

## ME 235 THERMODYNAMICS I – Fall 2018, Section 001

1311 EECS; Tuesday, Thursday: 1:30 PM – 3:00 PM

**Instructor:** Rohini Bala Chandran, [rbchan@umich.edu](mailto:rbchan@umich.edu)  
3455 G.G. Brown Building  
Office Hours: Tu. 3:00 PM – 4:00 PM or by appointment

Donald Siegel, [djsiege@umich.edu](mailto:djsiege@umich.edu) (Instructor, Section 002)  
2380 (ASO Main Office) G. G. Brown Building  
Office Hours: Wed. 3:00 PM – 4:00 PM

**GSIs:** Mr/ Kyle Nagy, [nagyky@umich.edu](mailto:nagyky@umich.edu) (Section 001)  
Mr. Micheal Schickling, [mschickl@umich.edu](mailto:mschickl@umich.edu) (Section 002)

### GSI Office Hours held in the Findlay Learning Center

Mondays	2:00 pm – 4:00 pm	Room C (Kyle)
Tuesdays	4:30 pm – 5:30 pm 7:30 pm – 8:30 pm	Room A (Michael)
Wednesdays	9:30 am – 11:30 am 1:30 pm – 3:30 pm 4:00 pm – 6:00 pm	Room C (Michael) Room B (Michael) Room C (Kyle)
Thursdays	10:30 am – 12:30 pm	Room C (Kyle)

### Problem Sessions held in Rooms C and D

Wednesdays	6:00 pm – 7:00 pm	Kyle and Michael alternate
------------	-------------------	----------------------------

**Course Description:** We will cover basic principles of engineering thermodynamics. First law, second law, control mass and control volume analyses; thermodynamic properties and behavior of pure substances; application of principles to thermodynamic systems operating in a steady state and for a transient process. Understanding typical power producing cycles, refrigerators, automobile, jet and gas-turbine engines

**Required Text:** *Fundamentals of Thermodynamics* by Borgnakke and Sonntag, 9<sup>th</sup> Edition, John Wiley & Sons, 2003. 978-1-118-13199-2; *Coverage:* Chapters 1-7, Chapter 9 (Secs. 1-3, 8-9), Chapter 10 (Secs. 1, 7-9)

**Other References:** *Thermodynamics: An Engineering Approach* by Cengel and Boles, 8<sup>th</sup> Edition, McGraw-Hill Education, 2015. 978-0-073-39817-4

**Prerequisites:** General Chemistry Chem 130, General and Inorganic Chemistry Chem 125, or Chem 210 and 211, Calculus II Math 116

**Course Grade:** Homework: 15%  
In-class activity: 5%  
Exam #1: 25%  
Exam #2: 25%  
Final: 30%

**Canvas +** <http://canvas.umich.edu>; Homework and exam solutions, the schedule, example and

**Piazza:** study problems, announcements, lecture recordings, etc. will be posted on Canvas. Please be sure to allow alerts to Canvas notifications from ME235 Section 001.

This semester we will be using **Piazza** to promote class discussion, which can be accessed through the Canvas course webpage. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions individually to fellow students or the GSI or the instructor, I encourage you to post your questions on Piazza that allows common questions/concerns to be answered. Find our Piazza page on Canvas or at:

<https://piazza.com/umich/fall2018/mecheng235>

**Homework &  
Class-activity  
Policy:**

- Assigned weekly and posted on Canvas
- Each problem graded 0-1-2-3 (0 – no attempt, 1 – attempt but clearly incorrect solution, 2 – attempt with partially correct solution, and 3 – attempt with fully correct solution)
- HWs are due on *Thursdays at the beginning of class*; late HWs may be turned in on Friday before 5 PM with a 25% penalty; *HWs will NOT be accepted after Friday 5 PM.*
- In-class activities are meant to encourage class participation and enhance active learning; these activities will be graded based on participation/attempt and may include quizzes and think-pair-share discussions
- Collaborations and discussions with current ME 235 students towards completing HWs is allowed and encouraged; such discussions should be to the benefit of all parties involved. However, the actual written submission must be completed independently and must reflect your own understanding of the material
- Written re-grading requests will be accepted up to one week after HWs are returned

**Exams:** There will be two midterm exams. Both will be held during the evenings to allow extra time. Date and time are subject to change.

Exam #1: Thursday, Oct. 18 <sup>th</sup>	7:00-8:30 pm	Location TBD
Exam #2: Monday, Nov. 19 <sup>th</sup>	7:00-8:30 pm	Location TBD
Final: Wednesday, Dec. 19 <sup>th</sup>	1:30-3:30 pm	Location TBD

The final exam is **comprehensive** covering all the course material.

**Exam policy:** All exams are closed-book – 1 page (2 sides) of notes with selected additional material and calculators will be allowed, no electronic devices/e-books will be allowed during the examination.

**Time Conflicts:** Conflicts with the exam schedule must be reported by email at least two weeks before the exam date. In addition, a written approval is needed for requesting alternate exam schedules (e.g., sport/art/scientific competitions representing UM, conflict with other exams, and sickness).

**Special  
accommodation:**

If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate

your participation and progress. As soon as you make me aware of your needs, we can work with the Services for Students with Disabilities (SSD) office to help us determine appropriate academic accommodations. SSD (734-763-3000; <http://ssd.umich.edu>) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such

**Honor code:**

All class policies are governed by the CoE honor code. In summary, the honor code states that “No member of the UM community shall take unfair advantage of any other member of the UM community”. For more information:

<http://www.engin.umich.edu/students/honorcode/brochure.pdf>

### Tentative Class Schedule – ME 235, Fall 2018, Section 001

Week	Date	Day	Topics	HW # due date
1	Sep 4,6	Tu,Th	Chapter 1: Introduction and class overview, definitions of control volumes, control surfaces, energy, thermodynamic properties, units conversion Chapter 2: Thermodynamic properties of a pure substance, thermodynamic state, phase diagrams	
2	Sep 11,13	Tu,Th	Chapter 2: P-v-T diagrams, thermodynamic tables, phase changes, ideal gas law, equations of state	HW#1 9/13/18
3	Sep 18, 20	Tu,Th	Chapter 2 continued; Chapter 3: 1 <sup>st</sup> law of thermodynamics, compressible work, moving boundary work, polytropic process	HW#2 9/20/18
4	Sep 25, 27	Tu,Th	Chapter 3: Definition of heat, heat transfer modes, internal energy, enthalpy, example problems	HW#3 9/27/18
5	Oct 2, Oct 4	Tu,Th	Chapter 3: Specific heat of ideal gases, transient process, problem solving, engineering applications	HW#4 10/4/18
6	Oct 9, Oct 11	Tu,Th	Chapter 4: Conservation of mass for a control volume, the energy equation, steady-state processes, example problems, transient flow processes	HW#5 10/11/18
7	Oct 18	Th	Chapter 4: problem solving; Chapter 5: Introduction to 2 <sup>nd</sup> law of thermodynamics	
<b>Oct 18 Exam #1 covering Chapters 1—3; Room TBD, 7:00 PM – 8.30 PM</b>				
8	Oct 23, 25	Tu, Th	Exam 1 review, Chapter 5: reversible and irreversible processes, Carnot cycle, ideal versus real cycles	HW #6 10/25/18
9	Oct 30, Nov 1	Tu,Th	Chapter 6: introducing entropy, thermodynamic property relation, entropy changes of an ideal gas,	HW #7 11/1/18
10	Nov 6, 8	Tu,Th	Chapter 6: entropy generation, entropy rate equation, problem solving	HW #8 11/8/18
11	Nov 13, 15	Tu,Th	Chapter 7: Entropy equation for a control volume, steady and transient processes, entropy generation, Bernoulli equation	HW #9 11/15/18
<b>Nov. 19<sup>th</sup> Exam #2 covering Chapters 1—6; Room TBD, 7:00 PM – 8.30 PM</b>				
12	Nov 20	Tu	Exam 2 review, Chapter 7: Principle of entropy increase, isentropic efficiencies, practical engineering implications	
13	Nov 27,29	Tu,Th	Chapter 9: Thermodynamic cycles: Power and refrigeration cycles, Rankine cycle with superheat, reheat and regeneration	HW #10 11/29/18
14	Dec 4,6	Tu,Th	Chapters 9 and 10: Gas-power cycles: Brayton, Otto, and Diesel cycles	HW #11 12/6/18
15	Dec 11	Tu,Th	Chapter 10 continued, Final exam review	HW #12 12/11/18
<b>December 19<sup>th</sup> , Final Comprehensive Exam; Room TBD, 1:30 PM – 3:30 PM</b>				