

King Fahd University of Petroleum & Minerals
MECHANICAL ENGINEERING DEPARTMENT
ME 203: Thermodynamics I

Catalogue Description: (3-0-3)

System and control volume concepts; Properties of a pure substance; Work and heat; First law of thermodynamics as applied to a system and a control volume; internal energy; enthalpy; second law of thermodynamics; Carnot cycle, entropy, reversible and irreversible processes; Applications of steady state steady-flow, uniform-flow, and other processes.

Status in Curriculum (Required or Elective): Required (offered Fall & Spring)

Prerequisites: MATH 102, PHYS 102

Co-requisites: None

Textbook: Yunus A. Cengel and Michael A. Boles. *Thermodynamics: An Engineering Approach*, 7th Ed. McGraw Hill, 2011.

References:

- 1) Borgnakke, C. and Sonntag, R. E., Fundamentals of Thermodynamics, 7th Ed., John Wiley & Sons, 2009.
- 2) Moran, M.J., and Shapiro, H.N., Fundamental of Engineering Thermodynamics, 5th Ed., John Wiley & Sons, 2006.

Coordinator: Dr. Maged A. I. El-Shaarawi, Professor of Mechanical Engineering

Goals (general objectives) :

- 1) Familiarize the students with basic concepts of the first and second laws of Thermodynamics and their applications in engineering problems.
- 2) Provide the student with a comprehensive treatment of classical Thermodynamics.
- 3) Prepare the student to effectively use thermodynamics in the practice of engineering.

Course Outline (Lecture Topics):

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|---|--------------|
| 1. Basic Concepts and Definitions | (4 classes) |
| 2. Energy and General Energy Analysis | (5 classes) |
| 3. Properties of Pure Substances. | (8 classes) |
| 4. Energy Analysis (First Law of Thermodynamics) of closed Systems. | (5 classes) |
| 5. Energy Analysis (First Law of Thermodynamics) of open Systems. | (6 classes) |
| 6. The Second Law of Thermodynamics. | (4 classes) |
| 7. Entropy and Applications | (10 classes) |
| 8. Tests | (3 classes) |

Computer Usage:

Students are encouraged to solve some problems using the available Energy Equations Solver (EES) software

Laboratory:

None

Assessment Tools:

In-class Test (By each instructor, on chapters 1, 2, and 3)	10 %
Major Exam I (Common, on chapters 3, 4 and 5)	20 %
Major Exam II (Common, on chapters 5, 6 and 7)	20 %
Quizzes (at least 3)	15%
Homework (7 assignments)	5 %
Final Exam (comprehensive)	30 %

Course Learning Outcomes:

In Connection with Course Objective 1:

After taking this course, students will be able to:

1. Demonstrate a basic understanding of the nature of the Thermodynamic processes for pure substances and ideal gases.
2. Demonstrate a basic understanding of the first law of Thermodynamics and its applications to systems and control volumes.

3. Demonstrate a basic knowledge of the second law of Thermodynamics and its applications to systems and control volumes.

Pertinent to Course Objective 2

4. Use the first law of Thermodynamics for energy conservation analysis of different Thermodynamic processes of systems and control volumes.

5. Use the second law of Thermodynamics for entropy balance analysis of different Thermodynamic processes of systems and control volumes.

6. Evaluate the thermal performance of different heat engines and refrigeration cycles through the calculation of their thermal efficiency or coefficient of performance.

Pertinent to Course Objective 3

7. Demonstrate the ability to present short written reports on first and second law analyses of different Thermodynamic processes of systems and control volumes.

Course Learning Outcomes mapped to Student (Program Educational) Outcomes:

Student Outcomes	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
Course-to-Student outcome mapping	1 through 7	7	5 through 7	3 through 7	3 through 7	6 and 7	3 through 7	3 through 7			
Emphasis*	S	L	M	S	S	M	S	S			

* L: Little/None M: Moderate S: Strong

Status of Continuous Improvement review of this Course:

Date reviewed: -----

Prepared by: Dr. Maged El-Shaarawi

Reviewed by: Thermo-fluids Group

Date prepared: September, 2014