Mechanical Engineering 432: 
Energy Systems (Advanced Thermodynamics) 
Course Syllabus – Spring 2023

INSTRUCTOR: 
Matthew Mione  
Campus Office: O’Connell 414  
Campus Phone: 530-898-5374  
mmione@csuchico.edu  
Office Hours: WW 11:00 AM – 1:00 PM  
Additionally, by appointment in person or on Zoom.  
*Subject to change

CLASS 
Lecture: TR 9:30 – 10:45 AM 
Lab: LANG 122  
Section 01: M 2:00 – 4:50 PM  
Section 02: T 2:00 – 4:50 PM

PREREQUISITES: 
MECH 338 – Heat Transfer

Overview
Energy systems is a challenging course and essential for becoming a competent and successful engineer. It builds upon concepts presented in thermodynamics but with an emphasis on the analysis of more complex systems and cycles. Additionally, there is a laboratory component to energy systems where one is exposed to the systems that are analyzed and studied in the classroom. This provides a unique and excellent way to witness engineering principles in action.

How to Succeed in this Class
To be successful in college one should understand what learning is. Learning is the process of creating new connections in the brain. Building these connections takes time and effort. At times, the effort to create these connections will cause one to get frustrated and feel like learning is a hopeless struggle. This is normal. Eventually, the brain creates enough connections that new information can be quickly and efficiently accessed and used. When this happens a powerful set of tools will be available for understanding, analyzing, and solving immensely diverse and important problems.

Succeeding in this class and succeeding in college in general has been researched extensively. There are known behaviors, situations, and attitudes that 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 one’s 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/2nF90sAW-Yg. Take this quiz, https://youtu.be/3vz6HU1UO.

I believe that everyone in my class is fully capable of succeeding at their highest level and that they belong in my class and at the university. I never thought that I would be a college professor. In fact, here is a short video that I made a couple years ago 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 3 hours of outside class work is required for every 1 hour of in-class work for most upper-division engineering courses. A total of 12 hours should be scheduled outside of class every week for this course. Combined with the hours spent in class, a total of 16 hours per week should be dedicated to studying energy systems 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.

**Course Description and Goals**

**Course Description**

Thermodynamics of power cycles, refrigeration, air-conditioning, and combustion processes; analysis, design, and testing of systems involving both conventional and renewable energy sources for power generation, heating, and cooling applications. 3 hours discussion, 3 hours laboratory.

**Course Goals**

Apply fluids, thermodynamics, heat transfer among other engineering principles to analyze the performance and efficiency of modern power systems. Develop critical thinking and judgment skills to setup, run, and monitor various data acquisition systems including diesel and turbine engines, wind tunnel, photovoltaic and battery storage system, heat exchanger and thermoelectric refrigerator. Become proficient at communicating technical information and experimental results in a lab report. Understand the consequences of using resources for our daily energy needs as an industrialized country and what that means for other countries or other generations and what considerations and/or responsibilities we have to support sustainable practices.

**Student Learning Outcomes**

Students shall be able to:

1. Define, using words familiar to the lay-person, basic principles including energy, power, heat, temperature, enthalpy, entropy, state postulate, 1st law, 2nd law, open, closed, and isolated systems, entropy generation, flow work/energy, and mechanical energy.
2. Calculate the efficiency and total or specific power or energy, of a gas power, vapor-compression refrigeration, heat pump, and vapor power system.
3. Use a psychrometric chart to evaluate the changes of state of moist air during cooling, heating, humidifying and de-humidifying.
4. Operate and monitor various data acquisition systems including diesel and turbine engines, wind tunnel, photovoltaic and battery storage system, heat exchanger and thermoelectric refrigerator.
5. Prepare written reports that clearly identify and state the engineering principles observed during laboratory experiments.
6. Use data and sound science and reasoning to interpret and explain results and clearly justify the significance of the findings.
7. Understand the consequences of using resources for our daily energy needs as an industrialized country and what this means for other countries or other generations and what considerations and/or responsibilities we have to support sustainable practices.
8. Perform limited research on a topic related to energy and suggest possible design solutions based on a thermodynamic analysis.
Course Usage of Blackboard Learn
Blackboard will be used to send announcements and emails to the entire class on occasion. Students are responsible for knowing and checking regularly the email account associated with their Chico State portal.

Textbook
A textbook is required for this course. 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; new textbooks are valuable resources in future work; new textbooks are expensive; thermodynamics principles described in textbooks has not changed in over 100 years.


Equipment
Approximately every other week we will be working with heavy, complex equipment and electronic data acquisition systems. Safety is of the utmost importance. All students will have on file a signed “Acknowledgment of Lab Safety Policies and Procedures” for the semester in which they are enrolled in this class.

Communication
If you need to meet or contact me, please attend office hours or email. Please use my contact information listed on the first page to communicate, and do not go through the Blackboard channels. Email is by far the best way to get a hole of me.

In the event that I need to contact the class (schedule, assignment, etc.), it will be done via your university email account linked to the Portal. University policy requires students to monitor campus email accounts and it is suggested that you set up email forwarding if you have another preferred email account.

Dropping and Adding
You are responsible for understanding the policies and procedures about add/drops, academic renewal, etc. found http://www.csuchico.edu/catalog/. You should be aware of the deadlines and penalties for adding and dropping classes. I do not handle adding into the course, you need to see or email our MMEM Administrative Support Coordinator, Martha Layne (mlayne@csuchico.edu), to do so. You are the only one responsible for dropping the class.

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 want to help all students develop into outstanding, productive engineers where one’s sense of curiosity is supported and celebrated. My teaching style is casual and informal. I want my classroom to be dynamic, contributory, inquisitive, and fun.

Upon graduation and as a professional, you will be asked to solve problems for which there will be no known answer. This is okay, and in fact, it is part of the definition of engineering, i.e. to solve problems. I want you to
readily embrace the challenges of being an engineer and to broaden your perspective and contribute to the solution of some of the many difficult problems that face our society and planet.

Respect
Students in this class are encouraged to speak up and participate during class meetings. Because the class will represent a diversity of individual beliefs, backgrounds, and experiences, every member of this class must show respect for every other member of this class. (Reference: http://www.csuchico.edu/diversity/)

Attendance and In-Class Activities
Attendance and in-class activities are extremely important to learning. Attendance will be monitored by collecting in-class activities in and recording assignments not picked up when returned. Assignments and exams will be returned in class only once. At the end of the semester, students will receive one absence for each assignment including homework, in-class activities, and exams that were not picked up when originally returned in class. The participation grade will be reduced two percentage points for each absence.

Assignment Policy

Homework
See the course rubric for additional help on how assignments will be evaluated and graded. The rubric is provided on the course Bblearn site. All assignments will be returned with a zero grade if there is no organization, they are not legible, portions are missing, or they are late.

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

- Given/Situation
- Find/Goal
- Assumptions/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 they are disorganized, illegible, missing parts or late. The total points available for each homework assignment is based on completing all problems assigned. The total points available for partially completed assignments is prorated based on the number of problems attempted.

Laboratory Reports
A laboratory report is due one week after completing the laboratory experiment. One report will be turned in per team. There will be approximately 4 teams per laboratory experiment. The requirements for writing an acceptable laboratory report will be reviewed in class prior to the first experiment. Grading of lab reports will follow the Lab Grading Rubric.

Late Assignment Policy
It will be posted on Bblearn for you to review.
Grading Policy

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 Weights

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<tr>
<th>Category</th>
<th>Weight</th>
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<tr>
<td>Homework</td>
<td>20%</td>
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<td>Laboratory Grade</td>
<td>25%</td>
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<td>Exams (2 Midterms – 15% each, 1 Final – 25%)</td>
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**TOTAL** 100%

*Subject to change as COVID requirements change*

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<th>Grade</th>
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<th>C+</th>
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Grade Disputes
Final grades are non-negotiable. If you think a grading error has been made for any graded assignment throughout the term, you must bring this to my attention within two weeks of the date the grade was posted. Grade disputes brought up after final grades are posted will not be considered.

Cheating
Engineering is an honorable profession. Cheating is not honorable. 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.

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 at [https://www.csuchico.edu/pres/em/2004/04-036.shtml](https://www.csuchico.edu/pres/em/2004/04-036.shtml).
COVID-19 Information

All students are required to complete their COVID-19 Vaccination Self-Certification by 8/15/2022. For additional information regarding this requirement please visit https://www.csuchico.edu/coronavirus/vaccine-certification-student.shtml.

Chico State may at any time require the use of an approved face covering which covers the nose and mouth in all indoor campus spaces and in order to participate in this course when in person. When face coverings are optional, they are always welcome on campus. You will be notified if face coverings are required.

Policies and requirements regarding COVID-19 are subject to change pursuant to campus, local, state and/or federal guidelines. Please note that dishonesty relating to the vaccination policy and/or your failure to comply with any COVID-19 related safety policy or mandate may result in disciplinary action against you through the office of Student Conduct, Rights and Responsibilities, which can include suspension or expulsion from the California State University system.

It is very important for students to contact the COVID-19 hotline if they become symptomatic, believe they have been exposed, or have tested positive for COVID-19. The hotline is (530) 898-2222 or covidhotline@csuchico.edu.

University Policies and Campus Resources

Academic integrity
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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. Students with disabilities requesting accommodations must register with the DSS Office (Disability Support Services) to establish a record of their disability.

Special accommodations for exams require ample notice to the testing office and must be submitted to the instructor well in advance of the exam date.

IT Support Services (http://www.csuchico.edu/itss)
The CAD lab with SolidWorks installed is located in OCNL 438. Other (non-CAD) 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.

Student Services (http://www.csuchico.edu/current-students)
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.
Americans with Disabilities Act ([http://www.csuchico.edu/arc](http://www.csuchico.edu/arc))
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
arcdpt@csuchico.edu

Student Learning Center ([http://www.csuchico.edu/slc](http://www.csuchico.edu/slc))
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.