San José State University
Mechanical Engineering Department
ME 114: Heat Transfer – Section 2, Spring 2020

Course and Contact Information

Instructor:	Prof. Crystal Han
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Office Hours:	Tuesdays 3 – 3:45 PM, Thursday 9:15 – 10:15 AM or by appointment
Class Days/Time:	Tuesdays and Thursdays, 1:30-2:45 AM
Classroom:	Engineering Building 329
Prerequisites:	ME 113 and Math 133A, both with a C- or better

Proof of Prerequisites

You must submit proof of prerequisites to your instructor before the **second day of class** to stay enrolled. Please hand in a copy of your unofficial transcript with the prerequisite courses highlighted. If your courses are being evaluated for equivalency, please attach a course description to your unofficial transcript. Graduate students may take ME 114 with recommendation from a graduate advisor.

Course Format

This course takes the in-person lecture format utilizing both written notes on the board and PowerPoint slides. Each lecture will also include in-class problem solving time on worksheets. Canvas will be used to post lecture notes, worksheets, handouts, grades, homework solutions, and weekly announcements. It is your responsibility to check Canvas regularly for any updates or course materials. I strongly suggest having all announcements forwarded to an email address you check daily. To use Canvas, go to http://my.sjsu.edu, click "Canvas," and login with your 9-digit SJSU ID and password.

A separate online system called McGraw-Hill will be used to facilitate the learning. I will post both conceptual and analytical problems related to homework problems. These will also serve as practice problems for your quizzes and exams. Access to the system requires that you purchase either the bundled book with access code from the bookstore, or otherwise purchase an access code (which gives you access to an e-book). To start using Connect, visit http://connect.mheducation.com/class/gosselin-me114-f17**.**

Course Description

Conduction, convection and radiation heat transfer with applications. Analytical, experimental, and computational methods of analyzing heat transfer behavior.

Course Learning Outcomes (CLO)

By the end of the course, each student should demonstrate an ability to

1. Apply the heat diffusion equation to calculate temperature distributions and heat transfer rates in simple geometries.
2. Determine the variation of thermal conductivity between classes of materials (metals, ceramics, and polymers), phases of matter, and with temperature (and pressure for gases).
3. Calculate thermal resistances, including contact resistances, and develop thermal circuits.
4. Analyze heat transfer from finned surfaces.
5. Apply finite difference techniques to compute heat conduction in 1- and 2-dimensional configurations, under steady and transient conditions.
6. State sources of uncertainty in computational fluid dynamics programs and determine ways to improve their accuracy
7. Analyze transient conduction using lumped capacitance and determine when its use is appropriate.
8. Calculate temperatures for transient heat conduction in multi-dimensional geometries where lumped capacitance does not apply.
9. Explain the importance of boundary layers to heat transfer.
10. Explain the importance and source of the convection transfer equations.
11. Explain the significance of non-dimensional parameters such as Re, Pr, Nu, and Sc.
12. Explain the analogy between heat and mass transfer.
13. Use correlations to determine heat transfer coefficients and/or temperatures for external flow over plates, cylinders, and spheres.
14. Use correlations to determine heat transfer coefficients and/or temperatures for internal flow in tubes.
15. Determine conditions under which convection is natural, forced, or mixed.
16. State the main categories of heat exchangers.
17. Determine overall heat exchanger coefficients for heat exchangers using the log-mean-temperature-difference (LMTD) and number of transfer units (NTU) methods.
18. Calculate heat transfer and pressure drop for a heat exchanger given a graph of j and f vs. Re.
19. Explain the differences among intensity, emissive power, radiosity, and irradiation and between spectral and hemispherical.
20. Explain the difference between diffuse and grey.
21. Apply Wien's Displacement Law, the Stefan-Boltzmann Law, band emission, and blackbody functions.
22. Compute the radiative properties emissivity, absorptivity, reflectivity, and transmissivity.
23. Apply Kirchoff's Law.
24. Account for environmental radiation.
25. Compute view factors.
26. Calculate radiation exchange between blackbodies.
27. Analyze radiation exchange between two diffuse, gray surfaces in an enclosure.

ABET Learning Outcomes

This course addresses the following outcomes for our accreditation by the Accreditation Board for Engineering and Technology. Graduates are expected to attain the following outcomes:

a. an ability to apply knowledge of mathematics, science and engineering.
e. an ability to identify, formulate and solve engineering problems.
j. a knowledge of contemporary issues.

Required Texts/Readings

Textbook

Heat and Mass Transfer: Fundamentals and Applications, by Cengel and Ghajar, 6th ed., McGraw-Hill.

First Day Inclusive Access Program

This course is part of an inclusive access program where you can easily access the required materials at a discounted price, and benefit from single sign-on access with no codes required in Canvas. SJSU will bill you at the discounted price as a course charge for this course. Although it is NOT recommended that you Opt-Out, you can choose to Opt-Out during the first few weeks. Please check the deadline to opt out from the Course Materials tab in the Canvas course website. If you choose to Opt-Out, you will be responsible for purchasing your course materials at the full retail price and access to your materials may be suspended.

Opting Out of First Day for your eTextbook: https://vimeo.com/304674616
FAQs and Tutorial Videos for the First Day Program: https://tinyurl.com/firstdayfaq

Other Materials

Connect from McGraw-Hill. First Day program includes an E-book and the Connect access. Problems related to homework for extra credits will be posted in Connect. If you click a 'McGraw-Hill Connect' tab on the left column of the ME114 class Canvas website, you will be automatically directed to Connect website. Alternatively, you can use the URL: https://connect.mheducation.com/class/c-han-me114-s2020.

Course Requirements and Assignments

Prerequisites

To enroll in this course, you must have completed ME113 and Math 133A, with a C- or better in each. You must turn in an unofficial transcript with the prerequisites highlighted by the **second day of class** to stay enrolled.

Expected Time Commitment

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found at http://www.sjsu.edu/senate/docs/S12-3.pdf.

In plain English: For a 3-credit class, you should devote approximately 6-9 hours per week to learning the material. You should spend this time completing homework and worksheet assignments, reviewing assigned reading, re-reading notes, completing extra problems, etc.

Class Attendance

NOTE that University policy F69-24 at http://www.sjsu.edu/senate/docs/F69-24.pdf states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading."

If you are unable to attend class for any reason, **you are responsible for making up any missed course materials and announcements.**

In-Class Worksheets

In most classes, there will be a time allocated for worksheets. Up to 3 people can work on a worksheet together, and each group will turn in one copy of completed worksheet at the end of the class. Group discussion is highly encouraged over individual work. **No late submission will be accepted in any case. However, the 3 lowest worksheet scores will be dropped.**

Homework

Homework will be assigned weekly on most weeks. The due dates are specified in the course schedule at the end of this syllabus. **Hand-written hard copy** solutions must be turned in **before the class starts (at 1:30 pm)** on due dates. Do not email the soft-copy (PDF or pictures) version of the homework. **No late homework will be accepted in any case; however, the 2 lowest homework scores will be dropped.** You may consider these assignments "freebies," but use them wisely!

Connect HW related Problems (for extra credits)

In McGraw-Hill Connect, I will post conceptual and analytical problems related to each homework. These will also serve as practice problems for your quizzes and exams. A single attempt will be allowed to earn extra points, and then you can access them in study mode throughout the semester. You can access Connect using a 'McGraw-Hill Connect' button on the left column of the Canvas course website.

Quizzes

There will be four short quizzes throughout the semester to test your basic understanding of the material in the beginning of classes on designated dates as shown below. **There will be no make-up quizzes in any case, but the one lowest quiz score will be dropped from your final grade.**

Quiz 1: February 18, 1:30 – 1:50 (20 min)
Quiz 2: March 12, 1:30 – 1:50 (20 min)
Quiz 3: March 26, 1:30 – 1:50 (20 min)
Quiz 4: April 30, 1:30 – 1:50 (20 min)

Midterms

There will be two midterm exams on the dates shown below. The exam is cumulative, that is, midterm 2 will include the chapters covered in the midterm 1. In Midterms, there will be questions testing your understanding on key concepts that comprise 10-20% of your score.

Midterm 1: February 27, 1:30 pm – 2:45 pm (75 min)
Midterm 2: April 14, 1:30 pm – 2:45 pm (75 min)

Final Examination

A final exam will be given at 12:15 pm – 2:30 pm on **Tuesday, May 19th**. The exam will be cumulative, but there will be more emphasis on material learned after the second midterm.

Exam Policy

All exams (quizzes, midterms, and final) will be **CLOSED BOOK and CLOSED NOTES with 1-page (single or double-sided) 8.5 by 11 inch equation sheet allowed**. **No electronic device** (cell phones, tablets, etc.) will be allowed during the exams. Make sure you bring your physical engineering calculator. Cell phone calculators will not be allowed. Violation of academic integrity will result in zero in the exam and a report to Student Conduct and Ethical Development.

Without a documented excuse, exams must be taken on the indicated dates. If you have any serious problems with the examination dates, please see me ASAP. An alternative arrangement can be made in case of college-approved circumstance (e.g. participating a technical conference related to work with SJSU faculty). The request for exam rescheduling should be made a minimum of three weeks before a scheduled midterm exam and four weeks before a final exam.

Grading Information

Grade Weighting

Homework	10%
In-Class Worksheets	10%
Quizzes	20%
Midterms	35%
Final Exam	25%*
Connect HW related problems	up to 3% extra credit

*An exceptional final exam (10% higher than your average grade before the final) will result in the final exam being weighted at 35% of your final grade, with the weight of the other items being decreased proportionally. **No extra credit** will be made available beyond what is listed in this syllabus.

Determination of Grades

Letter Grade	Score
A plus	97.0 to 100
A	93.0 to 96.9
A minus	90.0 to 92.9
B plus	87.0 to 89.9
B	83.0 to 86.9
B minus	80.0 to 82.0
C plus	77.0 to 79.9
C	73.0 to 76.9
C minus	70.0 to 72.9
D plus	67.0 to 69.9
D	63.0 to 66.9
D minus	60.0 to 62.9

Grading Philosophy

In engineering, getting the right answer is obviously important, but right now, I am more concerned with helping you become good problem-solvers, not good answer-finders. This means that the process will be weighted more heavily than the question. For any given quiz or exam problem, my *approximate* grading scheme (subject to change, and not applicable to multiple-choice problems!) is as follows:

Getting the correct answer	10%
Using the correct units	10%
Using the correct equations…	40%
…in the correct way.	40%

If you attempt to solve a problem, I will try my best to give you partial credit. The more clearly you write your solution, the easier it is for me to do this. A good solution contains the following:

- Your name, date, and homework assignment number (when applicable).

- A summary of the problem statement (for homework problems).
- A drawing or illustration of the problem.
- A list of all assumptions.
- Equations written in symbolic form first, before plugging in numbers.
- The final answer indicated clearly, including units.

Grade Errors and Regrades

Clear grading errors (points added or recorded incorrectly) may be corrected at any time. Regrading (when you believe you deserve more points for something) may only be requested *within two weeks of the assignment due date*. To bring an error to my attention or request a regrade, please return the document to me in class with an attached note about why you believe you deserve more points.

Classroom Protocol

Please place your cellphones on silent and refrain from using them during class. If you absolutely must take an emergency phone call, please leave the room quietly to do so. Important announcements and homework submission will be at the beginning of class at the beginning of class, so please be punctual. Bring an engineering calculator for in-class worksheets.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/"

Academic integrity

Your own commitment to learning, as evidenced by your enrollment at San José State University and the University's Academic Integrity Policy (http://www.sjsu.edu/studentconduct/docs/Academic%20Integrity%20Policy%20F15-7.pdf), requires you to be honest in all your academic course work. Faculty members are required to report all alleged violations of the Academic Integrity Policy to Student Conduct and Ethical Development. Instances of academic dishonesty will not be tolerated. Cheating or plagiarism will result in a zero in the exam involving the instance of academic dishonesty and administrative sanctions by the University.

"SOS!"

Sometimes, life happens. If you are really struggling with the course material, and/or if something is going on outside of class that may significantly disrupt your studies (financial concerns, upheaval in your home life, physical or mental health issues, etc.), I will do everything I can to help you succeed. If I am personally unable to help you, I will direct you to the appropriate resource. I will maintain a list on Canvas of all the resources available to you as an SJSU student. The earlier you ask for help with a problem, the easier it is to solve.

ME 114: Heat Transfer, Spring 2020
Tentative Course Schedule

Date	Topics, Readings, Assignments, Deadlines	Reading	Assignments
Jan-23	Introduction, Heat Transfer Overview	1.1-1.4	
Jan-28	Heat Transfer Mechanisms	1.5-1.9	
Jan-30	Conduction equation in cartesian coordinate	2.1-2.5	HW1
Feb-4	Conduction in spherical and cylindrical coordinate*	2.1-2.5	
Feb -6	Heat Generation in a Solid	2.6	HW2
Feb -11	Thermal Resistance Network**	3.1, 3.3	
Feb -13	Thermal Resistance Network, Contact Resistance	3.2, 3.4	HW3
Feb -18	**Quiz 1**, Critical Radius of Insulation, Finned Surfaces	3.5, 3.6	
Feb -20	Fins Effectiveness, Common Configurations	3.8	HW4
Feb -25	Lumped Capacitance, 1-D Transient Heat Transfer	4.1-4.2	
Feb -27	**Midterm 1**		
Mar-3	Semi-infinite Solids	4.3	
Mar-5	Multi-Dimensional Systems	4.4	HW5
Mar-10	Numerical Methods in Steady-State Heat Conduction	5.1-5.3	
Mar-12	**Quiz 2**, Introduction to Convection	6.1-6.6	HW6
Mar-17	Convection Equations, Reynolds Analogy	6.7,6.11	
Mar-19	Flow Over Flat Plates	7.1-7.2	HW7
Mar-24	Cylinders and Spheres, Internal Flow	7.3, 8.1-8.4	
Mar-26	**Quiz 3**, Internal Flow (cont'd)	8.5	HW8
Mar-31	No class (Spring recess)		
Apr-2	No class (Spring recess)		
Apr-7	Turbulent Internal Flow	8.6	
Apr-9	Heat Exchangers	11.1-11.4	HW9
Apr-14	**Midterm 2**		
Apr-16	Heat Exchangers (cont'd)	11.5-11.6	
Apr-21	Introduction to Radiation	12.1-12.4	
Apr-23	Radiative Properties, Atmospheric and Solar Radiation	12.5-12.6	HW10
Apr-28	View Factors	13.1-13.2	
Apr-30	**Quiz 3**, Black Surface Radiation Heat Transfer	13.3	HW11
May-5	Gray Surface Radiation Heat Transfer	13.4	
May-7	Review		HW12
May-19	**FINAL EXAM: 12:15-2:30 PM (Tuesday)**		

*Feb-4: Last day to drop without an entry on your permanent record
**Feb-11: Last day to add a class and register late