ME 220 Engineering Thermodynamics I
Winter 2023
Web Course, December 12 – January 14

INSTRUCTOR: Manohar Chidurala, PhD

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TELEPHONE: (504) 202-7388

LECTURES: Recorded lectures will be posted on Blackboard

LOCATION: Blackboard (WEB)

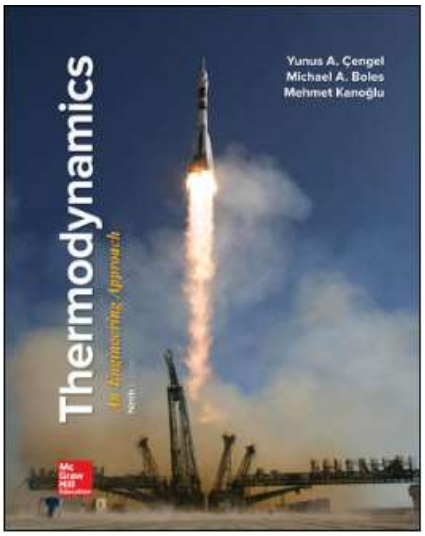
OFFICE HOURS: I will be available on ZOOM from 9:00am – 10:00am (CT) Monday-Friday. Let me know if you prefer a different time. In general, email is the best way to contact me.

PREREQUISITES: EM 221 or EM 222 (Engineering Statics)
MATH 331 (Ordinary Differential Equations)

COREQUISITES: MATH 331 (Ordinary Differential Equations)

REQUIRED MATERIALS:

Thermodynamics - An Engineering Approach (9th Ed) by Cengel and Boles (ISBN13: 9781259822674). As a loose-leaf packet, available from the WKU Bookstore.



Property Tables by Cengel and Boles: This is a separate copy of the appendices of the textbook, and is used on tests and homework problems. It is massively easier to have the tables in front of you with the text as it prevents the need to continually flip back and forth. We also use the tables on tests, so it is a good idea to have it.
Property tables ISBN13: 9781260048995.

MH Connect Access: This is an online homework system where all non-test assignments will be found. This should also be included with your electronic textbook (included with that bursar fee)

Scientific Calculator: While you can use any calculator to complete homework and quizzes, the tests and the final will follow NCEES Standard (what you will be allowed to use for professional exams). As of 2015, this is limited to:

Casio: All FX-115 models
HP: HP33s and HP35s models
TI: All TI 30X and TI36X models

If you don't have the right calculator for the tests or the final, you won't be allowed to use your "regular" calculator, or pass a classmate's calculator back and forth, or a calculator on your cell phone.

COURSE DESCRIPTION:
ME 220, Engineering Thermodynamics I, 3 Credit Hours, Lecture: Fundamental principles of thermodynamics, first law, physical properties, ideal and real gases, second law, reversibility and irreversibility, and consequences of thermodynamic cycles.

COURSE GOALS:
The goal of this course is to teach you the terminology, principles, theory, and practical application of thermodynamics. You will be able to apply these engineering principles to physical phenomena in the design of components, to integrate these concepts into a valid engineering design, and to apply these ideas in a mechanical engineer's job.

COURSE OUTCOMES:
1. Understand and explain the terminology and principles of thermodynamics and energy systems,
2. Understand and apply equations of state for pure substances,
3. Understand and apply the first law of thermodynamics to solve closed system and control volume (open system) problems,
4. Understand and explain the statements of the second law of thermodynamics and use the second law of thermodynamics to predict system efficiency,
5. Understand the characteristics of typical Gas, Vapor and Combined Power Cycles, calculate their efficiency, and apply their concepts to practical engineering problems and,
6. Use empirical data in the form of tables and figures to solve open-ended thermodynamic problems

BLACKBOARD:
Blackboard will be used extensively throughout this course.
- Homework will be posted in the Announcement Section of the Blackboard site and due dates in the course calendar.
- The course schedule will be available in the SYLLABUS folder.
- Class material will be posted in the CONTENT folder.
- Exams will be posted and collected in the EXAMS folder.
- Student grades will be posted in the Grade Center.

Make Sure You Know How to Use Blackboard

Bb Student User Training
If you have not used Blackboard as a student, or if this is your first online class, I *highly* recommend signing up for and completing the Blackboard Student User Training. These are topical modules that even those who have used Blackboard a lot have told us are helpful.

To sign up, go to Blackboard and sign in, and click the IT TRAINING tab (top, toward the right, black with white writing). Look for IT Blackboard Student User Training… you will gain instant access upon signing up. This is not required, but it could be very helpful for you and important for your success!

WKU Online Student Resource Center
You may also want to visit the WKU Student Resource Center:
http://www.wku.edu/online/src/

Blackboard Help/WKU IT Help Desk
270-745-7000

COURSE GRADE:

The final course grade will be determined as follows:

Homework (MH Connect)	25 %
Remote Quizzes (8)	50 %
In-person Final Exam (on January 14th)	25 %

Note: More details provided in Assignments and exams sections.
Scores for work will be based on the following rubric:

Letter Grade	Numeric Equivalent	Qualitative Description (Typical)
A	> 90%	Exemplar; no to minor mistakes.
B	> 80%	Proficient; several minor mistakes; almost no conceptual mistakes.
C	> 70%	Apprentice; several mistakes, some major; conceptual mistakes.
D	> 60%	Novice; many significant mistakes and conceptual errors.
F	< 60%	Non-response or completely incorrect response.

OTHER ITEMS NEEDED:

- Access to a computer (preferably your own) with a reliable Internet connection.
- A working web cam with working microphone (you will do a zoom audio/video for Instructor assistance)
- Microsoft Word in docx, file format.
- Adobe Acrobat Reader (a free download from Adobe.com).
- Additional technical requirements can be found in the Technical Requirements course menu link in the Blackboard course.

COURSE POLICIES:

- **Use of Technology**
  This is an online course where all required work (Homework & Exams) will be completed online through the use of Blackboard and the Internet. If you do not know how to use Blackboard, tutorials are available online (see the links above).
- **Attendance Policy**
  While there is no formal attendance policy, you will be expected to complete assignments according to the course schedule. The course schedule is posted on Blackboard under Syllabus folder.

- **Email and Blackboard Announcements**
  We will use Blackboard Announcements as a way of communicating with the whole class during this course. All Blackboard Announcements will also be sent via email. Therefore, please watch your email, or Blackboard Announcements, for course communication.
- **Evaluation**
  Your course grade will be based on the work outlined in this syllabus and schedule. Grades are always available on Blackboard (My Grades). To complete this course, you must successfully complete each assignment and activity on the Syllabus.
- **Late Work**
  As in a typical online class, you are expected to complete assignments by the scheduled due date. If circumstances beyond your control arise, contact me as soon as possible. No work will be accepted after the end date of the course. I strongly recommend that you do not wait until the last minute to submit your work. If your work does not meet the criteria, you may not have time to improve your submissions prior to the end date of the course.
- **Work Submission**
  Work for this course will take happen in your Blackboard course site.
  Assignments submitted to the Thermodynamics course must be submitted in docx or pdf or pptx file format, or else I cannot open/grade them. Assignments not submitted in one of those file formats will not be graded.
- **Failure of Technology**
  Blackboard can sometimes have issues. If you have issues with Blackboard, please contact the IT Help Desk at 270-745-7000.

ASSIGNMENTS:

- All the assignments will be posted on Blackboard via MH Connect.
- You must read the instructions on MH Connect before you begin the assignments.
- No late homework will be accepted. Students will be given less than 2 days time to complete assignments and ask questions prior to homework submission. DO NOT BEGIN your homework the night before it is due.
- Assignments will be weighted (ie some assignments will count more than others).
- Do not Email assignments to Instructor.
- PLEASE SEEK ASSISTANCE FROM YOUR INSTRUCTOR IF YOU NEED ANY HELP WITH THE ASSIGNMENTS.

QUIZZES:

- A total of 8 quizzes (up to 1 hour) will be given during the semester (remotely on Blackboard). The lowest quiz grade will be dropped.
- Quiz dates will be announced on Blackboard. These are fixed in time (preferably evenings) and we will adjust material covered on the quiz if we are ahead or behind schedule.
- You are allowed to use only the formula sheet (provided by the Instructor), the property tables booklet, and the approved calculator (See Calculator Policy Above) for the quizzes, no phones/smartwatches or backpacks will be allowed.
- NO MAKEUP QUIZZES WILL BE GIVEN. NO EARLY QUIZZES WILL BE GIVEN. NO LATE QUIZZES WILL BE GIVEN.

FINAL EXAM:

- There is one two-hour, in-person, final exam.
- The in-person final exam will be given on **Saturday, January 14th, 2023, 10:30 am – 12:30 pm** in EBS 2136.
- You are also allowed to take the final from any remote proctoring services (pre-approved) if you cannot make it to WKU Campus. Please make a note that these services will charge a service fee.
- You are allowed to use only the formula sheet (provided by the Instructor), the property tables booklet, and the approved calculator (See Calculator Policy Above) for the Final exam. No phones/smartwatches or backpacks will be allowed.
- NO MAKEUP EXAM WILL BE GIVEN. NO EARLY EXAM WILL BE GIVEN. NO LATE EXAM WILL BE GIVEN.

ACADEMIC DISHONESTY:

As an engineering student at WKU, you are expected to refrain from any form of academic dishonesty or deception such as cheating, stealing, plagiarism or lying on assignments, homework, quizzes, tests or exams. Furthermore, you understand and accept the potential consequences of punishable behavior, as stated in the WKU Catalog under Academic Dishonesty.

WKU COVID-19 VACCINE STATEMENT:

All students are strongly encouraged to get the COVID-19 vaccine. Out of respect for the health and safety of the WKU community and in adherence with CDC guidelines and practices of all public universities and colleges in Kentucky, the University requires that a cloth face covering (reusable or disposable) that covers both the nose and mouth must be worn at all times when in public areas within all buildings. Students must properly wear face coverings while in class regardless of the room size or the nature of the classroom activities. Students who fail to wear a face covering as required will be in violation of the WKU Student Code of Conduct and will be asked to comply or will face disciplinary action, including possible dismissal from the University. Accommodations can be requested in special cases through the Student Accessibility and Resource Center (SARC): 270-745-5004 (voice), 270-745-3030 (TTY), or 270-288-0597 (video).

All students must immediately report a positive Covid-19 test result or close contact with a person who has tested positive to the Covid-19 Assistance Line at 270-745-2019. The assistance line is available to answer questions regarding any Covid-19 related issue. This guidance is subject to change based on requirements set forth by public health agencies or the office of the governor. Please refer to the Healthy on the Hill website for the most current information. www.wku.edu/healthyonthehill

TITLE IX MISCONDUCT/ASSAULT STATEMENT:

Western Kentucky University (WKU) is committed to supporting faculty, staff and students by upholding WKU's Title IX Sexual Misconduct/Assault Policy (#0.2070) at https://wku.edu/eoo/documents/titleix/wkutitleixpolicyandgrievanceprocedure.pdf and Discrimination and Harassment Policy (#0.2040) at https://wku.edu/policies/hr_policies/2040_discrimination_harassment_policy.pdf.

Under these policies, discrimination, harassment and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment and/or sexual misconduct, you are encouraged to report it to the Title IX Coordinator, Andrea Anderson, 270-745-5398 or Title IX Investigators, Michael Crowe, 270-745-5429 or Joshua Hayes, 270-745-5121.

Please note that while you may report an incident of sex/gender based discrimination, harassment and/or sexual misconduct to a faculty member, WKU faculty are "Responsible Employees" of the University and **MUST** report what you share to WKU's Title IX Coordinator or Title IX Investigator. If you would like to speak with someone who may be able to afford you confidentiality, you may contact WKU's Counseling and Testing Center at 270-745-3159.

OGDEN STUDENT COURSE ATTENDANCE STATEMENT:

The faculty and staff of Ogden College of Science and Engineering are committed to providing you with learning experiences and opportunities. You must assume ownership of your education and be an active participant in the classroom and laboratory to take advantage of these opportunities. **Active participation requires you to attend.** Scientific studies have shown that attendance during scheduled classroom and laboratory meetings is directly correlated to your performance on assignments and exams and the potential to earn higher grades. Additionally, if you do not regularly attend class, you are missing important information about course topics, due dates, and assignment details that are crucial to your success in the course. Therefore, as a student enrolled in an Ogden course, you are expected to attend every class meeting and to inform your instructor regarding the reasons for any absences as soon as practical. **Your instructor may incorporate class attendance/participation as part of the grading criteria.**

ADA ACCOMMODATION STATEMENT:

In compliance with University policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, 1074. SARC can be reached by phone number at 270-745-5004 [270-745-3030 TTY] or via email at sarc.connect@wku.edu . Please do not request accommodations directly from the professor or instructor without a faculty notification letter (FNL) from The Student Accessibility Resource Center.

ME 220 ENGINEERING THERMODYNAMIC I
WINTER 2023 SESSION
Preliminary Schedule
(Subject to Change)

Days	Topics	Deliverables
12/12-12/14	Chapter 1: Basic Concepts Introduction, Definitions, Units, Systems Properties, State, Processes, Cycles State Postulate, Temperature, Pressure	HW
12/15-12/16	Chapter 2: General Energy Analysis Heat Transfer, Work, and Mechanical The First Law of Thermodynamics	HW
12/17-12/20	Chapter 3: Properties of Pure Substances Pure Substance, Phase-Change Process Property Diagrams Thermodynamic Property Tables The Ideal-Gas Equation of State Compressibility Factor, Other Equations of State	HW
12/21-12/22	Chapter 4: Closed Systems Moving Boundary Work Energy Balance for Closed Systems	HW
12/23-12/27	Chapter 4: Closed Systems Specific Heats Internal Energy, Enthalpy, Specific Heats for Ideal Gases Internal Energy, Enthalpy, Specific Heats of Solids and Liquids	HW
12/28-12/29	Chapter 5: Open Systems Conservation of Mass Flow Work and the Energy of a Flowing Fluid	HW
12/30-12/31	Chapter 5: Open Systems Energy Analysis for Steady-Flow Systems Nozzles, Diffusers, Turbines, Compressors, Throttling valves, Mixing chambers Heat exchangers, Pipe flow	HW
01/02-01/03	Chapter 6: Second Law of Thermodynamics Introduction to the Second law, Thermal Reservoirs Heat Engines, Refrigerators and Heat Pumps	HW

ME 220 ENGINEERING THERMODYNAMIC I
WINTER 2023 SESSION

Preliminary Schedule

(Subject to Change)

Days	Topics	Deliverables
01/04-01/05	Chapter 6: Second Law of Thermodynamics Reversible & Irreversible Processes, Carnot cycle Carnot Cycle, Carnot Principles The Thermodynamic Temperature Scale Carnot Heat Engine, Refrigerator and Heat Pump	HW
01/06-01/09	Chapter 7: Entropy Entropy Change of Pure Substance, Isentropic Processes Property Diagrams Involving Entropy, What Is Entropy T ds Relations, Entropy Change of Liquids and Solids	HW
01/10-01/11	Chapter 7: Entropy Entropy change of Ideal Gases Reversible Steady-Flow Work Isentropic Efficiencies of Steady-Flow Devices	HW
01/12-01/13	Chapters 9 & 10: Thermodynamic Cycles Basic Considerations in the Analysis of Power Cycles Brayton Cycle: The Ideal Cycle for Gas Turbine Engines Rankine Cycle: The Ideal Cycle for Vapor Power Cycles	HW
01/14	**Final Review** **Course Assessment**	

Final Exam*, Saturday, January 14th, 10:30 am – 12:30 pm, in EBS 2136**

*****Final Exam is <u>cumulative</u> (know your stuff).**