

MECH 338—Heat Transfer (3 units)
Course Syllabus
Fall 2019

**Mechanical and Mechatronic Engineering
and Sustainable Manufacturing**
California State University, Chico

Instructor: Webster Johnson (“Dr. J.”), Ph.D., OCNL 418, 898-5579, wjohnson@csuchico.edu
Office Hours: Mon 12:30-2:30 PM, Tu 12-1 PM, Th 12-1 PM

Classes Lecture: Tu-Th: 9:30-10:45 AM OCNL 254
Activity: Tu 2:00 – 3:50 PM, OCNL 254

Prerequisites: CIVL 321, Fluid Mechanics; MECH 332, Thermodynamics.
Recommended: MECH 306, Equation Solving Techniques

Textbook: “*Fundamentals of Heat & Mass Transfer*”, Bergman, Lavine, Incropera, and DeWitt, Wiley & Sons
One of the following editions:
8th Edition (Loose-Leaf): (available in bookstore)
7th Edition (internet sources)

Software Excel, Matlab

Internet: Lecture slides, text problem homework and solutions, design problems, and other course material are posted on Blackboard Learn.

Grading:

Homework Problems	15 %
Design Problems (2)	20 %
Activity Exercises	5 %
Midterm Exams (2)	40 %
Final Exam	20 %

Grade Schema

A	A-	B+	B	B-	C+	C	C-	D+	F
>= 93.33	>= 90.00	>= 86.67	>= 83.33	>= 80.00	>= 76.67	>= 73.33	>= 70.00	>= 65.00	< 65.00

Homework: There will be approximately 10 homework problem sets assigned during the semester. Problem solutions must be neat, legible, numbered, arranged in assigned order, written on only one side of the paper, and stapled. Solution analysis must follow a specific methodology, which is outlined in section 1.4 of the textbook and used for all text examples.

Homework is due at the beginning of class on the due date. **Late homework is not accepted. Homework submitted by e-mail is not accepted.**

Design Problems Two design problems will be assigned that focus on particular heat transfer applications. It is an open-ended problems that require more creative thought than homework problems. Required report format will be given with the assignment

Activity Session: The Tuesday activity sessions will be used for midterm exams, class exercises, lecturing, and some demonstrations. Participation in class exercises represents 5% of the course grade. Always bring your textbook and laptop to the activity session.

- Examinations:** There will be two, 2-hour midterm exams and a 2-hour final exam. The midterm exams will be given during the activity session on Thursdays. The Final Exam will have emphasis on those topics covered after the last midterm exam. Use of the textbook and one, 8½" x 11" page of notes are allowed during the exams.
- If you know you are going to miss an exam due to illness or other legitimate reason, you must contact me before the exam.** Make-up exams are only allowed for pre-arranged, legitimate absences.
- Email:** If you need to contact me outside of class or office hours, please use email. It is expected that all students will monitor their Wildcat email accounts as I will use this system to make important announcements from time to time. You can set up automatic forwarding of your Wildcat email to another preferred email provider at
- Cell Phones:** All alert sounds on your cell phone must be turned off during class. Cell phone use during class is not tolerated, except for emergency situations (911).
- Academic Integrity:** Students are expected to be familiar with the University's Academic Integrity Policy. Your own commitment to learning, as evidenced by your enrollment at California State University, Chico, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Judicial Affairs. The policy on academic integrity and other resources related to student conduct can be found at: <https://www.csuchico.edu/pres/em/2018/18-011.shtml>. Copying solutions from other sources is a form of plagiarism and punishable in accordance with the University Academic Integrity Policy.
- Disability Services:** If you need course adaptations or accommodations because of a disability or chronic illness, please see me during office hours as soon as possible. Students with disabilities requesting accommodations must register with Accessibility Resource Center (ARC) to establish a record of their disability. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations. Special accommodations for exams require ample notice to the testing office and must be submitted to the instructor well in advance of the exam date. The Disability Support Services website is <http://www.csuchico.edu/arc/index.shtml>.

Course Objectives: Students will learn to model, analyze, and design heat transfer systems, components and processes by applying the appropriate rate equations (for conduction, convection, and radiation) with the principle of energy conservation.

Specific Course Outcomes

1. Identify the important and/or possible heat transfer modes in *any* physical system.
2. Write surface and control volume energy balances with the appropriate heat transfer rate equations for any physical system.
3. Simplify the general heat conduction equation and write boundary conditions for any well-posed conduction heat transfer problem.
4. Represent any steady-state, 1-D conduction system as a *thermal circuit* and solve for unknown heat rates and/or temperatures.
5. Use the *lumped capacitance method* or appropriate analytical solution to solve transient conduction problems.
6. Calculate a convection heat transfer coefficient (h) from an appropriate empirical correlation and use it to determine a heat transfer for a variety of fluid flow configurations.
7. Design/specify a fin array or heat sink to meet a temperature or heat rate requirement.
8. Calculate pressure drop, fluid outlet temperatures, heat transfer rate, or required surface area for pipe flows and heat exchangers.
9. Determine view factors, compute radiation heat rates and/or temperatures in an n -sided enclosure with gray, diffuse surfaces.

Schedule (subject to fair modification and fair warning)

Week	Week of	Topic	Text	Activity
1	26-Aug	Introduction	1.1-1.7	0 Basics
2	2-Sep	Conduction Heat Transfer	2.1-2.5	1 Stove
3	9-Sep	1-D Steady State Heat Conduction	3.1-3.3	2 Wall R-Value
4	16-Sep	1-D Steady State Heat Conduction	3.4-3.5	3 Fin Study
5	23-Sep	1-D Extended Surfaces	3.6 & 3.10	4 Finite Difference
6	30-Sep	2-D Steady State Heat Conduction	4.1, 4.3 & 4.6	Midterm Exam 1
7	7-Oct	Transient Heat Conduction	5.1-5.7, 5.11	5 Transient Conduction
8	14-Oct	Convection Heat Transfer	6.1-6.8	6 Flat Plate Forced Convection
9	21-Oct	External Forced Convection	7.1-7.5, 7.7 & 7.9	No Activity
10	28-Oct	Internal Forced Convection	8.1-8.3	7 Internal Pipe Flow
11	4-Nov	Internal Forced Convection	8.4--8.7 & 8.19	8 Natural Convection
12	11-Nov	Free Convection	9.1-9.3, 9.5-9.11	Midterm Exam 2
13	18-Nov	Heat Exchangers	11.1-11.7	9 Heat Exchanger
	25-Nov	Fall Break		
14	2-Dec	Radiation Heat Transfer	12.1-12.10	10 Thermal Radiation
15	9-Dec	Radiation Heat Transfer	13.1-13.5 & 13.7	Review
16	16-Dec	Final Exams Week		

Important Dates

Date	Event
17-Sep	Project #1 Announced
1-Oct	Midterm #1
17-Oct	Project #1 Due
3-Nov	Project #2 Announced
11-Nov	Midterm #2
Nov 25-29	No classes: Spring Break
3-Dec	Project #2 Due
13-Dec	Last day to challenge grades
Dec 16-20	Finals Week