San Jose State University
Department of Mechanical Engineering
ME 210, Advanced Thermodynamics, Spring 2015

Instructor: Younes Shabany
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Email: yshabany@yahoo.com
Office Hours: Mondays and Wednesdays 9:00 – 10:00 PM
Class Days/Time: Mondays and Wednesdays 6:00 – 7:15 PM
Classroom: Sweeney Hall 242
Prerequisites: ME 113 or equivalent undergraduate thermodynamics course

Faculty Web Page
Check my faculty web site at http://www.engr.sjsu.edu/shabany regularly for course materials such as the syllabus, course notes, homework assignments and homework solution, etc.

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 fluid flow.

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

- “Advanced Engineering Thermodynamics”, Adrian Bejan, John Wiley and Sons
- “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 necessary.
- Participation in class discussions is encouraged.
- No cell phone or computer use during the lecture.

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% (Wednesday, March 18, Class Time)
Final: 30% (Monday, May 18, 5:15 – 7:30 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 cannot 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](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)](http://www.drc.sjsu.edu/) at [http://www.drc.sjsu.edu/](http://www.drc.sjsu.edu/) to establish a record of their disability.
# Tentative Topics and Schedule

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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>January 26</td>
<td>Introduction&lt;br&gt;Importance, Significance and Limitations&lt;br&gt;Review of Thermodynamics Concepts and Terminologies&lt;br&gt;Mathematical Background</td>
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<td>January 28</td>
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<td>2</td>
<td>February 2</td>
<td>First Law of Thermodynamics&lt;br&gt;Macroscopic and Microscopic Energies&lt;br&gt;Zeroth Law&lt;br&gt;First Law for Closed Systems&lt;br&gt;Quasi-Equilibrium and Nonquasi-Equilibrium Heat and Work Transfers&lt;br&gt;Enthalpy and First Law&lt;br&gt;First Law for an Open System&lt;br&gt;Applications of the First Law for an Open System&lt;br&gt;Integral and Differential Forms of Conservation Equations</td>
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<td>February 4</td>
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<td>February 9</td>
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<td>February 23</td>
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<td>February 25</td>
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<td>6</td>
<td>March 2</td>
<td>Availability Analysis&lt;br&gt;Physical Meaning of Availability/Exergy&lt;br&gt;Optimum Work and Irreversibility in a Closed System&lt;br&gt;Availability/Exergy Analysis for a Closed System&lt;br&gt;Generalized Availability Analysis - Gibbs Function&lt;br&gt;Availability Efficiency&lt;br&gt;Chemical Availability&lt;br&gt;Integral and Differential Forms of Availability Balance</td>
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<td>March 4</td>
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<td>March 9</td>
<td>State Relationships for Real Gases&lt;br&gt;Equation of State&lt;br&gt;Various Real Gas State Equations</td>
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<td>March 11</td>
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<td>8</td>
<td>March 16</td>
<td>Compressibility Charts&lt;br&gt;Midterm Exam</td>
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<td>March 18</td>
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<td>9</td>
<td>March 23</td>
<td>Spring Recess (No Classes)</td>
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<td>March 25</td>
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<td>Week</td>
<td>Dates</td>
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| 10   | March 30 - April 1 | 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   | April 6 - April 8 | Thermodynamic Properties of Mixtures  
Mixture Composition, Generalized Relations, Partial Molal Property  
Useful Relations for Partial Molal Properties  
Ideal Gas Mixture  
Ideal Solutions |
| 12   | April 13 - April 15 | Chemically Reacting Systems  
Fuels and Combustion  
Chemical Reaction and Combustion  
Thermochemistry  
First Law Analysis for Chemically Reacting Systems |
| 13   | April 20 - April 22 | Chemically Reacting Systems  
Second Law Analysis of Chemically reacting Systems  
Mass Conservation and Mole Balance Equations |
| 14   | April 27 - April 29 | Reaction Direction and Chemical Equilibrium  
Criteria for Direction of Reaction for Fixed-Mass System  
Generalized Chemical Equilibrium Relations |
| 15   | May 4 - May 6 | Projects Presentations |
| 16   | May 11 - May 13 | Review |
|      | May 18 | **Final Exam** |