ME 351  THERMODYNAMICS I
SYLLABUS

Text: "Fundamentals of Thermodynamics" by Borgnakke and Sonntag, 8th edition.

Instructor:  Dr. Sherman Goplen, Dolve 116, office phone 231-8301
e-mail: sherman.goplen@ndsu.edu, office hours will be posted.

COURSE DESCRIPTION

Basic concepts, properties of pure substances and ideal gases. First and second law, entropy, and
availability. Prereq: ME 222, MATH 259

COURSE CONTENT

The intended content of the course is outlined below. This is subject to change based on weather, etc.

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Topics</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Introductory concepts</td>
</tr>
<tr>
<td>2</td>
<td>Properties of a pure substance</td>
</tr>
<tr>
<td>3</td>
<td>First law of Thermodynamics, closed system</td>
</tr>
<tr>
<td>4</td>
<td>First law of Thermodynamics, open system</td>
</tr>
<tr>
<td>5</td>
<td>Second law of Thermodynamics</td>
</tr>
<tr>
<td>6</td>
<td>Entropy</td>
</tr>
<tr>
<td>7</td>
<td>Second law of Thermodynamics, open system</td>
</tr>
</tbody>
</table>

Course description

A student achieving a passing grade in this course will be able to solve typical problems involving the
application of the first and second laws of thermodynamics to pure substances. This will include
understanding and using the property tables.

COURSE OUTCOMES:

1. Students must understand the closed system and open system/control volume concepts and be able to
describe engineering problems in terms of these concepts. (a, e)

2. Students must understand the concepts of an equation of state and be able to use such an equation to
describe pure substances. This includes understanding and being able to apply various property
tables. (a, e)

3. Students must understand the first and second laws of thermodynamics and learn how to apply these
laws to both open and closed systems. (a, e)
Course Outcomes continued:

4. Students must understand how materials store energy and the relationship between the energy storage and phase changes in materials. (a, e)

5. Students must be prepared for the thermodynamic applications discussed in ME 353. (k)

COURSE GRADES

The grades for the course will be determined as follows:

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Exams</td>
<td>60%</td>
</tr>
<tr>
<td>Final exam</td>
<td>30%</td>
</tr>
<tr>
<td>Homework and quizzes</td>
<td>10%</td>
</tr>
</tbody>
</table>

There will be three or four 50-minute exams given during the semester. **Make-up exams will be given for missed exams at the discretion of the instructor and only for an excused absences (university approved absences).**

The two-hour final exam will be given at the time designated by the University final test schedule. All students must take the final exam at this time.

Homework will be assigned daily and is considered due the following class period. Homework problems may occasionally be collected at the **beginning of class** and may be graded. **No late papers will be accepted, it must be turned in at the beginning of class.** Homework must be in acceptable engineering form including a problem statement, labeled drawings of the system considered and all equations and units must be shown or the problem will not be graded.

Quizzes will be given on a random basis, some times announced ahead of time and others will be unannounced. **Make-up quizzes will be given only for excused absences.**

**Students are expected to attend every class session. You may assume that any absences for reasons other than university functions are not excused absences and make-ups will not be given.**

Final course grades will assigned according to the following scale.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>90% or greater</td>
</tr>
<tr>
<td>B</td>
<td>80% to less than 90%</td>
</tr>
<tr>
<td>C</td>
<td>70% to less than 80%</td>
</tr>
<tr>
<td>D</td>
<td>60% to less than 70%</td>
</tr>
<tr>
<td>F</td>
<td>less than 60%</td>
</tr>
</tbody>
</table>

**STUDENTS WITH SPECIAL NEEDS**
Students who have any disability that might affect their performance in this class are encouraged to speak with the instructor early in the semester.
Veterans and student soldiers with special circumstances or who are activated are encouraged to notify the instructor in advance.

All work in this course must be completed in a manner consistent with NDSU University Senate Policy, Section 335: Code of Academic Responsibility and Conduct (http://www.ndsu.nodak.edu/policy.335.htm) and the CEA Honor System available at http://www.ndsu.nodak.edu/ndsu/cea/

CEA Honor Pledge:
“On my honor I will not give nor receive unauthorized assistance in completing assignments and work submitted for review or assessment. Furthermore, I understand the requirements in the College of Engineering and Architecture Honor System and accept the responsibility I have to complete all my work with complete integrity. Students who are suspected of academic dishonesty may not withdraw from the course in which dishonesty is suspected while the case is under review by the Honor Commission (NDSU Policy Manual, Section 335, 2b).”

Department of Mechanical Engineering, North Dakota State University

Mission

To educate undergraduate and graduate students in the fundamentals of the discipline, and prepare graduates (BS, MS, or PhD) to effectively function in society in the field of their choice while also having the learning skills to adapt to evolving personal and professional goals.

Student Outcomes

To foster attainment of the educational objectives, the ME Department has developed a curriculum that insures students will achieve the following outcomes by the time of graduation:

a) Graduates must have the ability to apply knowledge of mathematics and science to solve engineering problems.
b) Graduates must have the ability to design and conduct experiments as well as to analyze and interpret data.
c) Graduates must have the ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) Graduates must have the ability to function on multidisciplinary teams.
e) Graduates must have the ability to identify, formulate, and solve fundamental engineering problems.
f) Graduates must have an understanding of professional and ethical responsibility.
g) Graduates must have the ability to communicate effectively.
h) Graduates must possess the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) Graduates must recognize the need for, and possess an ability to engage in, life-long learning.
j) Graduates must possess knowledge of contemporary issues.
k) Graduates must have the ability to use techniques, skills, and modern engineering tools necessary for engineering practice.
Homework problems:

1. Homework problems will be done on engineering paper, one problem to a page.
2. Problems will consist of three parts: given, find and solution.
   a) The given statement will be a complete description of the problem in the form of sentences. The reader should be able to understand the problem without needing the text.
   b) The find statement will tell the reader what is to be solved for in the problem.
   c) The solution will show all work needed to solve the problem. Any equations used will be shown in symbol form first and then solved for the symbol representing the unknown. Next the numbers (including units) will be substituted for the symbols. The last step will be to show the answer including units. The units must be verified and conversion factors shown.
      When using Engineering units, force must be shown in units of Lbf, mass in units of Lbm. Lb is considered meaningless.
   d) The solution will also include any drawings needed for solving the problem. The drawings must be neat and clearly labeled to agree with the equations.
   e) Homework must be done neat and be clearly understandable.
   f) Problems must be worked in the unit system given.
   g) HOMEWORK NOT DONE IN THE ABOVE FORM WILL NOT BE GRADED.
3. On days when homework is to be handed in, it will be collected at the beginning of class; late papers will NOT be accepted.

Quiz and test problems:

1. Given and find statements are NOT needed for quiz problems.
2. Equations must be used the same way as in the homework problems and units must be included.
3. Problems must be worked in the unit system given.

As a courtesy to other students, the use of cell phones during class is not permitted. All cell phones must be shut off and in your book bag during class. Anybody using a cell phone during class will be asked to leave. Using a cell phone during a quiz or test will result in a zero on that paper.

If classes are canceled for any reason on the day a quiz or test is scheduled, the quiz or test will be rescheduled for the next class period that we meet.

It is expected that all students will take notes during class and will study these notes.

No sharing of textbooks or calculators during tests, quizzes, etc. No electronic textbooks during a quiz or tests. No laptop computers, etc. during a quiz or a test. Only a calculator may be used during a test or a quiz.