ME 400: Energy Conversion Systems
Spring 2026

Instructor: Prof. Ke Tang
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Office Hours: 2:00 – 3:00 pm on Fri.
Additional office hours by appointment.

Lectures: 3:00 – 3:50 pm, MWF, 4100 LUMEB

Course Website: via Canvas https://canvas.illinois.edu/
iClicker will be used in class for polling questions as classwork. Please refer to the iClicker website for guidance (https://www.iclicker.com/students/).

Text: Fundamentals of Engineering Thermodynamics by Michael J Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey, 9th edition (Any earlier edition will work.)

Course Description:
This course focuses on the application of basic thermodynamic relations for analyzing energy conversion processes regarding the typical thermal energy conversion systems, including power generation systems, refrigeration systems, air-conditioning systems, combusters, etc. Python programming with the CoolProp library for thermal property calculations will be practiced throughout this course as part of energy conversion analysis. This approach aims to foster computational thinking and enhance computational skills, preparing students for future careers in both academic and industrial settings. Additionally, in response to the rapid development of AI technologies, this course incorporates structured activities involving AI tools to support problem solving and to help students develop critical thinking, ethical awareness, and informed judgment when collaborating with AI tools.
Prerequisite: ME 200 Thermodynamics

Topics:
1) Review of thermodynamics
2) Typical vapor power cycles
3) Typical vapor-compression refrigeration cycles
4) Typical gas power cycles and gas refrigeration cycles
5) Thermodynamics for ideal gas mixtures
6) Psychrometrics for air-conditioning processes
7) Reacting mixtures and combustion processes

Objectives:
At the end of this course, students will be able to:
1) identify various power cycle and refrigeration cycle processes and components;
2) analyze the efficiency of power cycles and refrigeration cycles;

3) determine the sources of inefficiency in power and refrigeration cycles;
4) analyze the air-conditioning processes by psychrometrics;
5) calculate the energy released by reacting mixtures (focusing on combustion processes);
6) code in Python with the CoolProp database for thermodynamic analysis of energy conversion systems;
7) identify the strengths and limitations of AI technologies in engineering problem solving and apply critical thinking during collaborative engineering problem solving with AI tools.

Course Grading

3 credit Hours		**4 credit Hours**	
Classwork	5%	Classwork	5%
Homework	10%	Homework	10%
Midterm Exam	32.5%	Exam 1	22.5%
Final Exam	32.5%	Exam 2	22.5%
Team Project	20%	Team Project	20%
		Literature Review	20%

The final letter grade will be assigned using the following numerical cutoffs:

97 – 100 A+	93 – 97 A	90 – 93 A-
87 – 90 B+	83 – 87 B	80 – 83 B-
77 – 80 C+	73 – 77 C	70 – 73 C-
67 – 70 D+	63 – 67 D	60 – 63 D-
0 – 60 F		

Classwork must be submitted in class and no late submission will be accepted. The classwork will also be used to check attendance. Zero points will be given for the classwork assignment if you miss the lecture. You can email me ahead of time to request a leave of excused absence and in this way you can be exempt from the classwork. Completion grade will be assigned to classwork with 5 points for each classwork. If the classwork involves polling questions and you answer all of them correctly, you will earn 1 extra point for classwork. The extra classwork points can be used to compensate for points lost on classwork assignments but cannot be applied to any other assignments or exams. Two classwork assignments will be dropped off.

Homework must be an electronic version in a single PDF file and must be submitted on the course website via Canvas. Homework must be submitted on time. An extension of one day can be automatically granted, but it will be accompanied by a 20% reduction in your score. No homework will be accepted after an extension. Homework will be graded on completion. Homework may involve coding in Python for analysis of thermal processes or thermal systems. Some homework problems will require students to solve them independently and then again with the assistance of an AI tool, followed by a comparison of the two solutions. Clear instructions will be provided for those AI-related homework problems. No homework assignments will be dropped off.

Both midterm exam and final exam will be closed-book exams. The midterm exam will covers the topics of power systems and refireration systems. The final exam will cover the topics of ideal gas mixtures, psychrometrics, and reacting mixtures. The schedule for the exams can be found in the teaching calendar. The students who need the accommodation of extra time for exams must schedule and take their exams at the DRES TAC (Testing Accommodations Center of Disability Resources and Educational Services). Please complete scheduling the exams at the DRES TAC as soon as possible, since the DRES TAC may not accept your application and schedule when they reach the capacity limit. If students fail in scheduling exams at the DRES TAC, they must attend the regular exams without the accommodation of extra exam time.

As for the team project, each team will have 4 members, unless a student is 'fired' from a team. Everything submitted must be computer-generated. The project work must be submitted on the course website via Canvas. The submission includes a PDF file of the final report, as well as the calculation files, e.g. Python code, etc. Additionally, each team member must submit the Project Individual Effort Evaluation Form. The project work must be submitted on time. An extension of one day can be automatically granted, but it will be accompanied by a 20% reduction in the score. An extension of one day can be granted for the submission of the Project Individual Effort Evaluation Form, but it will be accompanied by a 5% reduction in the score of the individual team members involved. Missing the submission of the Project Individual Effort Evaluation Form will lead to a 10% reduction in the score of the individual team members involved. No project work will be accepted after an extension. Individual grades in the team project may differ based on peer evaluation by team members.

The students for 4 credit hours are required to complete additional tasks of the project, as well as literature review of various energy conversion systems. For the literature review, students must complete the literature review report and presentation. The PDF files of literature review report, PowerPoint files of presentation, and .mp4 video files of presentation recording must be submitted on the course website via Canvas on time. An extension of one day can be automatically granted, but it will be accompanied by a 20% reduction in your score. No late submission will be accepted after an extension. AI tools, such as ChatGPT, Copilot, Gemini, etc., are not permitted to create the literature review report. Use of AI tool to create the literature review report will be considered academic dishonesty and a violation of the University of Illinois Student Code.

The excused absence from class and the late submission beyond a one-day extension can be considered only if you ask for a leave or an additional extension in advance. It is the student's responsibility to make sure of a successful submission of their work. After the submission of your work on the Canvas course website, please immediately check if your work has been submitted successfully. If not, please redo the submission. If the resubmission online fails, you must email me your work for submission, as well as the evidence of the work completion on time, by the following day of the due date. The instructor will decide whether the work can be accepted or not. It is also the student's responsibility to make sure that their work is submitted correctly and completely. Zero points will be assigned for a wrong submission. No resubmission will be accepted for an incomplete submission.

Do not duplicate anyone's work. Any duplication identified during the grading process will result in sanctions according to the Academic Integrity Policy in the Student Code.

This course is committed to creating a respectful and inclusive learning environment. All students are expected to engage with one another with professionalism, empathy, and openness. Discrimination, harassment, and microaggressions of any kind are not acceptable.

ADDITIONAL INFORMATION FOR THE UNIVERSITY OF ILLINOIS AND THE GRAINGER COLLEGE OF ENGINEERING

Academic Integrity

The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: http://studentcode.illinois.edu/.

Academic dishonesty will result in a sanction proportionate to the severity of the infraction, with possible sanctions described in 1-404 of the Student Code (https://studentcode.illinois.edu/article1/part4/1-404/). Every student is expected to review and abide by the Academic Integrity Policy as defined in the Student Code: https://studentcode.illinois.edu/article1/part4/1-401/. As a student, it is your responsibility to refrain from infractions of academic integrity and from conduct that aids others in such infractions. A short guide to academic integrity issues may be found at https://provost.illinois.edu/policies/policies/academic-integrity/students-quick-reference-guide-to-academic-integrity/. Ignorance of these policies is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Anti-Racism and Inclusivity Statement

The Grainger College of Engineering is committed to the creation of an anti-racist, inclusive community that welcomes diversity along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, or religious beliefs. The College recognizes that we are learning together in the midst of the Black Lives Matter movement, that Black, Hispanic, and Indigenous voices and contributions have largely either been excluded from, or not recognized in, science and engineering, and that both overt racism and micro-aggressions threaten the well-being of our students and our university community.

The effectiveness of this course is dependent upon each of us to create a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course director if you feel comfortable. You can also report these behaviors to Campus Belonging Resources (https://diversity.illinois.edu/diversity-campus-culture/belonging-resources/). Based on your report, Members of the Office of the Vice Chancellor for Diversity, Equity & Inclusion staff will follow up and reach out to students to make sure they have the support they need to be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.

Community of Care

As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (217-333-0050 or http://odos.illinois.edu/community-of- care/referral/). Based on your report, the staff in the Student Assistance Center reaches out to students to make sure they have the support they need to be healthy and safe.

Further, we understand the impact that struggles with mental health can have on your experience at Illinois. Significant stress, strained relationships, anxiety, excessive worry, alcohol/drug problems, a loss of motivation, or problems with eating and/or sleeping can all interfere with optimal academic performance. We encourage all students to reach out to talk with someone, and we want to make sure you are aware that you can access mental health support at McKinley Health Center (https://mckinley.illinois.edu/). Or the Counseling Center (https://counselingcenter.illinois.edu/). For urgent matters during business hours, no appointment is needed to contact the Counseling Center. For mental health emergencies, you can call 911.

Disruptive Behavior

Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office for Student Conflict Resolution (https://conflictresolution.illinois.edu; conflictresolution@illinois.edu; 333-3680) for disciplinary action.

Emergency Response Recommendations

Emergency response recommendations can be found at the following website: http://police.illinois.edu/emergency-preparedness/. I encourage you to review this website and the campus building floor plans website within the first 10 days of class. http://police.illinois.edu/emergency-preparedness/building-emergency-action-plans/.

Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See https://registrar.illinois.edu/academic-records/ferpa/ for more information on FERPA.

Mental Health

Significant stress, mood changes, excessive worry, substance/alcohol misuse or interferences in eating or sleep can have an impact on academic performance, social development, and emotional wellbeing. The University of Illinois offers a variety of confidential services including individual and group counseling, crisis intervention, psychiatric services, and specialized screenings which are covered through the Student Health Fee. If you or someone you know experiences any of the above mental health concerns, it is strongly encouraged to contact or visit any of the University's resources provided below. Getting help is a smart and courageous thing to do for yourself and for those who care about you.

- Counseling Center (217) 333-3704
- McKinley Health Center (217) 333-2700
- National Suicide Prevention Lifeline (800) 273-8255
- Rosecrance Crisis Line (217) 359-4141 (available 24/7, 365 days a year)

If you are in immediate danger, call 911

*This statement is approved by the University of Illinois Counseling Center

Religious Observances

Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at https://odos.illinois.edu/community-of-care/resources/students/religious-observances/ to request appropriate accommodations. This should be done in the first two weeks of classes.

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: https://wecare.illinois.edu/resources/students/#confidential.

Other information about resources and reporting is available here: https://wecare.illinois.edu/.

Students with Disabilities

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the as soon as possible. To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class should contact Disability Resources and Educational Services (DRES) and see the instructor as soon as possible. If you need accommodations for any sort of disability, please speak to me after class, or make an appointment to see me or see me during my office hours. DRES provides students with academic accommodations, access, and support services. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TDD), or e-mail disability@illinois.edu. http://www.disability.illinois.edu/.