California State University, Chico
College of Engineering, Computer Science, and Construction Management
Mechanical and Mechatronic Engineering and Sustainable Manufacturing

MECH 332, Thermodynamics, Section 01, Spring 2016

Instructor: Assistant Professor David G. Alexander
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Office hours: Th 3:30 to 5:00 PM and F 3:30 to 5:00 PM or by appointment

Class days and times: Lecture: MWF 11:00 AM – 11:50 AM
Classroom: Lecture: Plumas Hall 201
Prerequisites: PHYS 204A (indirectly, MATH 121 & MATH 120)

Overview
Thermodynamics is a challenging course and essential for becoming a competent and successful engineer. There are many new concepts and many principles that at first seem counter-intuitive. At times the material may be confusing and learning may be frustratingly slow. This is normal. Learning is the process of creating new connections in the brain. This takes time and effort. This is normal. Learning is struggling. Struggling is the only way that the brain can create new cognitive connections. This is normal. Eventually, understanding these new concepts will open up a powerful set of tools that can be used to solve an immensely diverse set of problems and situations. I will do my best to support you in your learning.

How to Succeed in this Class
Succeeding in this class and succeeding in college in general has been researched extensively. There are known behaviors, situations, and attitudes the directly relate to student success.

A powerful attitude or understanding that significantly improves student success is based on the idea that intelligence does not predetermine ones abilities or level of mastery in anything. In fact, believing that intelligence will lead to a high level of achievement and understanding is negatively correlated with success. Watch the
following educational research-based video on this topic, https://youtu.be/Yn966v5lNa?list=PL4111402B45D10AFC.

Another highly researched topic that has been shown to affect individual performance is stereotype threat. Information about stereotype threat can be found here, http://www.reducingstereotypethreat.org/situations.html. There are numerous studies that show when a particular group is identified as being different than another group, just the mere mention of a difference can cause the threatened group to perform significantly worse than if no mention or no noticeable difference were evident or perceived. For example, standardized test scores drop significantly when participants are asked to identify their race or gender prior to taking the test as compared to the performance of similar groups when questions of gender or race are asked after the test is completed. The simple identification of belonging to an underrepresented minority within a group causes anxiety that can result in decreased performance or unexpected uncharacteristic behaviors.

I believe that everyone in my class is fully capable of succeeding at the highest level and that they belong in my class and in the university. I never thought that I would be a college professor. In fact, here is a short video that I made last year during a teaching workshop about my path to becoming a professor, https://youtu.be/uxLUj7jD6Ws.

Here is some practical advice for succeeding in class. A minimum of 2 to 3 hours of outside class work is required for every 1 hour of in-class work. Assuming the higher end of time spent outside of class, a total of 9 hours should be scheduled outside of class every week. Combined with the hours spent in class, a grand total of 12 hours per week should be dedicated to studying thermodynamics to make it possible to earn a C or better grade. If an engineering student is taking four engineering classes, a total of 48 hours per week should be set aside in order to do well in all classes. If one does not have these many hours because of work or other obligations, then one’s level of understanding and grades will likely suffer. So, there is a choice to be made.

Remember, a degree in engineering while it may take four, five, or six+ years, will pay off. Starting salary data for the class of 2015,
Course Description and Goals

Catalog Description
Properties of substances, ideal gas equation of state, heat and work, first and second laws of thermodynamics, steady-state analysis of closed and open systems, entropy, gas and vapor power cycles, introduction to renewable energy sources. 3 hours discussion.

Course Goals
Understand and apply principles from physics, thermodynamics, and other engineering disciplines to analyze properties and states of substances, processes, and the performance of systems that store and transform energy.

Student Learning Outcomes
Students will:
Be able to identify a thermodynamic system and use properties to evaluate its state.
Understand the various forms of energy and work, and calculate the energy of a system or rate of change of energy of a system using the first law of thermodynamics and calculate system efficiency.
Describe the phases of pure substances, understand how to determine and
calculate the state of a substance, and locate the state within a completely labelled phase diagram or property table.

Calculate the moving boundary work of a closed ideal gas system undergoing an isothermal, isobaric, or polytropic process.

Be able to identify and determine the properties and processes necessary to calculate the work and/or heat and energy changes of a closed system.

Identify and evaluate the following steady-flow devices: nozzles/diffusers, turbines/compressors, throttling valves, mixing chambers, heat exchangers, and pipe and duct flow.

Describe the second law of thermodynamics and evaluate the efficiency of a thermodynamic system or cycle and compare it to the maximum theoretical efficiency.

Describe entropy and be able to use it as a thermodynamic property to analyze the state of a solid, liquid or gas and determine the efficiency.

Identify and analyze the following ideal cycles: Otto, Diesel, Brayton, Rankine, and vapor-compression.

**Required Materials**

**Textbook**

A textbook is required for this course, however I recognize that there are different levels of interest and financial abilities among students. Consider the following, it is helpful having a book in class during lectures, this could be electronic or hardcopy. Textbooks, electronic or hardcopy, are not allowed during exams. Some students are very interested in thermodynamics, and I would recommend buying a hardback textbook. Some students are not very interested in thermodynamics and it is the only major obstacle in the way of graduating. In this case, an electronic version of the textbook would suffice.

**Required:** Çengel and Boles, “Thermodynamics, An Engineering Approach, 8th, 7th or 6th Editions,” McGraw-Hill Education.

**Permissible:** 8th Ed., hardback or 3-ring binder (available at CSUC bookstore).

**Permissible:** 7th Ed. or International 7th Ed., hardback, paperback, or 3-ring binder.

**Permissible:** 6th Ed., hardback or 3-ring binder.

**Permissible:** 8th, 7th, or 6th Eds. in electronic form.

**Thermodynamics Properties Booklet**

The American Society of Mechanical Engineers student chapter at Chico State prints a booklet of thermodynamic property data. This booklet is required for all students. The price for the booklet is $15.00 and details on how to purchase the booklet will
be provided during the first week of the semester. See me if the cost of this booklet causes financial hardship. A limited number of booklets are available on loan for the semester.

**Classroom Protocol**

**Learning Environment**
This is an upper division engineering course, and I have high expectations of all students. Come to class prepared and ready to engage in discussion and exploration in various topics most of which will be about engineering.

I treat all students with fairness and respect, and I expect the same treatment. I also want to help all students develop into outstanding, productive engineers where one’s sense of curiosity is supported and celebrated. My teaching style is very casual and informal. Do not confuse this with being irresponsible or disrespectful. I want my classroom to be dynamic, contributory, inquisitive, and fun. I will not have all your answers, however I will help you to develop skills, processes, and knowledge that will enable you to solve your own problems.

Please refrain from using electronic devices while anyone is presenting to the class. It is very distracting and disrespectful.

**Homework**
Homework assignments will be due throughout the semester. These assignments require short answers, short essays, and/or engineering problem solving and calculations.

All homework assignments will be completed and submitted on engineering graph paper. This is usually green but other colors are acceptable. All pages that are turned in will be stapled and folded lengthwise with your name, course title and number, date, and homework assignment title or number written legibly on the top outside of the folded sheets. All answers will be clearly marked with a box. Units will be used and carried throughout. More discussion about the process will be included in class.

All assignments that require a numerical solution will follow an organized problem solving process using the following headings:

- Situation
- Goal
- Generate Ideas
- Solution
- Review

See the course rubric for additional help on how assignments will be evaluated and graded. The rubric is provided on the course Bblearn site. Homework assignments will be returned with a zero grade if there is no organization, they are not legible,
portions are missing or they are late. The total points available for each homework assignment will be based on completing all problems assigned. The total points available for partially completed assignments will be prorated based on the number of problems attempted. **LATE ASSIGNMENTS ARE ACCEPTED ONLY WITH AN APPROVED AND COMPLETED LATE ASSIGNMENT POLICY AGREEMENT.**

**Exams**

There will be two exams given throughout the semester and one final exam. Each exam and final will cover approximately 1/3 of the entire course material. The final exam will be material from the entire course. The final exam will be worth the equivalent of two exams. **MAKE-UP EXAMS ARE ACCEPTED ONLY WITH AN APPROVED AND COMPLETED LATE ASSIGNMENT POLICY AGREEMENT.**

**Attendance and In-Class Activities**

Attendance and In-class activities are extremely important to learning. I will keep track of attendance by regularly collecting in-class activities, recording assignments turned in and recording assignments that are returned but not picked up. At the end of the semester, I will add up absences based largely on assignments that were not picked up and reduce the participation percentage one percentage point for each recorded absence. **NO MAKE-UP IS AVAILABLE FOR IN-CLASS ACTIVITIES.**

**Assignments and Grading Policy**

Homework is collected and graded weekly. I have a grader assess the homework. The grader looks for organization, neatness, completeness, and a review of the final answer or answers. The grader follows the grading rubric in assigning scores. If the assignment is not organized, not neat, and/or not complete, I have instructed the grader to give at most half-credit.

I grade every exam. I look for organization, neatness, and completeness, however I weigh more heavily the process followed to arrive at a solution. If I cannot follow the solution process and/or the answer is provided with little calculations that support it, I will take away points even if the answer is correct. If only an answer is provided and no explanation, justification, or calculation is included, I will give zero credit.

I grade all written assignments that are turned in, which is mostly the mini-project. I weight the ability to communicate clearly, concisely, and accurately as much as I weight the ability to solve technical problems. I take away points for misspellings, poor grammar, poor sentence structure, and poorly organized paragraphs and sections.

Please come see me if there are any questions or if you think there is an error in the score that was received on any assignment.

**CSUC Definition of Grading Symbols**

A - Superior work; a level of achievement so outstanding that it is normally attained by relatively few students.
B - Very good work; a high level of achievement clearly better than adequate competence in the subject matter/skill, but not as good as the unusual, superior achievement of students earning an A.
C - Adequate work; a level of achievement indicating adequate competence in the subject matter/skill. This level or higher will usually be met by a majority of students in the class.
D - Minimally acceptable work; a level of achievement which meets the minimum requirements of the course.
F - Unacceptable work; a level of achievement that fails to meet the minimum requirements of the course. Not passing.

Grading

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<tr>
<th>Grade</th>
<th>Minimum Percentage</th>
<th>Maximum Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>93.3%</td>
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<tr>
<td>A-</td>
<td>86.7%</td>
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<td>B+</td>
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<tr>
<td>B</td>
<td>76.7%</td>
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<td>B-</td>
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<tr>
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Grade Distribution

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<tr>
<td>Homework Assessments</td>
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<tr>
<td>In Class Examinations (2+final)</td>
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<tr>
<td>Mini-project</td>
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<tr>
<td>Attendance and In-class Activities</td>
<td>10%</td>
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</table>

**TOTAL 100.00%**

Course Usage of Blackboard Learn

Copies of the course syllabus and major assignments may be found on Blackboard Learn. You are responsible for regularly checking the online resources, which is accessed through the Chico State Portal at [http://portal.csuchico.edu](http://portal.csuchico.edu).

Deadlines for assignments are provided in the schedule. Some assignments will be administered online through Blackboard Learn. Sometimes deadlines are adjusted and a new schedule is announced in class. You are responsible for any announcements given in class related to assignment deadlines and due dates. Once the deadline is reached the assignment will no longer be available and will no longer be accepted.

Dropping and Adding

You are responsible for understanding the policies and procedures about add/drops, academic renewal, etc., found in the [CSU Chico University Catalog](http://portal.csuchico.edu). You should be aware of the new deadlines and penalties for adding and dropping classes.
Academic Integrity
Engineering is an honorable profession. Cheating is not honorable. Don't be a cheater. Anyone caught cheating on the exam or on any assignment will receive an automatic F for the course, a report will be submitted to Student Judicial Affairs, and retaking the course for forgiveness will not be possible.

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, http://www.csuchico.edu/sjd/.

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](#).