

## MEEN 3380: Thermodynamics II

### Course Description

Applications of thermodynamics principle and laws in power generation, propulsion and HVAC are introduced through concepts of gas power cycles, vapor and combined power cycles, refrigeration cycles, properties of gas mixtures, psychrometric chart, and thermodynamics of chemically reacting systems. Design aspects of engineering thermodynamic are introduced through the assignments of open-ended problems and design projects. State-of-the art software programs are introduced to solve the design problems and projects.

**Prerequisite:** The prerequisites are MEEN 2374 and MATH 3301

**Class Time:** 10:20 am – 11:15 am; Monday, Wednesday and Friday

**Class Location:** Cherry Engineering Building, Room #2603

**Instructor:** Dr. AKM Monayem H. Mazumder  
Visiting Assistant Professor  
Department of Mechanical Engineering  
Office: Cherry Engineering Building, Room #1617  
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**Office Hours:** 12:30 PM – 2:30 PM; Monday and Wednesday (Any other time by appointment)

### Textbook:

Cengel, Y. A. and Boles, M. A., **Thermodynamics: An Engineering Approach**, 8<sup>th</sup> Edition, McGraw Hill, 2015.

### References:

Moran, M. J., Shapiro, H. N., Boettner, D. D., and Bailey, M. B., **Fundamentals of Engineering Thermodynamics**, 8<sup>th</sup> Edition, John Wiley & Sons, 2014.

Borgnakke, C. and Sonntag, R. E., **Fundamentals of Thermodynamics**, 8<sup>th</sup> Edition, John Wiley & Sons, 2013.

### Evaluation:

Attendance	10%
Homework	10%
Course Project	10%
Pop Quizzes	10%
Exams 1	10%
Exams 2	15%
Exams 3	15%
Final Exam	20%

A = 90-100%; B = 80-89%; C = 70-79%; D = 60-69%; F=< 60%.
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### Course Objectives:

- To demonstrate the use of second law in thermodynamic processes.
- To introduce applications of thermodynamics cycles in power generation, propulsion, heat engines and refrigeration.
- To explore properties of air-vapor mixtures through the use of psychrometric chart.
- To apply thermodynamic principles to study chemically reacting mixtures.
- To provide students hands-on experience in thermodynamic software for solving open-ended design problems and projects.

### Course Outcomes: Students will be able to do the followings:

- Apply second law of thermodynamics to analyze both closed and open systems.
- Differentiate between the first and second law analyses of thermodynamic processes
- Calculate the performance of vapor power cycle, air cycle and refrigeration cycle
- Discuss differences between the ideal power cycles and actual cycles
- Define properties of air-vapor mixtures
- Determine properties of air-vapor mixtures using psychrometric chart
- Calculate stoichiometry, air-fuel ratio, and equivalence ratio of reacting mixtures
- Determine thermodynamic properties of chemically reacting mixtures
- Compute adiabatic flame temperature of chemically reacting mixtures
- Use thermodynamics software to solve engineering thermodynamic problems

### Course Contents:

1. Introduction and Review of Thermodynamics I
2. Review of Entropy
3. Exergy
4. Gas Power Cycles
5. Vapor and Combined Power Cycles
6. Refrigeration Cycles
7. Gas Mixtures
8. Gas-Vapor Mixtures and Air-Conditioning
9. Chemical Reactions

### Detailed Topics: (Subject to adjustment based on students feedback)

Week 1	<b>09/04</b> - 09/08 <b>Labor Day</b> ; Introduction; Review of Thermodynamics I
Week 2	09/11 - 09/15 Entropy (Review)
Week 3	<b>09/18</b> - 09/22 <b>Exam 1 - 09/18</b> ; Gas Power Cycle
Week 4	09/25 - 09/29 Gas Power Cycle
Week 5	10/02 - 10/06 Vapor & Combined Power Cycles
Week 6	10/09 - 10/13 Vapor & Combined Power Cycles; Review
Week 7	<b>10/16</b> - 10/20 <b>Exam 2 - 10/16</b> ; Refrigeration Cycles
Week 8	10/23 - 10/27 Refrigeration Cycles
Week 9	10/30 - 11/03 Refrigeration Cycles; Gas Mixtures

Week 10	11/06 - 11/10 Gas-Vapor Mixtures and Air-Conditioning
Week 11	11/13 - 11/17 Gas-Vapor Mixtures and Air-Conditioning; Review
Week 12	<b>11/20 - 11/24 Exam 3 - 11/20; Thanksgiving</b>
Week 13	11/27 - 12/01 Exergy; Chemical Reactions
Week 14	12/04 - 12/08 Chemical Reactions; Final Exam Review
Week *	<b>12/11 Final Exam</b> (Monday at 9:00 AM – 11:30 AM)

### Class Policies:

- **Attendance** is required. Students are responsible for all the work missed due to their absence. *Students with perfect attendance will receive 10 points toward their final.* One point will be deducted for each unexcused absence.
- **The quizzes** might be pop-up without prior announcement. Students who miss class will receive a grade of zero for the quiz. The **only exception** is for **officially approved University Excused Absences**. Proper documentation must be submitted for the absence within one week following an excused absence.
- **ABSOLUTELY NO PHONES AND NO TEXTING IN CLASS. ALL PHONES MUST BE INVISIBLE FOR DURATION OF THE CLASS.**
- **Late papers** will receive 50% credit before the grading starts and 0% after that.
- **Makeup exams** (with an approved reason) can receive a maximum of 75% points before the solutions are given and 0% after that. There will be no makeup quizzes/exams unless it is for medical emergency.
- **Academic dishonesty:** This course complies with university policies on academic dishonesty as printed in the Lamar University *Student Handbook* and *Faculty Handbook*.
- **Students with disabilities:** This course complies with all accommodations prescribed by the Lamar University Office of Services for Students with Disabilities. It is the responsibility of the student to insure that the instructor has been informed of all prescribed accommodations.
- Students are required to bring a calculator to the class and must be prepared to work on problems during class.
- Each student must have a print copy of the textbook.

### Emergency Procedures

In the event of an announced campus closure in excess of four days due to a hurricane or other disaster, students are expected to login to Lamar University's website's homepage ([www.lamar.edu](http://www.lamar.edu)) for instructions about continuing courses remotely.

Many types of emergencies can occur on campus; instructions for severe weather or violence/active shooter, fire, or chemical release can be found at:

<http://www.lamar.edu/about-lu/administration/risk-management/index.html>.

Following are procedures for the first two:

### **Severe Weather**

- ✓ Follow the directions of the instructor or emergency personnel.
- ✓ Seek shelter in an interior room or hallway on the lowest floor, putting as many walls as possible between you and the outside.
- ✓ If you are in a multi-story building, and you cannot get to the lowest floor, pick a hallway in the center of the building.
- ✓ Stay in the center of the room, away from exterior walls, windows, and doors.

### **Violence/Active Shooter (CADD)**

- ✓ **CALL** - 8-3-1-1 from a campus phone (880-8311 from a cell phone). Note: Calling 9-1-1 from either a campus phone or cell phone will contact Beaumont City Police Dispatch rather than University Police.
- ✓ **AVOID**- If possible, self-evacuate to a safe area outside the building. Follow directions of police officers.
- ✓ **DENY**- Barricade the door with desks, chairs, bookcases or any other items. Move to a place inside the room where you are not visible. Turn off the lights and remain quiet. Remain there until told by police it is safe.
- ✓ **DEFEND**- Use chairs, desks, cell phones or whatever is immediately available to distract and/or defend yourself and others from attack.

### **Academic Continuation Policy:**

In the event of a campus closure due to hurricane or other disaster, courses will continue after a four-day lapse to allow time for evacuation. This course will be conducted via email. Students must begin checking their Lamar email address for where instructions and course materials and required student work will be sent and received by the instructor.