SYLLABUS
MENG 2203-301: Thermodynamics
(Required Course)
Summer 2012

Instructor: Dr. Salim Azzouz
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Office Hours: See schedule on syllabus last page. Other days and times by appointment.

Course Schedule: MTWR 12:20 - 2:20 PM.
Location: DB 178 (Dillard Building)

CATALOG DESCRIPTION
The fundamental laws of thermodynamics; properties of systems, solids, liquids, and gases; and thermodynamics tables.

COURSE PREREQUISITES
MATH 2534 Calculus III

OTHER PREREQUISITES
Basic computer skills, MS Excel, hand calculator

TEXTBOOK
Fundamentals of Engineering THERMODYNAMICS, Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey.

REFERENCES
Additional material will be distributed in the form of handouts.

TOPICS COVERED
• Defining volume, pressure, and temperature
• Energy and the First Law of Thermodynamics
• Evaluating Properties
• Control Volume, Analysis Using Energy
• The Second Law of Thermodynamics
• Using Entropy
• Exergy Analysis
• Vapor Power Systems
• Gas Power Systems
• Refrigeration and Heat Pump Systems
• Thermodynamics Relations
• Psychrometric Applications
• Combustion
### COURSE LEARNING OBJECTIVES AND RELATIONSHIP TO PROGRAM EDUCATIONAL OUTCOMES

<table>
<thead>
<tr>
<th>Outcome-Related Course Learning Objectives</th>
<th>Program Outcomes</th>
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<tbody>
<tr>
<td><strong>Apply SI and English engineering units, including units for specific volume, pressure, and temperature (Hw, Exam)</strong></td>
<td>3a 3b 3c 3d 3e 3f 3g 3h 3i 3j 3k 1 m n</td>
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<tr>
<td><strong>Demonstrate understanding of key concepts related to the first law of thermodynamics, including internal, kinetic, and potential energy, work, heat transfer, and power cycles, (Hw, Exam)</strong></td>
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<tr>
<td><strong>Sketch T-v, p-v, and phase diagrams, and locate states on these diagrams (Hw, Exam)</strong></td>
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<td><strong>Apply mass and energy balances to control volumes (Hw, Exam)</strong></td>
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<td><strong>Describe the Carnot cycle (Hw, Exam)</strong></td>
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<td><strong>Evaluate entropy change between two states, and analyze isentropic processes (Hw, Exam)</strong></td>
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<tr>
<td><strong>Demonstrate understanding of key concepts related to exergy analysis (Hw, Exam)</strong></td>
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<td><strong>Sketching schematic cycles and accompanying T-s diagrams (Hw, Exam)</strong></td>
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<td><strong>Define gas power cycles (Hw, Exam)</strong></td>
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<tr>
<td><strong>Develop understanding of basic vapor-compression refrigeration and heat pump cycles (Hw, Exam)</strong></td>
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<tr>
<td><strong>Calculate p-v-T data using equations of state (Hw, Exam)</strong></td>
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<tr>
<td><strong>Demonstrate basic understanding of humidity ratio, relative humidity, and Dew point temperature (Hw, Exam)</strong></td>
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</table>

**3a:** an ability to apply knowledge of mathematics, science, and engineering

**3b:** an ability to design and conduct experiments, as well as to analyze and interpret data

**3c:** an ability to design a system, component, or process to meet desired needs

**3d:** an ability to function on multidisciplinary teams

**3e:** an ability to identify, formulate, and solve engineering problems

**3f:** an understanding of professional and ethical responsibility

**3g:** an ability to communicate effectively

**3h:** the broad education necessary to understand the impact of engineering solutions in a global and societal context

**3i:** a recognition of the need for, and an ability to engage in lifelong learning

**3j:** a knowledge of contemporary issues

**3k:** an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

**3l:** a knowledge of chemistry and calculus-based physics with depth in at least one

**3m:** the ability to apply advanced mathematics through multivariate calculus and differential equations

**3n:** the ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems

### CONTRIBUTION OF COURSE TO PROFESSIONAL COMPONENT

This course contributes to the engineering science component of the mechanical engineering program.

### COURSE ORGANIZATION AND STUDENT PERFORMANCES ASSESSMENT
• **Lecture Format**
  This course consists of a two 50-minutes sessions per day (MTWR). The two hours class will be spent mostly explaining and discussing concepts, and solving relevant case problems. Lectures will not be used to communicate the entire textbook course content and thus, you will have to study a set of course paragraphs specified by the instructor on your own to further your understanding. Student participation in class discussions is highly encouraged and rewarded.

• **Exams**
  There will be two regular exams plus one comprehensive exam at the end of the semester. Each exam is based on two testing parts. A Theoretical part based on chapters reading (closed book) is designed to test the students’ ability to acquire a self-reading knowledge of the taught materials. A hand written sheet summarizing the exam materials is allowed during the closed book session. A practical part (open book) is designed to test the students’ ability to analyze and solve a set of problems. Each exam is based on the course materials developed between two consecutive exams, except for the last one which is comprehensive. During this session only your hand written notes, the textbook, and the handouts distributed by the instructor are allowed. Any other document is considered illegal. You are expected to take the exam on the scheduled date and time it is given. However, if for a major and acceptable reason you are unable to do so, then you must inform the instructor in advance in writing and give a valid proof of your absence. The instructor will give then a make-up exam toward the end of the semester. For those who did not have a valid reason for missing the exam, they are allowed to take the make-up exam, but they will be graded over 80% of the regular 100% exam grade. The examination materials for the make-up exam may be very different from the ones given in regular exams. It is strictly forbidden to use cell phones during the exam. Cell phones will be collected at the beginning of the exam and restituted at the end of it.

• **Quizzes**
  The goal of these quizzes is to encourage the students to study the course materials by themselves. Quizzes will consist of true/false, multiple choice type of questions and/or short problems. You are expected to take these quizzes on random scheduled dates and times. However, if for a major reason you are unable to do so, then you must provide the instructor with a valid written excuse. For those who missed quizzes with a valid reason, the instructor will then give two make-up quizzes at the end of the semester. For those who did not have a valid reason for missing the quizzes, they are allowed to take the make-up quizzes, but they will be graded over 80% of the regular 100% quiz grade. The examination materials for the make-up quizzes may be very different from the ones given in regular quizzes. Cell phones and any type of notes are strictly forbidden during quizzes.

• **Homework**
  Homework will be assigned from a set of chosen chapters by the instructor. It will be turned in each week, unless specified by the instructor. Homework must be turned in on the due date at the beginning of class. Once class starts, homework will be still accepted for a grace period of 48 hours and graded over 80% of the regular 100% homework grade. After the grace period, homework will be accepted and graded over 60% of the regular 100% homework grade. Each student is responsible for submitting his own individual personal homework copy, written in his own words. No dual or group homework copy is accepted unless specified by the instructor.

• **Course Grade**
  The final grade for the course will be based on the scores earned in the two mandatory exams, the mandatory comprehensive exam, the average score earned in the quizzes, and the average score earned in the homework. Each one of the two exams contributes 15%, the comprehensive exam contributes 20%, quizzes average contributes 25%, homework average contributes 15%, and participation, neatness, attitude, and class attendance contribute 10%, for a total of 100%. The overall average score (X) for the course is determined as follows:

\[
X = 0.15 \times E_1 + 0.15 \times E_2 + 0.20 \times CE + 0.25 \times Q + 0.15 \times H + 0.10 \times P
\]

where:
- \(E_1\) and \(E_2\) are the scores of the two mandatory exams.
- \(CE\) is the score of the comprehensive exam.
- \(Q\) is the average score in the quizzes.
- \(H\) is the average score in the homework.
- \(P\) is a combination of participation, neatness, attitude, and class attendance score.

\[
X = \frac{0.15 \times E_1 + 0.15 \times E_2 + 0.20 \times CE + 0.25 \times Q + 0.15 \times H + 0.10 \times P}{1}
\]
X = 0.15 x (exam 1 score + exam 2 score) + 0.20 x (Comprehensive exam score) + 0.25 x (quizzes average score) + 0.15 x (homework average score) + 0.10 x (participation/neatness/attitude/attendance scores).

The final letter grade for the course is based on the value of X and is determined from the following grade levels:

<table>
<thead>
<tr>
<th>Value of X (in %)</th>
<th>90 - 100</th>
<th>80 - 89</th>
<th>70 - 79</th>
<th>60 - 69</th>
<th>&lt;60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter Grade</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>F</td>
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GENERAL GUIDELINES

- Plan on spending at least 6 hours outside of class to study the material and to work on homework assignments.
- Read the course material before coming to class.
- Utilize the office hours throughout the semester to seek explanations from the instructor.
- Use engineering paper for all homework assignments and exams. Use a systematic approach to solve problems. If a problem involves drawing a graph, use Excel, Matlab, or any other graphic software tool to draw the graph. In engineering, neatness is a must, not a luxury. Be advised that you will be penalized for lack of neatness.
- You are strongly encouraged to study in group.

GENERAL EDUCATION STATEMENT

Students in this course must demonstrate their competency in oral and written communication through written homework assignments, quizzes, and exams. They must also demonstrate their ability to use the English language.

ACADEMIC INTEGRITY POLICY

Scholastic dishonesty will not be tolerated and will be prosecuted to the fullest extent. You are expected to have read and understood the current issue of the student handbook regarding student responsibilities & rights, and the intellectual property policy information about procedures and what constitutes acceptable on-campus behavior. Any form of plagiarism will not be accepted, and will be heavily reprimanded.

DISABILITY SUPPORT SERVICES

Students registered with Disability Support Services should have a letter verifying their disability and the appropriate accommodations.

DISCLAIMER STATEMENT

Information contained in this syllabus, other than grading, late assignments, makeup work, and attendance policies, may be subject to change with advance notice, as deemed appropriate by the instructor.

Prepared by: Dr. Salim Azzouz
Date: 05/28/2012