San Jose State University
Department of Mechanical Engineering
ME 210, Advanced Thermodynamics, Fall 2022

Instructor:	Younes Shabany
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Office Hours:	Fridays 4:00 – 5:45 PM (ENG 348) and 8:45 – 9:45 PM (Classroom)
Class Days/Time:	Wednesdays and Fridays 7:30 – 8:45 PM
Classroom:	Clark 324
Prerequisites:	ME 113 or equivalent undergraduate thermodynamics course

Canvas and Course Messaging

Copies of the course materials such as the syllabus, course notes, assignments, homework solutions, etc. will be posted on the Canvas site for the class. I will be using this system for any communication with the class. This system will also allow you to have discussions or chat with others in the class. This feature may be especially helpful if you need assistance on a homework problem.

To log in, go to the Canvas URL http://sjsu.instructure.com. Log in with your 9-digit SJSU ID and password you use for your SJSUOne account. For questions on the use of Canvas, please check out http://www.sjsu.edu/at/ec/canvas/student_resources/index.html

You are responsible for regularly checking with the messaging system through Canvas. You can set up your Canvas account to forward all email sent to your Canvas account to any other email address you wish.

Course Description

This course covers thermodynamics concepts at a graduate level. It covers applications of the first and second laws of thermodynamics to the analysis of engineering systems, availability analysis, equations of state, thermodynamic property relations, mixtures, chemical equilibrium, and combustion.

Course Goals

- To present thermodynamics concepts taught in undergraduate thermodynamics courses in more depth.
- To teach more advanced, graduate level, thermodynamics concepts.
- To demonstrate how different thermodynamics concepts can be used to analyze various engineering systems.
- To teach basics of research and engineering

Student Learning Objectives

- To demonstrate a deep understanding of various thermodynamics concepts and principles.
- To master the use of thermodynamics principles in analyzing engineering systems.
- To learn how to use advanced tools such as spreadsheets and equation solvers when thermodynamics principles are used to analyze complex engineering systems.
- To learn elements of research in thermodynamics and energy analysis.

Required Texts/Readings

Textbook

- There is no specific textbook for this course.
- Course notes, and other relevant readings to supplement the course notes, will be provided.

Other References

- "Engineering Thermodynamics", William C. Reynolds and Henry C. Perkins, McGraw Hill
- "Advanced Engineering Thermodynamics", Adrian Bejan, John Wiley and Sons
- "Advanced Thermodynamics Engineering", Kalyan Annamalai, Ishwar, K. Puri, Milind, A. Jog, 2nd Edition, CRC Press, 2011
- "Thermodynamics; An Engineering Approach", Yunus Cengel, McGraw Hill
- "Introduction to Engineering Thermodynamics", Richard E. Sontag and Claus Borgnakke, John Wiley and Sons
- "Fundamentals of Engineering Thermodynamics", Michael J. Moran and Howard N. Shapiro, John Wiley and Sons

Classroom Protocol

- Class attendance and arriving on time are encouraged.
- Participation in class discussions is encouraged.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic year calendars document on the Academic Calendars webpage at http://www.sjsu.edu/provost/services/academic_calendars/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

Assignments

Academic Policy S12-3 at http://www.sjsu.edu/senate/docs/S12-3.pdf has defined expected student workload as follows:

"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/ studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

- Individual and team homework assignments and projects will be given.
- Homework assignments and projects will challenge students' problem solving capability and may require using tools such as Excel, Matlab, etc.
- Homework sets have to be turned in before the lecture starts on the date they are due.
- Homework sets may be submitted with a maximum of one week delay, but with 10% penalty.
- For each project, each team will submit one typed report.
- Homework sets shall be professional, neat and easy to follow.

Grading Policy

Homework:	20%
Projects:	30%
Midterm:	20% (Friday, October 14, Class Time)
Final:	30% (Friday, December 9, 7:45 – 10:00 PM)

- The dates for midterm and final exams are final and will not change.
- All students shall plan to take the midterm and final tests on these dates.
- If you can not take either the midterm or the final test on these dates, only due to circumstances beyond your control, please let me know two weeks in advance to make alternative arrangements.

University Policies

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University's Academic Integrity policy S07-2, located at http://www.sjsu.edu/education/Palgiarism.pdf requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at http://www.sjsu.edu/studentconduct/.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Integrity Policy S07-2 requires approval of instructors.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, 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. Presidential Directive 97-03 at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the Disability Resource Center (DRC) at http://www.drc.sjsu.edu/ to establish a record of their disability.

Tentative Topics and Schedule

Week	Date	Topic
1	August 19	Introduction Importance, Significance and Limitations Review of Thermodynamics Concepts and Terminologies Mathematical Background
2	August 24 August 26	First Law of Thermodynamics Macroscopic and Microscopic Energies Zeroth Law First Law for Closed Systems Quasi-Equilibrium and Nonquasi-Equilibrium Heat and Work Transfers
3	August 31 September 2	Enthalpy and First Law First Law for an Open System Applications of the First Law for an Open System Integral and Differential Forms of Conservation Equations
4	September 7 September 9	Second Law of Thermodynamics Thermal and Mechanical Energy Reservoirs Heat Engine and Heat Pump Consequences of Second Law
5	September 14 September 16	Entropy Entropy Balance Equation for a Closed System Irreversibility
6	September 21 September 23	Second Law of Thermodynamics Entropy Measurement and Evaluation Entropy Balance Equation for an Open System Irreversible Processes and Efficiencies and Coefficient of Performances Entropy Balance in Integral and Differential Forms Maximum Entropy and Minimum Energy
7	September 28 September 30	Availability Analysis Physical Meaning of Availability/Exergy Optimum Work and Irreversibility in a Closed System Availability/Exergy Analysis for a Closed System Control Volume Availability Analysis Second Law or Availability Efficiency Integral and Differential Forms of Availability Balance Chemical Availability
8	October 5 October 7	State Relationships for Real Gases Equation of State Various Real Gas State Equations Compressibility Charts Compressibility Charts
9	October 12 **October 14**	Review **Midterm Exam**

10	October 19 October 21	Thermodynamic Properties of Pure Fluids Ideal Gas Properties Maxwell Relations Generalized Relations Evaluation of Thermodynamic Properties Vapor-Liquid Equilibrium Curve - Clapeyron Equation Throttling Processes - Joule-Thomson Coefficient
11	October 26 October 28	Thermodynamic Properties of Mixtures Mixture Composition, Generalized Relations, Partial Molal Property Useful Relations for Partial Molal Properties Ideal Gas Mixture Ideal Solutions
12	November 2 November 4	Chemically Reacting Systems Fuels and Combustion Chemical Reaction and Combustion Thermochemistry First Law Analysis for Chemically Reacting Systems
13	November 9 **November 11**	Chemically Reacting Systems Second Law Analysis of Chemically reacting Systems **Veteran's Day, Campus Closed**
14	November 16 November 18	Reaction Direction and Chemical Equilibrium Reaction Direction and Chemical Equilibrium Criteria for Direction of Reaction for Fixed-Mass System Generalized Chemical Equilibrium Relations Reaction Direction and Chemical Equilibrium (Examples)
15	**November 23** **November 25**	**Thanksgiving Holiday**
16	November 30 December 2	Project Presentations
17	**December 9**	**Final Exam**