

# NC STATE UNIVERSITY

## MAE 201 Course Syllabus

### Thermal-Fluid Sciences

Fall 2024

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### Instructor Information

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Name	Office Phone	Email	Office Location
Professor Nancy Moore	919-513-3562	njmoore3@ncsu.edu	3274, Engineering Building 3

### Office Hours

- Sections 003 and 004: I am available for in-person office hours on Tuesdays and Thursdays 3:15-4:15 pm when classes are in session.
- Section 605: I am available for virtual office hours Wednesdays 2:00-2:30 pm when classes are in session. Email me in advance before you attend.
- Please see the Moodle Calendar for additional hours prior to exams.
- "Office hours" means time set aside for students to ask questions and get help understanding any material in the course. No appointment is necessary to attend office hours. Outside of office hours, email me for an appointment.

### Preferred Method of Communication & Response Time

- **Preferred method of communication:** Most communication should take place through the Moodle Student Help Forum unless the matter is personal in nature and/or specific to one student (such as a homework question), in which case direct email is required. You can expect to receive a response within two business days but not after 8:00 pm or on weekends. If I email you directly, please strive to respond within two business days. It is recommended that you check your NC State email at least once a day to stay on top of course communications.

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- **Asking questions about the course:** If you have a question about the course or its content, you can post your question on the Student Help Forum in Moodle. You cannot post questions about any graded assignment until after the assignment is graded or a solution is posted. Email me directly if you have a question about a graded assignment.
- **Email guidelines:** Always include a descriptive, specific but concise subject. Include your course number and section in your email, and provide adequate context for your question in order to ensure full understanding of your email. Be sure to use your NC State email account. Please refer to the syllabus and Moodle for the answer to your question before sending an email.

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## Course Information

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**Course Website:** [NC State WolfWare](#)

**Meeting Time and Location:**

- **Section 003:** Tuesdays and Thursdays 8:30-9:45 am, Room 2213 EB 3
- **Section 004:** Tuesdays and Thursdays 11:45-1:00 pm, Room 1007 EB1
- **Section 605:** Tuesdays and Thursdays 8:30-9:45 am, Site Based Havelock

**Course Credit Hours:** 3

## Catalog Description

An integrated introduction to the concept of energy and the laws governing the transfers and transformations of energy and momentum. Emphasis on thermodynamic properties and the First and Second Law analysis of systems and control volumes, internal flows and heat transfer in simple geometries.

## Structure

The majority of this course is **synchronous**, delivered through real-time, face-to-face class sessions. Additional materials and activities are delivered through **Moodle**, a secure and easy-to-use online learning platform.

Learning activities in this course will include reading assignments, homeworks, adaptive learning modules, individual and group projects, and exams.

This course consists of different modules that emphasize in an integrated way the analysis (via control volume and control mass analysis) of thermodynamic devices and systems, flows and modes of heat transfer in these devices. Assignments are made and are due on a regular basis.

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## Meeting Time and Tool Used

Meeting times depend on the section. Communication and course material is shared through Moodle.

## Prerequisites/Corequisites

Prerequisites: MA 242, PY 208 or PY 202

## Minimum Technical and Digital Information Literacy Skills

### Required technical skills

- Navigate and use Moodle, NC State's Learning Management System.
- Use Gmail, including attaching files to email messages
- Create and submit files in commonly used word processing program formats (MS Word, text editors, Google Docs).
- Download and install software as needed (see [section on required software](#))
- Download and upload attachments
- Use spreadsheets, presentations, graphics programs, and other applications in digital environments
- Use web conferencing tools including Zoom.
- Post to discussion boards and forums

### Required digital information literacy skills

- Perform online research using various search engines and library databases. Visit [Distance Learning Services](#) at NC State Libraries for more information.
- Use computer networks to locate and store files or data.
- Use online search tools for specific academic purposes.
- Analyze digital information for credibility, currency, and bias (e.g... disinformation, misinformation)
- Properly cite information sources
- Prepare a report on research findings

## General Education Program (GEP) Information

### GEP Category Fulfilled

None

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## GEP Corequisites

None

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## Learning Outcomes

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Upon completion of this course, the students will be asked to demonstrate their knowledge of the material covered in MAE 201 through their mastery of the following course objectives. Through the study of MAE 201 the student will be able to:

1. Determine properties of real substances, such as steam and refrigerant 134-a, and ideal gases from either tabular data or equations of state.

- Use absolute, gage, and vacuum pressures correctly.
- Calculate gage and vacuum pressures using the manometer equation.
- Use absolute and Celsius temperatures correctly.
- Determine property data using the steam and R-134a tables.
- Sketch P-v, T-v, and P-T plots for steam, R-134a, and ideal gases.
- Locate data states on P-v, T-v, and P-T plots for steam, R-134a, and ideal gases.
- Determine the condition of a data state as a compressed, saturated, or superheated state and determine the thermodynamic properties at that state by using property tables.
- Demonstrate the use of quality in finding properties of two-phase substances.
- Apply the concept of the generalized compressibility factor to demonstrate when the ideal gas equation may be used to determine the state of a gas.
- Apply the ideal gas equation to solve problems involving pressure, temperature, and volume of ideal gases.
- Determine changes in internal energy and enthalpy for ideal gases.
- Determine mass flow rate from its definition and relation to volume flow rate.

2. Analyze processes involving ideal gases and real substances as working fluids in both closed systems and open systems or control volumes to determine process diagrams, apply the first law of thermodynamics to perform energy balances, and determine heat and work transfers.

- Determine the pressure-volume relation for processes and plot the processes on P-v and diagrams.
- Calculate the boundary work for a variety of processes for closed systems.
- Apply the first law to closed systems containing ideal gases, steam, or R-134a to determine heat transfer, work, or property changes during processes.
- Apply the first law to steady-flow open systems containing ideal gases, steam, and refrigerant-134a to determine heat transfer, work, and property changes during processes.

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3. Analyze internal flow processes.

- Use the Bernoulli's equation to analyze flows.
- Use control volume analysis to evaluate forces across internal flow devices.
- Determine pressure losses in internal flows.

4. Analyze canonical heat transfer problems.

- Evaluate heat conductivity and heat transfer coefficients.
- Determine heating rates in internal flows for conduction, convection and radiation.

5. Analyze systems and control volumes through the application of the second law.

- Determine the efficiency of heat engines and compare with the Carnot heat engine efficiency.
- Determine the coefficient of performance of refrigerators and heat pumps and compare with refrigerators and heat pumps operating on the reversed Carnot cycle.
- Determine entropy changes for both ideal gases and real substances.
- Determine the properties of a working fluid at the end of an isentropic process.
- Plot processes on both P-v and T-s diagrams.
- Apply both the first and second laws to determine heat transfer, work, and property changes during processes occurring in both closed and open systems.

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## Course Materials

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### Required textbook

Y. A. Çengel, M. A. Boles and Mehmet Kanoglu, Thermodynamics: an Engineering Approach (Packet including Property Table Booklet), 10th Ed, The McGraw Hill Companies, New York, 2023.

Either book, ebook, or Connect

### Other required materials

Only models of calculators approved by the instructor are permitted to be used in the classroom during tests and the final exam. *No other models of calculators or variations of the models listed below are permitted during tests and the final exam.*

The following are the only calculators that will be permitted in the classroom during tests and the final exam and are the only ones allowed on the Fundamentals of Engineering Exam (see [this link](#)). Prices for these calculators typically range from \$9.95 to \$20.00.

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- Hewlett Packard – HP 33s and 35s
- Casio – FX-115 and FX-991
- Texas Instruments – TI-30X and TI-36X

Additional materials may be required for specific assignments. If this is an issue, please email me.

## Optional materials

Y. A. Çengel, M. A. Boles and Mehmet Kanoglu, Thermodynamics: an Engineering Approach (Packet including Property Table Booklet), 10th Ed, The McGraw Hill Companies, New York, 2023.

Additional supplementary notes will be provided to cover material not covered in the textbook.

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## Technology Requirements

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NC State University Libraries offers [Technology Lending](#), where many devices are available to borrow for a 7-day period. [Computer labs](#) are available in various locations around campus for student use.

## Computer

A laptop computer is recommended for students taking this course. NC State's Online and Distance Education provides [technology requirements and recommendations](#) for computer hardware, and NC State's Office of Information Technology provides recommendations for [your computer at NC State](#).

## Software and digitally-hosted course components

The following software and tools will be used in this course. Some tools are a part of NC State's enterprise tools. See [information about their purpose, how to access them, accessibility information, and privacy policies](#). The same information for any other tools required in this course is provided in the list below.

- Moodle
- Gradescope
- Top Hat

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## Other Student Expenses

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None

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## Communication Guidelines

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### Respecting our learning community

The [NC State Code of Student Conduct](#) outlines expectations for behavior in the classroom (whether virtual or physical) and the consequences for students who violate these expectations. Any behavior that impacts other students' ability to learn and succeed will be addressed, but expressing diverse viewpoints and interpretations of course content is welcome.

Community guidelines for this course include:

- Use a respectful tone in all forms of communication (email, written, oral, visual)
- Maintain professionalism (avoid slang, poor grammar, etc.) in your written communication.
- Respect regional dialects and culturally embedded ways of oral communication.
- Stay home or in your dorm room if you are exhibiting symptoms of a contagious illness (fever, chills, etc.).
- Enter our classroom community respectfully by refraining from lewd or indecent speech or behavior, helping to maintain a safe physical environment, not using your cell phone for voice or text communication except when explicitly given leave to do so, and not attending class under the influence of any substance.
- Treat each community member with respect by not recording others without their consent or engaging in any form of hazing, harassment, intimidation, or abuse.
- Respect cultural differences that may influence communication styles and needs.

### Plan for interaction between instructors and students

Feedback is provided throughout the semester through the different evaluation methods (including homework and exams).

### Expectations for learner participation and interaction

Some course activities including synchronous class sessions and group work will require you to interact with other students in the course. Communication expectations including frequency and content are detailed in the information about each assignment or activity when it appears in the course.

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## Grading and Feedback

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### Grading criteria, details

Percentage of grade	Component	Details
5 %	Attendance	Submit the word of the day provided in each lecture on a form available on Moodle.
5 %	Adaptive Learning Modules	Access and complete each module online.
5 %	Homework	Lowest grade dropped. Homework must be done individually. Assignments posted online. Work submitted online. Work can be written on paper or computer but must be legible. Typically due on class day. May be due during the final week of classes.
10 %	Group Project	Must be done in groups. Description posted online.
15 %	Mini-project	Individual short projects. Description posted online.
60 %	Tests (3) and Final exam	Lowest of the 4 worth 10%, highest 20%, the others 15% each. Closed book and notes. Approved calculators only.*

\*Each test is given during class time (75 minutes). The date and time of the final exam is determined by the university (see [this link](#)). The university policy regarding exams will be followed, and any request for a change in the exam date must be made by the last day of classes and done according to university policy (see also [this link](#)). The property tables pdf or booklet is allowed and must be free of handwriting. An equation sheet will be provided and posted in advance. Student's handwriting on the test must be legible. All tests will be graded for accuracy and the correct method.



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Arrangements for missed tests will be made on an individual basis provided there is an acceptable, certifiable excuse (what constitutes an 'Excused Absence,' is at [this link](#) with more information available [here](#)). These arrangements must be made at least one week in advance and preferably as soon as possible (except in the case of emergency). Oral make-up exams may be required. If tests or exams are scheduled on days that the University is closed due to emergencies, those tests or exams will be held during the first scheduled class period after the University reopens.

Once assignments are graded according to the rubric, no changes will be made to the rubric. You may meet with me to review the rubric of any assignment after it has been graded.

If you believe that an incorrect grade has been given on any assignment based on the rubric, you must provide me with reasons for a change of the grade within one week of its return by means of a written explanation of the error. After this deadline has passed, I will review your assignment. Any objections made after one week will not be considered.

Raw grades will be posted on Moodle during the semester (Moodle will not show course averages). It is the student's responsibility to contact the instructor regarding any missing grade or typographical error on Moodle. Throughout the semester, I will provide written notice to students of deadlines after which posted grades on Moodle will not be changed for any reason. Final course averages will be calculated from the posted grades on Moodle and are not negotiable.

## Grading scale

This course uses this grading scale with plus/minus grading given at the discretion of the instructor:

Low	Letter	High
97 ≤	A+	≤ 100
93 ≤	A	< 97
90 ≤	A-	< 93
87 ≤	B+	< 90
83 ≤	B	< 87
80 ≤	B-	< 83
77 ≤	C+	< 80
73 ≤	C	< 77

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70 ≤	C-	< 73
67 ≤	D+	< 70
63 ≤	D	< 67
60 ≤	D-	< 63
0 ≤	F	< 60

## Requirements for earning a grade of “Satisfactory”

If you are taking this course for credit only (S/U), your grade will be reported as S (Satisfactory) when coursework is equivalent to a C- or better or U (Unsatisfactory) when coursework is equivalent to less than a C-. For more information, see the [Credit Only Courses regulation](#).

## Requirements and procedures for auditing this course

Auditing this course is approved on a case-by-case basis. Please contact the course instructor to attain approval. Refer to the [Audit regulation](#) for more information and links to required forms.

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## Course Schedule

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Please note: the course schedule is subject to change.

Week	Topic	Reading	Test
1	Introduction. Definitions, Units, Properties.	1-1 through 1-9, 1-11	
2	Energy, Heat, Work. Conduction, Radiation.	2-1 through 2-5 Supplementary Material	
3	First Law, Efficiencies. Pure Substance, Diagrams, Property Tables.	2-6 through 2-7 3-1 through 3-5	

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## Final Exam Schedule

Section 003: Dec. 10, 8:30-11:00 am

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Section 004: Dec. 5, 12:00-2:30 pm

Section 605: Dec. 10, 8:30-11:00 am

## Late assignments, extensions

Work that is late due to an excused absence (according to NCSU policy) will either be 'excused' from your grade, or it may be turned in late. It is the students' responsibility to contact the instructor immediately to discuss the most appropriate action. Work that is late due to any other reason will not be accepted.

Each student will be able to receive one extension on an eligible assignment for the semester. The extension of two days will be granted if the request is submitted before the original deadline. The request form is on Moodle.

## Incomplete grades, withdrawals

Information on incomplete grades can be found at [REG 02.50.03 – Grades and Grade Point Average](#). If you encounter a serious disruption to your work not caused by you and you would have otherwise successfully completed the course, contact your instructor as soon as you can to discuss the possibility of earning an incomplete in the course for the semester, including an agreement on when the remaining work must be done in order to change the grade to the appropriate letter grade.

If you must withdraw from a course or from the University due to hardship beyond your control, see [Withdrawal Process and Timeline | Student Services Center](#) for information and instructions.

## Attendance

All lectures will be recorded (barring technical difficulties) and the recording will be available to students after class. Students must submit the word of the day provided in class on a form available on Moodle. Submissions may be made while in class or while watching the lecture recording. For each class period, the submission must be made within one week with no exceptions for weekends or holidays.

Related NC State Policy: [REG 02.20.03 – Attendance Regulations](#)

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## University Policies

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### Academic integrity and honesty

Students are required to comply with the university policy on academic integrity found in the [Code of Student Conduct 11.35.01 sections 8 and 9](#). Therefore, students are required to uphold the Pack Pledge: "I have neither

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given nor received unauthorized aid on this test or assignment.” Violations of academic integrity will be handled in accordance with the [Student Discipline Procedures](#).

Please refer to the [Academic Integrity](#) web page for a detailed explanation of the University’s policies on academic integrity and some of the common understandings related to those policies.

Solution manuals or solutions solved by someone else are considered to be unauthorized aid. Scientific calculators (beyond the ones allowed on tests and exams), Excel, Matlab, and Desmos are allowed on assignments. Students should check with the professor before using other technologies and indicate every technology used (beyond those listed above). AI is not designed for and should not be used to solve engineering problems as a stand alone product. Students should be prepared to defend their work orally upon request. If you cannot explain and defend your analysis, you will not receive credit.

## Student privacy

### Class recording statement:

In-class sessions are recorded in such a way that might also record students in this course. These recordings MAY be used beyond the current semester or in any other setting outside of the course. Contact your instructor if you have concerns.

### Class privacy statement:

This course requires online exchanges among students and the instructor, but NOT with persons outside the course. Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web postings, where relevant to the course. Examples include online discussions of class topics and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

## Other Policies

Students are responsible for reviewing the NC State University PRR’s which pertain to their course rights and responsibilities:

- [Equal Opportunity and Non-Discrimination Policy Statement](#) and [additional references](#)
- [Code of Student Conduct](#)
- [Grades and Grade Point Average](#)
- [Credit-Only Courses](#)
- [Audits](#)

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## Student Resources

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Academic and Student Affairs maintains a website with links for student support on campus, including academic support, community support, health and wellness, financial hardship or insecurity, and more. [Find Help on Campus.](#)

### Disability resources

Any student with DRO accommodations must meet with the instructor immediately (and at least a week before examinations, assignments, etc.). Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the [Disability Resource Office \(DRO\)](#). For more information on NC State's policy on working with students with disabilities, please see the [Policies, Rules and Regulations page maintained by the DRO](#) and [REG 02.20.01 Academic Accommodations for Students with Disabilities](#).

### Safe at NC State

At NC State, we take the health and safety of students, faculty and staff seriously. The [Office for Institutional Equity and Diversity](#) supports the university community by providing services and resources to support and guide individuals in obtaining the help they need. See the [Safe at NC State webpage](#) for resources.

### Supporting Fellow Students in Distress

As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that this classroom and the campus as a whole remain a healthy and safe environment for learning. Occasionally, you may come across a fellow classmate whose personal behavior concerns or worries you, either for the classmate's well-being or yours. If you feel this way, I would encourage you to report this behavior to the [NC State CARES website](#). Although you can report anonymously, it is preferred that you share your contact information so they can follow up with you personally.

As a student you may experience a range of personal issues that can impede learning, such as strained relationships, increased anxiety, alcohol/drug concerns, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may impact your ability to participate in daily activities. It is very important that you have a support system and that you ask for help when you are struggling. The Counseling Center at NC State offers confidential mental health services for full time NC State students, including same-day emergency services. Please visit <https://counseling.dasa.ncsu.edu/> to get connected.

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Additionally, the MAE department is committed to the success and wellbeing of our students. Please go to <https://www.mae.ncsu.edu/mae-wellness/> to learn about opportunities to get involved and stay healthy.

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## Course Evaluations

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ClassEval is the end-of-semester survey for students to evaluate the instruction of all university classes. The current survey is administered online and includes 12 closed-ended questions and 3 open-ended questions. Deans, department heads, and instructors may add a limited number of their own questions to these 15 common-core questions.

Each semester students' responses are compiled into a ClassEval report for every instructor and class. Instructors use the evaluations to improve instruction and include them in their promotion and tenure dossiers, while department heads use them in annual reviews. The reports are included in instructors' personnel files and are considered confidential.

Online class evaluations will be available for students to complete during the last two weeks of the semester for full-semester courses and the last week of shorter sessions. Students will receive an email directing them to a website to complete class evaluations. These become unavailable at 8 am on the first day of finals.

- Contact ClassEval Help Desk: [classeval@ncsu.edu](mailto:classeval@ncsu.edu)
- [ClassEval website](#)
- [More information about ClassEval](#)

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## Syllabus Modification Statement

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Note: this syllabus is not a contract and can be altered at any point with advanced notice to accommodate the educational goals of the course.