Western Michigan University
Department of Industrial and Manufacturing Engineering
IME 2830 (Thermodynamics)
Spring 2011

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Lecture class: M 9:30AM-10:20PM, CEAS-E0121
Lab class: F 8:30-11:20 PM, CEAS-E0121
Office hours: MW 11:00 AM – 1:00 PM

Catalog Description: Fundamentals of thermodynamics, first and second laws for open and closed systems, basics of heat transfer. Laboratory practices on thermodynamic system behavior.

Objectives :

1. Learn fundamentals of the first and second laws of thermodynamics (a,b,f)
2. Learn applications of the ideal gas law (a,b,f)
3. Learn to utilize tables and charts of thermodynamic properties to solve problems (a,f)
4. Understand how to apply thermodynamic principles to solve problems (a,b,f)
5. Apply thermodynamic principles to verify behavior of practical applications (a,b,c,f)
   (Letter in parenthesis refers to the ABET-TAC criteria)

Prerequisite by topics:

1. Basic understanding of mechanics and heat - PHYS 1130 and PHYS 1140
2. Basic understanding of exponential function, differential and integral calculus - MATH 1220 or MATH 1700 or MATH 2000

Textbook (required):

Granet and Bluestein, **Thermodynamics and heat power**, 7th Edition, Pearson Prentice Hall, 2004.

References (optional):

1. Rolle, K; **Thermodynamics and Heat Power**, Pearson Prentice Hall; 2005.
2. Cengel, Y. and Boles, M.; **Thermodynamics an Engineering Approach**; McGraw Hill Companies, 2011.

Evaluations:

Grade will be based on a modified class average with a minimum grade of 60% is required to receive a passing grade (D).

1.	Midterm	20%
2.	Final	30%
3.	Quizzes	10%
4.	Homework and Lab assignment	40%

For the purpose of assigning final letter grades, the following scale will be used.

Grade	Range
A	90 – 100
B/A	88 – 89.9
B	80 – 87.9
C/B	78-79.9
C	70 – 77.9
D/C	68 – 69.9
D	60 – 67.9
E	Below 60

Performance Criteria: Student should be;

1. Able to use proper units to calculate thermodynamic properties of substances (1,2,3,4)
2. Know how the ideal gas law can be applied to calculate state of substances and work in multi-step thermodynamic processes (1,2,3,4)
3. Demonstrate proficiency in using the principles of first and second laws to solve problems in thermodynamic applications (1,2,3,4)
4. Know how to use tables and charts to determine substance properties in saturated, unsaturated and superheated conditions (2,3,4)
5. Demonstrate an understanding of the concepts of heat transfer (2,4)
6. Demonstrate skill in measurement of heat, work, temperature and heat transfer (4)
7. Demonstrate understanding of available energy sources and energy conversion devices (1,2,3,4)

(Numbers in brackets are the evaluation methods listed in previous section)

Lecture class: Attendance and punctuality are essential for success in this course. Student participation discussion of concepts, applications and problems in class are expected. There will be a quiz each week which may be solution of a problem or answer of descriptive questions. Quiz and exam makeups are no allowed. Homework is due at the beginning of next class. Late homework will be penalized by 10% per day. No late work will be acceptable after the assignment has already been graded and returned.

Laboratory class: Laboratory sessions will include both problem solving and laboratory practices. Details of the problems and lab practices will be provided in the lab handouts.

Academic Honesty: You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate and Graduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at http://catalog.wmich.edu under Academic Policies, Student Rights and Responsibilities.] If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.

Week	**Topic**	**Chapter**
1. (Jan 10, *14*)	Introduction, thermodynamic system and fundamental concepts *No Lab*	1
2. (Jan 17, *21*)	MLK day recess - no class *Lab#1 – Thermodynamic systems*	--
3. (Jan 24, *28*)	Thermodynamics quantities, symbols and units *Lab#2 – Units and thermodynamic quantities*	1
4. (Jan 31, Feb *4*)	Work, energy, heat and power Ideal gas law, heat and energy *Lab#3 – Thermodynamic quantities*	2, 6
5. (Feb 7, *11*)	Thermodynamic processes *Lab4 – Work – energy - power*	6
6. (Feb 14, *18*)	Work and energy in thermodynamic processes *Lab#5 – Work in thermodynamic processes*	6
7. (Feb 21, *25*)	– Review for midterm **Midterm February 25,** 8:30-10:30 AM **- (Ch 1, 2, 6)**	
8. (Feb 28, *Mar 4*)	Spring break – no classes	
9. (Mar 7, *11*)	First law of thermodynamics *Lab#6 – Work, energy and power in thermodynamic processes*	3
10. (Mar 14, *18*)	First law of thermodynamics *Lab#7 – First law of thermodynamics for closed system*	3
11. (Mar 21, *25*)	First law of thermodynamics for open system *Lab#8 – Steady flow system*	3
12. (Mar 28, *Apr 1*)	Thermodynamic properties *Lab#9 – First law of thermodynamics for open system*	5
13. (Apr 4, *8*)	Second law of thermodynamics and heat engines *Lab#10 – Efficiency of heat engines*	4, 8, 9
14. (Apr 11, *15*)	Heat engines and heat transfer *Lab#11 – Heat transfer due to conduction*	8,9,11
15. (Apr 18, *22*)	Heat transfer and review *No lab* **Final Exam – Tuesday, April 26, 10:15 AM - 12:15 PM** **(Chapter 1, 2, 3, 4, 5, 6, 8, 9, 11)**	11