

MECH 338—Heat Transfer (3 units)
Course Syllabus
Spring 2022

Mechanical & Mechatronic Engineering
and Advanced Manufacturing
CSU, Chico

Instructor: Webster Johnson (“Dr. J.”), Ph.D., OCNL 418, 898-5579, wrjohnson@csuchico.edu
 Office Hours: TBD (See class page on Bb Learn)

Classes Lecture: OCNL 124, MWF 11-11:50 AM
 Activity: OCNL 124, Tu 3:00 – 5:00 PM

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 (Digital, Loose-Leaf, or Hard-Bound): (available in bookstore [Link](#))
 7th or 6th Edition (internet sources)
 6th Edition
Note: The *WileyPlus* bundle is **not** necessary

Software Excel, Matlab

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

Grading:

Homework Problems	15 %
Activities	5%
Design Problems (2)	20 %
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 Tuesday. The midterms and final exam will cover the subjects since the previous exam. The exams are in-person.

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.

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).

University Policies and Campus Resources

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 on the [Student Judicial Affairs web site](#).

IT Support Services (Optional)

Computer labs for student use are located on the first and fourth floor of the Meriam Library, Room 116 and 450, Tehama Hall Room 131, and the Bell Memorial Union (BMU) basement. You can get help using your computer from IT Support Services; contact them through the [ITSS web site](#). Additional labs may be available to students in your department or college.

Student Services (Optional)

Student services are designed to assist students in the development of their full academic potential and to motivate them to become self-directed learners. Students can find support for services such as skills assessment, individual or group tutorials, subject advising, learning assistance, summer academic preparation and basic skills development. Student services information can be found on the [current students page of the CSU Chico web site](#).

Americans with Disabilities Act

If you need course adaptations or accommodations because of a disability or chronic illness, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Please also contact Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. 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.

[Accessibility Resource Center](#)

530-898-5959

Student Services Center 170

arcdept@csuchico.edu***Student Learning Center (Optional)***

The mission of the Student Learning Center (SLC) is to provide services that will assist CSU, Chico students to become independent learners. The SLC prepares and supports students in their college course work by offering a variety of programs and resources to meet student needs. The SLC facilitates the academic transition and retention of students from high schools and community colleges by providing study strategy information, content subject tutoring, and supplemental instruction. The University Writing Center has been combined with the Student Learning Center. You can also visit the [Student Learning Center web site](#).

Blackboard ALLY

Chico State is committed to providing you the best learning experience possible. With this goal we have activated Blackboard ALLY in your courses. ALLY is a revolutionary product that focuses on making digital course content more accessible to all students. You will now be able to download any content in this course in the format that fits best with your learning style. PDF, HTML, .EPUB and Audio files are now available for most content items. Here is a link to more [information on formats available](#) as well as what each format offers. Should you have any questions or experience issues while using ALLY please contact the Office of Accessible Technology and Services at oats@csuchico.edu or 530-898-6532.

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)

Term Week	Week Starting	Topic	Text	Activity
1	25-Jan	Introduction	1.1-1.7	0 Basics
2	1-Feb	Conduction Heat Transfer	2.1-2.5	1 Stove
3	8-Feb	1-D Steady State Heat Conduction	3.1-3.3	2 Wall R-Value
4	15-Feb	1-D Steady State Heat Conduction	3.4-3.5	3 TBA
5	22-Feb	1-D Extended Surfaces	3.6 & 3.10	4 Fin Study
6	1-Mar	2-D Steady State Heat Conduction	4.1, 4.3 & 4.6	5 Transient Conduction
7	8-Mar	Transient Heat Conduction	5.1-5.7, 5.11	Midterm Exam 1
—	15-Mar	SPRING BREAK	—	—
8	22-Mar	Convection Heat Transfer	6.1-6.8	6 Flat Plate Forced Convection
9	29-Mar	External Forced Convection	7.1-7.5, 7.7 & 7.9	7 Ext. Forced Convection
10	5-Apr	Internal Forced Convection	8.1-8.3	8 Internal Pipe Flow
11	12-Apr	Internal Forced, Free Convection	8.4--8.7 & 8.19	9 Natural Convection
12	19-Apr	Free Convection	9.1-9.3, 9.5-9.11	Midterm Exam 2
13	26-Apr	Heat Exchangers	11.1-11.7	10 Heat Exchanger
14	3-May	Radiation Heat Transfer	12.1-12.10	11 Thermal Radiation
15	10-May	Radiation Heat Transfer	13.1-13.5 & 13.7	Review
16	17-May	Final Exam: Monday May 17, 12-2		

Important Dates

Date	Event
17-Feb	Project #1 Announced
9-Mar	Midterm #1
22-Mar	Project #1 Due
Mar 15-19	No classes: Spring Break
19-Apr	Project #2 Announced
27-Apr	Midterm #2
14-May	Project #2 Due
14-May	Last day to challenge grades
17-May	Final Exam @12Noon-1:50PM