this course, you will be able to:

1- Identify modes of heat transfer, introduce rate equations, and apply energy balance.
2- State assumptions, simplify conduction equations, and determine temperature distributions and heat transfer rates for different boundary conditions.
3- Analyze multi-dimensional conduction problems and solve them by using the finitedifference method.
4- Analyze time-dependent conduction problems.
5- Identify flow situations and apply empirical correlations for forced and free convection.
6- Classify types of heat exchangers and carry out design and performance thermal analysis.
7- Recognize properties of radiation and analyze radiation exchange between surfaces.

Topic	Chapter	Section	Selection of Problems (7th Edition)
Introduction	1	1.1 – 1.7	1 , 2 , 5 , 9 , 10 , 11 , 13 , 15 , 18 , 20 , 21 , 22 , 25 , 26 , 28 , 29 , 30 , 32 , 35 , 44 , 45 , 49 , 62 , 64 , 65 , 72 , 73 , 75 , 76 , 77 , 78 , 79 , 80 , 81 , 83 , 86 , 87
Introduction to Conduction	2	2.1 – 2.5	1,4 ,6, 10 ,11 , 12 , 13 , 19 , 24 , 30 , 31 , 32 , 33 , 34 , 40 , 48 , 51 , 53 , 54 , 55 , 57 , 58 , 59 , 62 , 65 , 69
1-D, Steady-State Conduction	3	3.1 – 3.6 , 3.10	1 , 3 , 7 , 10 , 12 , 13 , 18 , 19 , 20 , 26 , 29 , 39 , 41 , 42 , 45 , 50 , 58 , 65 , 74 , 75 , 80 , 81 , 84 , 88 , 96 , 101 , 102 , 104 , 130 , 141 , 158
2-D, Steady-State Conduction	4	4.1 – 4.6	2 , 6 , 9 , 14 , 16 , 20 , 38 , 47 , 61 , 64
Transient Conduction	5	5.1–5.5 , 5.7, 5.9,5.10,5.11	6 , 8 , 10 , 43 , 51 , 57 , 85 , 86 , 91 , 92 , 93 , 110 , 114
Introduction to Convection	6	6.1 – 6.6 , 6.7.3, 6.8	2 , 3 , 5 , 7 , 8 , 19 , 21 , 27 , 28 , 32 , 35 , 37 , 45
External Flow	7	7.1 – 7.6 ,7.9	1 , 2 , 10 , 17 , 34 , 43 , 47 , 65 , 74 , 75 , 92
Internal Flow	8	8.1–8.6, 8.10	6 , 25 , 29 , 35 , 42 , 43 , 66 , 80 , 85 , 87 , 93 , 97
Free Convection	9	9.1–9.6, 9.11	2,3,7,13,17, 35 , 52 , 53 , 55 , 76 , 77
Heat Exchangers	11	11.1 – 11.7	7 , 13 , 14 , 16 , 18 , 20 , 25 , 32 , 44 , 79 , 82
Radiation: Processes and Properties	12	12.1 – 12.10	1 , 5 , 6 , 7 , 9 , 10 , 16 , 37 , 49 , 62 , 69
Radiation Exchange Between Surfaces	13	13.1 – 13.2 , 13.7	1 , 3 , 6 , 8 , 11 , 21

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